

THE ROYAL CANADIAN AIR FORCE JOURNAL

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IN JOINT OPERATIONS

A KNOWLEDGE-MANAGEMENT
PROPOSAL FOR THE RCAF

AND MUCH MORE!



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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 aerospace 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 aerospace 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. ☎

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THE ROYAL CANADIAN
AIR FORCE JOURNAL



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ITEM	WORD LIMIT*	DETAILS
LETTERS TO THE EDITOR	50-250	Commentary on any portion of a previous <i>Journal</i> .
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CF Photo: MCpl Roy MacLellan

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Reprint from *Communication and Electronics Branch Newsletter*,
Volume 60, Winter 2013

EDITOR'S MESSAGE

Well, the winter of 2013–14 has come and gone, but it will be remembered for the snow (never-ending), the cold (always bitter) and budget reductions (always fun). Still, the Royal Canadian Air Force (RCAF) seems to have survived these phenomena in good spirits—bruised but not defeated.

This issue of the *Journal* seems to be a bit thicker than most; not that I am complaining. As an editor, I would rather face the quandary of having too much material than too little. For you, the reader, this means that, hopefully, you will find something appealing to your particular interests. Of note, I draw your attention to the article on knowledge management by retired generals Joe Sharpe and Terry Leversedge. Our ability (or in many cases, our inability) to capitalize on our wealth of institutional and personal knowledge and experience is a critical asset. Not only is it a force-multiplier when it comes to the conduct of operations, it is also an essential element in force generation, procurement and governance. Long story short: we need to be better at it.

Being marked in 2014 is the 90th anniversary of the RCAF—so happy birthday to us! There are numerous activities and mess dinners that have already occurred in celebration of this occasion, with a few more planned for the summer months.

As we gather to hoist a beverage and celebrate our heritage and future, we may want to spend a moment or two thinking about the BIG BIRTHDAY that is just around the corner. I allude, of course, to our 100th anniversary on 1 April 2024. It is only a decade away, and as demonstrated by the Royal Canadian Navy's (RCN's) very successful centenary celebration in 2011, you can never start planning too early. Our RCN comrades put almost a decade's worth of effort into their event, and it would behove us to do the same. After all, a big part of knowledge management is building upon the lessons from the past. Or, as I like to put it: "Anything the Navy can do, we can do better!"

Enjoy the read.

Sic Itur Ad Astra ☪



Major William March, CD, MA
Senior Editor

Abbreviations

RCAF Royal Canadian Air Force

RCN Royal Canadian Navy

LETTERS TO THE EDITOR

Dear Sir:

I read with great interest and a sense of humour Dave Bashow's comments¹ regarding Lynne Chaloux's article on Harris and Bomber Command.²

Having read over 20 books on the Allied Bombing Campaign (some good, some not so good), having been a lifetime professional student of the subject, and having lectured extensively on the campaign at university, numerous Toronto Public Library branches and other locations, I agree fully with Chaloux's research and comments.

Basically, Harris was given too much power, and maybe Portal should have accepted his resignation, which Harris offered on more than one occasion. After reading about every Royal Air Force bombing mission in the old Penguin classic *The Bomber Command War Diaries*,³ I have come to the conclusion, without a doubt, that had Harris concentrated on his given directive of bombing oil installations as well as aircraft assembly and aero-engine plants earlier rather than reluctantly later, more effective results would have been the order of the day. By 1944, Churchill was having his doubts regarding Harris's area bombing but seemed reluctant to interfere.

We know that Churchill's biggest fear was the unrelenting U-boat campaign. Harris did not think much of wasting resources for more aircraft going to Coastal Command and once made the comment that Coastal Command searching for U-boats was like "looking for a needle in a haystack." But, had more aircraft resources been given to Coastal Command, then the fight against the U-boats would have been won earlier than the turn around in May 1943.

On the other hand, we need to look at wartime roles, not necessarily from a PhD point of view, but with hindsight and some common sense.

I have just finished an advanced copy from the United Kingdom of *The Bombing War*, by Dr Richard Overy.⁴ It is undoubtedly, in my opinion, the most researched and best authority on this complex subject; his comments on Harris's role are well argued and worthy of close study.

Thank you and kind regards,

Keith Hyde
Aviation historian
Toronto

Notes

1. Dave Bashow, "Letters to the Editor," *The Royal Canadian Air Force Journal* 2, no. 4 (Fall 2013).

2. Major Lynne Chaloux, "Unshakeable Faith: The Flawed Command of Bomber Harris," *The Royal Canadian Air Force Journal* 2, no. 2 (Spring 2013).

3. Martin Middlebrook and Chris Everitt, *The Bomber Command War Diaries: An Operational Reference Book 1939–1945* (New York: Viking Penguin, 1985).

4. Richard Overy, *The Bombing War: Europe 1939–1945* (London: Allen Lane, 2013).

Dear Bill,

I very much enjoyed the entire fall 2013 issue. It was nice to hear Chris Brooks is still with us; I remember him as a medical officer in Shearwater. Having been somewhat involved in putting together information for the Sea King 50th, I found the article by Lieutenant(N) Jason Delaney¹ enlightening, having spent some of the early years in the trenches as a leading seaman naval aircrewman (LSNA). Many things in the article were, at the time, as the Americans say, “above my pay grade.” That being said, there was one small discrepancy I noticed: the HS50 Sea King detachment was deployed to Isla Grande Coast Guard Station in San Juan, not Roosevelt Roads. I believe that VS880 Trackers along with Greenwood aircraft were in Rosy, but HS50 was not. My logbook shows I was detached to Isla Grande January 20 to March 11, 1967. Further, I was detached to Her Majesty’s Canadian Ship (HMCS) SAGUENAY from March 6 to 17, returning a Sea King to Shearwater. Our bird was craned on by HMCS CAPE SCOTT at Isla Grande and craned off back in Halifax. The SAGUENAY experience is a whole other story, but our detachment consisted of the pilot, Sub-Lieutenant Glen Urquhart; Detachment Commander Chief Petty Officer, Second Class Scotty Grant; Leading Seaman Aviation Technician Jim Kennedy; LSNA Yves Martel; and me. In true Navy fashion, the three leading seamen stood watches in the hangar, “babysitting” the aircraft, much to the amusement of the watch petty officers. What we could have done had anything untoward happened is still beyond me, as I don’t recall the Beartrap being in service, the hangar fire-suppression system wasn’t hooked up, and the hangar doors had to be operated manually. My log shows my first flight from HMCS FRASER as July 6, 1967. Now, there has been much discussion about the first operational detachment, but I still believe FRASER’s was the first that embarked for the ships’ work-ups and departed as the ship went into a work period.

Yours Aye,

Paul Peacey
Warrant Officer (Retired)
Airborne Electronic Sensor Operator

Editor’s Response:

Dear Paul:

Thank you for the letter and kind words. I have forwarded your observation to Lieutenant(N) Delaney for his consideration.

Cheers,

Bill

Notes

1. Jason Delaney, “Seasprite to Sea King: The Royal Canadian Navy’s Ship-borne Antisubmarine Helicopter Capability,” *The Royal Canadian Air Force Journal* 2, no. 4. (2013), 18–43.

A VERY GOOD SHOW

Davis Strait

Hudson Strait

● Churchill

The RCAF and Exercise
NORTHERN CRUISE,
1948



Goose Bay

Strait of Belle Isle

By Dr. Richard Mayne, CD, PhD

Greenwood

Halifax



The Canadian Arctic region had little to fear from enemy activity during the Second World War. Aside from the crew of a German U-boat setting up a weather station on the coast of Labrador (at that time a British colony), the Northern reaches of Canada were well out of Germany's range and were of no strategic significance. That changed quickly in the immediate post-war period as the worsening relationship between the Soviet Union and the West, along with breakthroughs in maritime and long-range aircraft technologies, raised the real possibility that the Canadian North would become a theatre of operations in a potential third world war. Concerned with

the possibility of having to fight submarines and surface ships as well as defend against long-range patrol aircraft in an Arctic environment, the Royal Canadian Navy (RCN) and the Royal Canadian Air Force (RCAF) agreed to conduct joint operations off the coast of Labrador as part of a naval exercise known as NORTHERN CRUISE. Admittedly, NORTHERN CRUISE, which was held in early September 1948, was a small exercise in the earliest stages of the cold war, but it nevertheless provided the RCAF with key tactical and strategic lessons for the future of maritime air operations. It was also one of the pivotal moments that marked the rebirth of an important long-range maritime-air capability and community within the RCAF, and it is for these reasons that this particular exercise is worth a closer examination.

Even before the end of the Second World War, the Canadian Army was eager to try out equipment and explore tactics in the Canadian North. Most of these activities were designed to prepare for cold-weather operations during the war, but the Army continued to hold these types of exercises even after Germany and Japan had surrendered. RCAF support was often essential to these efforts, yet the Army was well ahead of the other services when it came to planning early Northern operations—a point that at least one senior officer on the General Staff was quick to emphasize when he noted on 30 September 1946 that “it was too bad that the RCN and RCAF were not putting up some of these [Arctic] proposals to the Chief of Staff Committee.”¹

While the RCAF played a key role in support of early Army exercises, they had yet to work with the RCN in this region. The reason why was simple: the RCN had never sailed into the Canadian Arctic. This was something that the RCN was keen to change, and as early as October 1946, naval planners began to look into the idea of developing a purely Canadian

Arctic expedition. Much of this was based on a desire to familiarize the RCN with the region, but the fact that other nations were taking an interest in the North also played a role. Certainly RCN planners were well aware that there was “some reason to suspect that a Russian submarine [had] been operating in the Davis Strait,”² while others were concerned that activities in Northern waters by a close ally, the United States, nonetheless represented a challenge to Canadian sovereignty. The RCN’s solution was to send two destroyers from Halifax, Nova Scotia, to Churchill, Manitoba, in late summer 1947 for a “preliminary familiarization cruise” code-named Operation ICE WORM.³ It was clear that the RCN wanted to benefit from Canadian Army and Air Force participation, and as a result, the RCAF was asked whether it could provide aircraft for tracking and other exercises in the vicinities of Churchill and Southhampton Island as well as ice spotting. Unfortunately, this was as far as the plan went. On 21 June 1947, the RCN noted that “after very careful consideration” the minister had decided not to proceed with the cruise.⁴



Although the plans for ICE WORM had fallen flat, the RCN did not give up on its desire to sail into the Canadian Arctic. Like the previous year’s efforts, a new concept was drafted and again an appeal was made for both the Army and RCAF to participate. The Army was too busy with other requirements—a somewhat ironic development given their previous clamouring for Navy and Air Force initiated joint Arctic exercises, but the RCAF was willing to take a deeper look at what it could do. This was particularly good news for the RCN. Along with two destroyers, the RCN also intended to include its new aircraft carrier, His Majesty’s Canadian Ship (HMCS) MAGNIFICENT, for at least part of the deployment to Churchill. As a result, RCAF participation was deemed essential for a more active programme for the carrier and offered a better opportunity to learn about operating naval aircraft in Northern latitudes. Preliminary discussions were, therefore, carried out in February 1948 between the RCAF and RCN regarding the coordination of air operations in the area of Hudson Strait.⁵

Despite this initial enthusiasm, other operational commitments meant that the RCAF did not have any aircraft to spare for this exercise. Like all the services, drastic post-war cuts had left the RCAF with a fraction of the force that it had during the Second World War. From an apex of 215,000 serving members in January 1944, post-war plans made provisions for a force of only 16,100 regulars, 4,500 auxiliary members and 10,000 reservists.⁶ Such limitations made it difficult for the RCAF to fulfil all of its peacetime operational commitments. Worse yet, these reductions had left the RCAF with little choice but to disband the vast majority of its antisubmarine squadrons as well as Eastern Air Command (EAC)—the former nerve centre for Canada’s air war against Germany’s U-boats—which, it was assumed, was no longer needed. With no foreseeable threat on the horizon and most of its aircraft with the scrap metal industry, EAC was officially shut down on 1 March 1947, and the remnants were reconstituted as Central Air Command’s 10 Group.⁷ All these changes and pressures meant that the RCAF’s immediate post-war maritime-air capability was little more than a token force, yet the Air Force was still interested in working with the Navy in the North. This resulted in a proposal to provide two Air Force observers—one qualified in fighter operations and the second in coastal operations—whose presence, it was anticipated, would result in a better appreciation of the control, organization, communication and air-sea rescue arrangements necessary for the conduct of successful exercises between surface ships and aircraft. However, just as it seemed that the RCAF aircraft would miss out on the RCN’s Exercise NORTHERN CRUISE, the Chief of the Air Staff (CAS), Air Marshal W. A. Curtis, suddenly reversed

course by sending a memorandum in mid-June 1948, advising the Navy that he was willing to make some aircraft available. Operational commitments were still precluding the stationing of aircraft at either Churchill or Chimo as the RCN had hoped, but the CAS was prepared to use assets already based on the East Coast to carry out interception and shadowing of the task force (MAGNIFICENT and two destroyers) on its outward journey from Halifax.⁸ Although Curtis was doing whatever he could to scratch together some sort of commitment to the exercise from his understaffed and overworked Air Force, the CAS ensured that the RCN understood that “such air patrols as are authorized will however be few in number and depend entirely on the availability of aircraft.”⁹

Exactly why the Air Force changed its mind is unclear, but it is certainly possible that international events played a part. Tensions over the control of Berlin were growing in the months prior to the Soviets imposing their blockade on that city in June 1948. Concerns that this situation could result in a third world war only reinforced the interpretations of a number of strategists, planners and military officials who foresaw the coming cold war well before the Berlin Airlift.¹⁰ Likewise, although the Soviets did not yet possess a true blue-water navy, both the RCAF and RCN were well aware that this former ally was building a massive submarine fleet—a fact that took on even more relevance with the crisis over Berlin.

This was certainly reflected in NORTHERN CRUISE’s original scenario in which the fictitious countries of “Blueland” and “Redland” were at war. The aim of the exercise was for a Blueland carrier and two destroyers to escort a convoy from Halifax to Hudson Bay. While en route, the carrier’s aircraft were to carry out searches and photo reconnaissance of certain bays and inlets to determine if Redland had established refuelling depots on the Labrador coast and whether there was any evidence of enemy submarines.¹¹ Redland’s forces were unknown, but it was observed that an enemy submarine, as well as long-range shadowing aircraft, was in the area. (For the purposes of the exercise, small ice could be reported as a submarine while the RCAF played the role of hostile aircraft.) Actual air operations fell into six separate phases, consisting of:

- a. RCAF aircraft searching for the naval force (1,000 feet [ft] / 305 metres [m]);
- b. RCAF aircraft shadowing the naval force. (RCAF aircraft will attempt to avoid detection and interception by naval aircraft (1,000 ft [305 m] or lower);
- c. naval fighters intercepting RCAF aircraft (2,000 ft [610 m]; RCAF to cease shadowing and carry out dummy attack on naval force at 500 ft [152.4 m]);
- d. RCAF aircraft conducting antisubmarine patrols;
- e. naval aircraft strike shore targets; and
- f. RCAF aircraft conducting homing practice.¹²

Although these were the specific aims of the air portion of NORTHERN CRUISE, the detachment report captured the general purpose of the exercise, which, for the Air Force, was “to familiarize the RCAF crews with Naval Operations” while for the Navy it was “to enable their fighter aircraft to deal with enemy attacks from the air, make fighter interceptions and to familiarize the [task force] with RCAF tactics.”¹³ There was also a real-time mission for

the RCAF—namely, to continue to provide ice-reconnaissance flights while the task force passed through Hudson Strait. Of course, acting as a reminder that these aircraft were being diverted from their primary role, it was further added that search and rescue (SAR) was still the priority requirement, meaning that one or both of the aircraft would have to abandon the exercise should a real emergency arise elsewhere.



Lancaster



PBY-5A Canso

Lancaster “CHK” and Canso “CHB” from 103 Rescue Flight were selected to carry out the RCAF’s portion of the exercise. Leaving their RCAF base at Greenwood, Nova Scotia, on 1 September, both aircraft arrived later that day at Goose Bay, which was to serve as their temporary home for the duration of the exercise. It was an uneventful trip, but upon landing, it was discovered that the Canso had developed a faulty radio transmitter and had an inoperable Loran set, while the Lancaster was having trouble with its H2S radar. A key requirement for the upcoming exercise, the radar was repaired only to break down again while the Lancaster was practicing approaches. Fortunately, the RCN was experiencing its own delays, and that provided just enough time for replacement parts for the H2S to be flown in from Greenwood.



H2S radar indicator unit

This, however, was not the only glitch to hit the Lancaster, as a short circuit in its wiring resulted in fire extinguishers going off in all four engines. Again, innovative thinking saved the day as the Lancaster that had delivered the spare parts to repair the H2S was robbed of its extinguishers, and that ensured CHK was able to fly on time.¹⁴

The first phase of the exercise (search for naval force) began on the following day (4 September) with the Lancaster and Canso taking-off half-an-hour early—both as a precaution against the task force not being in its estimated position but also to give the navy a bit of a surprise. Contact was made as anticipated in the Strait of Belle Isle, and that initiated the exercise’s second and third phases (shadowing and intercepting). For three hours, the Lancaster and Canso used the clouds as well as the coastal terrain near the shores of the Strait to evade MAGNIFICENT’s fighters and report on the convoy’s movements. Upon completion of this evolution, the Canso carried out a patrol ahead of the convoy, while the Lancaster conducted a homing exercise with the destroyer HMCS NOOTKA. With the exception of sea fog, which forced MAGNIFICENT to recall her aircraft and order the Lancaster and Canso to return to base early, the first day of the exercise was considered “quite successful,” particularly since “a good time was had by all.”¹⁵

Unfortunately, the achievements of the first day were not repeated as weather played havoc with the rest of the operational schedule. Thanks to continued fog and low cloud cover, MAGNIFICENT’s aircraft remained onboard for the rest of the exercise, leaving the Lancaster to practice homing and radar tracking with the destroyers. The weather also limited the Canso’s involvement since this aircraft’s lack of radar made it of little use in reduced-visibility situations. The weather eventually took its toll on the Lancaster. While returning to Goose Bay after a full day of flight operations off the tip of Labrador (homing and radar tracking practice) on 8 September,

the Lancaster was forced to “haul through fairly heavy icing conditions” which left two of its engines unserviceable.¹⁶ With no sign of improvement in the weather, MAGNIFICENT saw little reason to tempt fate on the last day of the exercise. As a result, the carrier sent a signal which read: “Thank you for your ready co-operation. The exercises have been of great value to the Magnificent [sic],” soliciting the response from the RCAF that they too “enjoyed entire operation. It was of great benefit to us all. Hope to carry out similar exercise with you again.”¹⁷ And with that, the air portion of NORTHERN CRUISE 1948 came to an early and abrupt end.

The fact that the carrier’s flight operations were limited to one day was perhaps the greatest regret expressed by all aircrew as it was observed how “their morale was rapidly increasing, and they felt that their efficiency and airmanship was on the up grade with the lessons learnt each day.”¹⁸ The potential problem that weather would pose for future joint RCAF/RCN northern air operations was one of the first lessons observed; post-exercise analysis produced others. For instance, it was found that climatic conditions were not always detrimental to the task force’s efforts to locate the shadows. Acting as an important lesson for the RCAF, the shadowing aircraft often gave away their position by flying too low in misty conditions. This had the effect of creating a slipstream track which stayed on the surface long enough to conveniently guide the carrier’s fighters directly to their target.¹⁹

Other lessons included the need to provide air navigators more opportunities to sharpen their skills in Northern latitudes (calls for more searches, patrols and time devoted to relative navigation appeared in more than one post-exercise report) as well as some interesting observations on antisubmarine warfare (ASW) work in this region. Specifically, the Canso crew found the ASW patrol patterns for the exercise “a bit ridiculous for that area” since the strait was “very narrow” and that often led them over land. This was such a problem, in fact, that one observer could not resist the temptation to cheekily decry that patrolling over forest-covered terrain made it “rather difficult to spot a submarine there!”²⁰ Although humorous, the comment raised an important point: search patterns designed during the Second World War for hunting submarines in the openness of the Atlantic were not entirely suitable for any future conflict in the confined littoral waters like those of the Strait of Belle Isle or, more importantly, the ones further north in Canada’s Arctic archipelago. And this was not the only area where tactical thinking from the last war was creeping into the planning and practicing for a potential new one that would also include combat in the Arctic.



Sea Fury

The shadowing flights also produced some excellent tactical lessons as well as the RCAF’s most controversial observation. It was clear at the time of NORTHERN CRUISE that the Canso was no match for MAGNIFICENT’s Sea Fury fighters. Despite flying at low altitudes, the Canso’s slow speed made it an easy mark; a fact that was confirmed by it being intercepted virtually every time it approached the task force. The Canso crews and officer commanding the detachment tried to put the best face on a bad situation with one arguing that “had this been wartime, I am certain that she could send out reams of valuable information before being shot down.”²¹ Yet another gave the crew a slightly better chance of survival, feeling that the Canso had made effective tactical use of the Strait’s coastal terrain and that “several times, we like to think, the tired old work horse was able to pop out from behind the hills and get a good look at the Force without being detected.”²² Post-exercise analysis identified that this was wishful thinking and that the proud old Canso—while suitable for its current SAR function—simply would not survive against modern aircraft if it was tasked to the maritime-air role.



The Lancaster was a different matter. Over the course of shadowing for three hours, it made contact with the task force approximately every 15 minutes, and in all these approaches, it was intercepted only once. The fact that this was done while the RCN had continuous fighter cover made it all the more remarkable, and that led one RCAF officer to report:

The conclusion we drew from the days [sic] work is, that although the Task Force could possibly give a good account of itself against slow aircraft like the Canso, they would have to be very sharp indeed to keep their vessel afloat when encountering modern high speed aircraft that are fully equipped with radar and other Navigation aids.²³

As telling as that comment may have been, it was another RCAF account that actually caused the most debate within the RCN:

From the experience gained in the first days [sic] operation in which the Naval aircraft participated, it was unanimously felt by the RCAF crews that shadowing of surface vessels by a high speed aircraft such as a Lancaster, confronted the Naval Fighters with a problem that only concentrated practice on their part would overcome. The fact that ... the Lancaster was only intercepted once would make it appear that a fast aircraft is a formidable threat to all surface craft.²⁴

Some in the RCN accepted the RCAF's position, as one staff officer recorded how "the exercise [was] of great value if only, to show how much actual practice we do need."²⁵ Commodore G. R. Miles, MAGNIFICENT's commanding officer (CO), agreed. But while Miles admitted that there was "a certain amount of truth in the RCAF claim about shadowers creating problems that only practice [could] solve," he felt that the RCAF was overlooking the fact that "in open sea (as opposed to the Straits [sic] of Belle Isle) radar detection of a low shadower would be more reliable and rapid, and with two CAPs [combat air patrol] airborne [at the time only four aircraft, as one division, were being operated against two targets] interception would be much easier."²⁶ The CO of the RCN's Air Station in Dartmouth, Acting-Captain A. B. F. Fraser-Harris, felt the same way. He, too, argued that the results of the exercise were not entirely valid since the confined waters of the Strait of Belle Isle made visual detection more challenging whereas the "problem of interception is much easier in the open sea."²⁷ Yet a third opinion, this one voiced by the Director Naval Aviation, came to a similar conclusion by noting that the RCAF had "assumed a lesson which is contrary to the experience of the last war Fighters, with less than half the speed of Sea Furies, successfully dealt with these shadowers, despite the low performance of radar and lack of good fighter direction of the period."²⁸ Few in the RCAF would disagree with these points, but the trouble was that the larger exercise was designed on the premise of fighting a future battle in an Arctic archipelago that was filled with confined waters similar to those of the Strait of Belle Isle. The argument the RCAF was making, therefore, was that the littorals of this potential future battlespace were not the same as what both the Air Force and



Navy faced while fighting German U-boats in the “openness” of the North Atlantic during the last war. Put another way, the new threat and combat environment in Canada’s North needed new tactics, and according to the RCAF, that was the key lesson.

This was not the only conclusion that had the RCAF analysing the requirements for a new war against the Russians. The drastic military reductions of the immediate post-war period had left the RCAF with a problem when it came to the growing Soviet submarine threat. Not only did the RCAF need to immediately recreate a maritime-air organization, but it also required aircraft to perform this task. The former issue was solved in late 1949 through a transformation which saw 10 Group reconstituted as a Maritime Group and assigned the important task of conducting aerial reconnaissance of the sea approaches to Canada as well as other key maritime air operations. With the old EAC’s aircraft long since destroyed, the RCAF’s solution to the latter issue was to take some of their old 6 Group Lancasters out of storage and restore them to operational status.²⁹ While a stopgap measure, turning these former bombers into maritime patrol aircraft (MPA) was nevertheless effective, and it appears that NORTHERN CRUISE played a key role in convincing the RCAF that the concept was a valid one.

Comments that the serviceability of the Lancaster “was excellent” or that it was “able to carry on the job with extreme success” left no doubt that the RCAF believed this aircraft was the star performer of an exercise where it had clearly made “a very good show” as an MPA.³⁰ The fact that a full tank of fuel permitted flights of 10 hours (with 2 hours’ reserve for alternatives) was also impressive. Of course, not all the news was good. The H2S set, for instance, was a great asset. However, it was dated, and coastal command operations required the more modern search radars that were available. Moreover, it was found that it was impossible for the navigator or wireless operator to leave their duties long enough to operate the radar; a problem that was fixed during NORTHERN CRUISE by getting a radar mechanic from Greenwood to fly with the Lancaster so that he could operate the set on a continual basis.³¹ All these observations would help with the development of the Lancaster as an MPA, but certain voices in the RCN were not so convinced that it was right for the role. Specifically, the RCN found it difficult to swallow RCAF claims that the Lancaster was a “fast aircraft” and that its speed was a key factor in its defeat of the task force. Instead, at least one senior RCN naval aviator thought it would be more realistic to arrange an exercise during an upcoming cruise in the Atlantic whereby MAGNIFICENT’s much quicker Firefly aircraft, which were much quicker than the Lancaster, could test the mettle of the Sea Furies in the combat-air-patrol role by playing fast shadower.³² As with all peacetime exercises, there was undoubtedly room for debate and interpretation, but this did not change the fact that the RCAF had seen enough evidence that the Lancaster “had proved itself [an] aircraft for this type of [maritime-air] operation.”³³

Exactly how well the Lancaster would have performed against a real and hostile naval force was not tested as the cold war, fortunately, never turned hot. In some measure, that did not matter. The RCAF was well aware that these aircraft were close to being obsolete from the moment they re-entered service, explaining why the process to find a replacement aircraft was started almost immediately. The greatest achievement of the Lancaster, therefore, was that it gave the RCAF the time it needed to respond quickly to a sudden submarine threat by rebuilding and resuscitating an essential capability. Moreover, NORTHERN CRUISE was also important in that it gave the RCAF confidence in the Lancaster as an MPA. Admittedly, the RCAF had few other options available, but NORTHERN CRUISE identified that the Lancaster crews, unlike the slaughter the Canso had faced during the exercise, actually stood a good chance of surviving contact with a modern naval task force in the Arctic.

NORTHERN CRUISE is equally important to the current long-range MPA community and its sense of identity. With the once mighty EAC all but wiped out from post-war cuts, the inclusion in this naval exercise of a SAR Lancaster and Canso in the maritime-patrol role represented a rebirth of a legacy and capability that the RCAF almost lost. Indeed, the growth of MPA in the years following NORTHERN CRUISE was remarkable. Beginning with the formation of No. 2 (Maritime) Operational Training Unit at Greenwood in November 1949, the RCAF maritime-air community sprung back to life with the formation of 405 Maritime Reconnaissance (MR) Squadron. In time, 405 (a former pathfinder squadron that flew Wellingtons, Halifaxes and Lancasters during the war) was joined by two other reformed squadrons: 404 and 407 (the former wartime service was with Blenheims, Beaufighters and Mosquitoes, while the latter flew Blenheims, Hudsons and Wellingtons). The three squadrons fell under the rubrics of the newly formed Maritime Air Command.³⁴ Using their refurbished Lancasters to relearn the art of maritime reconnaissance, these squadrons developed the skills and eventually acquired the equipment to give Canada a considerable capability. This proud legacy continued throughout the cold-war period as the Lancaster gave way to a new fleet of Neptune and Argus aircraft, which, in turn, were replaced by the Auroras that today's 404, 405 and 407 Squadrons use to meet Canada's current maritime air needs. (Note: 415 Squadron, which reformed in the spring of 1961 and was stood down and amalgamated with 405 in 2005, was also part of this proud cold-war heritage. So, too, was 449 Maritime Training Squadron, which flew the Argus between 1968 and 1975 during its short-lived existence).³⁵

While understanding the cold-war lineage of the RCAF's maritime-air community is important from a heritage perspective, NORTHERN CRUISE also provides significant tactical, operational and strategic lessons for today's generation as well as those interested in modern air power. For instance, while the air portion of the exercise was not, strictly speaking, conducted in the Arctic (the furthest extent of the Lancaster's operations only took it to the northern tip of Labrador), the RCAF nevertheless realized that the unique characteristics of the region created certain challenges that the tactics of the last war would not solve. Fighting in the Arctic, therefore, required new ways of thinking. Further exercises would have helped develop RCAF/RCN joint Arctic doctrine as well as awareness, and both services were keen to repeat the experience. While the RCAF and RCN would conduct individual exercises and operations in the Arctic, a lack of political will, restricted budgets and heavy operational commitments elsewhere all conspired to ensure that it was some time before they engaged in another joint venture. NORTHERN CRUISE had identified that there was much to learn about northern maritime-air operations, but the lack of joint exercises meant that—had the Arctic become a theatre of war in the 1950s—both the RCAF and RCN would have had to discover these lessons during actual combat. This explains why it is essential for northern countries (like Canada) to not only maintain a continuous presence in the Arctic but also conduct regular joint military exercises which ensure that corporate knowledge of the region is preserved.

The story surrounding the resuscitation of a maritime-air capability for the RCAF also provides important strategic lessons that are just as valid today as they were 65 years ago. No nation can be fully prepared for unexpected shifts in geopolitical sphere, but the extent to which the Canadian military was cut immediately after the Second World War stands as an illustration of the challenges that can emerge from periods of austerity. Reconstructing lost capabilities is never an easy task, and there is nothing worse than trying to do so in the middle of a war, national emergency or global crisis. This was exactly the challenge

the RCAF faced in the late 1940s, and they were fortunate to have a large number of stockpiled Lancasters that helped them to quickly rebuild a much-needed maritime-patrol capability. In fairness to the government of the time, there was no crystal ball in Ottawa to warn them about Soviet aggression or the coming cold war. In their view, the German U-boat threat was defeated, and in a time when Canada was trying to return to a peacetime economy, there was no perceived need for the RCAF to maintain a large maritime-air fleet. And that is the problem with sudden shifts in the strategic environment (shocks), preparing for them is extremely difficult since their implications are only understood in hindsight.³⁶ Few nations have the money or unlimited resources to respond to every possible military contingency, and as a result, politicians and senior military officers are often left with little choice but to take measured risks when designing their future force structures. Extensive strategic analysis, historical case studies, good intelligence and a thorough understanding of the security environment represents the best way to mitigate such gambles. For the British, this has resulted in the difficult decision to save economies by not replacing their fleet of Nimrod MPA. Only time will tell whether the loss of this capability was the right choice or if a new shift in the geopolitical environment will put them in a similar position to the one the RCAF faced in the early days of the cold war. ☺

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Abbreviations

Acc	Accession
ACNS	Assistant Chief of Naval Staff
ASW	antisubmarine warfare
CAS	Chief of the Air Staff
CO	commanding officer
det	detachment
DHH	Directorate of History and Heritage
EAC	Eastern Air Command
ft	foot/feet
HMCS	His Majesty's Canadian Ship
LAC	Library and Archives of Canada
m	metre
MPA	maritime patrol aircraft
OC	officer commanding
RCAF	Royal Canadian Air Force
RCN	Royal Canadian Navy
RG	Record Group
SAR	search and rescue

Notes

1. C. C. Mann to H. G. DeWolf, 30 September 1946, Library and Archives of Canada (LAC), Record Group (RG) 24, Volume (Vol). 8153, file NSS 1660-8, volume (v).1. For articles on early Northern exercises see: Sean Maloney, "Canada's Arctic Spies: The Director's Cut," *Canadian Military Journal* 9, no. 1: 76–88; Hugh Halliday, "Recapturing the North: Exercises Eskimo, Polar Bear and Lemming, 1945," *Canadian Military History* 6, no. 2 (Autumn 1997): 29–38; Hugh Halliday, "Exercise Musk Ox: Asserting Sovereignty North of 60," *Canadian Military History* 7, no. 4 (Autumn 1998): 37–44; and Hugh Halliday, "Arctic Investigations," *Legion Magazine* (July–August 2010): 55–57.

2. H. N. Lay to ACNS [Assistant Chief of Naval Staff], 21 October 1946, Proposed Joint Exercise in the Arctic 1947–1948, LAC, RG 24,



Vol. 8153, file NSS 1660-18, v.1. Unfortunately, Lay never explained what intelligence suggested that a Soviet submarine was operating in Davis Strait nor does there appear to be any evidence that one did.

3. Extract from minutes of the 95th meeting of the Joint Planning Committee, 13 May 1947, LAC, RG 24, Vol. 8153, file NSS 1660-18, v.1.

4. Flight Lieutenant Houghton to G. C. Jones, 21 June 1947, LAC, RG 24, Vol. 8153, file NSS 1660-18, v.1.

5. Staff Officer (Operations) to Vice Chief of Naval Staff, 17 February 1948, Directorate of History and Heritage (DHH), 81/520/1650-239/2, box 105, file 7; and NORTHERN CRUISE draft operation plan, no date (n.d.), DHH, 81/520/1650-239/2, box 105, file 7.

6. Randall Wakelam, *Cold War Fighters: Canadian Aircraft Procurement 1945–1954*, (Vancouver: University of British Columbia Press, 2011), 37.

7. S. Kostenuk and J. Griffin, *RCAF Squadrons and Aircraft* (Toronto: Samuel Stevens Hakkert & Company, 1977), 209–10.

8. W. A. Curtis to Chief of Naval Staff, 15 June 1948, LAC, RG 24, Vol. 8153, file NSS 1660-18, v.1.

9. Ibid.

10. For key accounts on the Berlin Air Lift and the early days of the cold war see: John Gaddis, *We Now Know: Rethinking Cold War History* (New York: Oxford University Press, 1997); and Carolyn Eisenberg, *Drawing the Line: The American Decision to Divide Germany 1944–1949* (Cambridge: Cambridge University Press, 1996).

11. Draft operational plan, [July 1948?], LAC, RG 24, Vol. 11193, file Accession (Acc) 1650-26 SUB 1.

12. Ibid.

13. Flight Lieutenant Publicover, OC [Officer Commanding] Detachment Report, n.d., LAC, RG 24, Vol. 8153, file NSS 1660-18, v.2.

14. Appendix A – Daily diary 103 SAR Detachment RCAF Station Goose Bay, Labrador, n.d., LAC, RG 24, Vol. 8153, file NSS 1660-18, v.2.

15. Ibid.; Annex B RCN – RCAF Combined Operational Report on Lancaster CHK, n.d., LAC, RG 24, Vol. 8153, file NSS 1660-18, v.2.; and Annex C RCN – RCAF Combined Operational Report on Canso CHB, n.d., LAC, RG 24, Vol. 8153, file NSS 1660-18, v.2.

16. Annex B RCN – RCAF Combined Operational Report on Lancaster CHK, n.d., LAC, RG 24, Vol. 8153, file NSS 1660-18, v.2.

17. Daily diary 103 SAR DET[achment] Report, n.d., LAC, RG 24, Vol. 8153, file NSS 1660-18, vol.2.

18. A. B. F. Fraser-Harris (CO RCN Air Station Dartmouth) to Flag Officer Atlantic Coast, 30 Dec 1948, LAC, RG 24, Vol. 8153, file NSS 1660-18, v.2.

19. Ibid.

20. Daily diary 103 SAR DET Report, n.d., LAC, RG 24, Vol. 8153, file NSS 1660-18, v.2.

21. Annex C RCN – RCAF Combined Operational Report on Canso CHB, n.d., LAC, RG 24, Vol. 8153, file NSS 1660-18, v.2.

22. Ibid.

23. Daily diary 103 SAR DET Report, n.d., LAC, RG 24, Vol. 8153, file NSS 1660-18, v.2.

24. OC Det Report, RCN – RCAF Combined Operation, n.d., LAC, RG 24, Vol. 8153, file NSS 1660-18, v.2.

25. SO (ND) Report RCAF participation – NORTHERN CRUISE, 30 October 1949, LAC, RG 24, Vol. 11193, file Acc 1650-26, Sub 1 FD 1.

26. CO MAGNIFICENT to Flag Officer Atlantic Coast, 7 December 1949, LAC, RG 24, Vol. 11193, file Acc 1650-26, Sub I FD 1.

27. A. B. F. Fraser-Harris, n.d., LAC, RG 24, Vol. 8153, file NSS 1660-18, v.2.

28. C. N. Lentaigne to ACNS Staff, 9 March 1949, LAC, RG 24, Vol. 8153, file NSS 1660-18, v.2.

29. Ernest Cable, “Challenging the Submarine Threat: Maritime Air Command and the Cold War,” *Airforce Magazine* 33, no.1 (Spring 2009): 15–16.

30. Appendix A – Daily diary 103 SAR Detachment RCAF Station Goose Bay, Labrador, n.d., LAC, RG 24 Vol. 8153, file NSS 1660-18, v.2.

31. Ibid.

32. A. B. F. Fraser-Harris, n.d., LAC, RG 24, Vol. 8153, file NSS 1660-18, v.2.

33. Annex B RCN – RCAF Combined Operational Report on Lancaster CHK, n.d., LAC, RG 24, Vol. 8153, file NSS 1660-18, v.2.

34. Information on these squadrons’ lineages can be found in Kostenuk and Griffin; and Department of National Defence, A-AD-267-000/AF-004, *The Insignia and Lineages of the Canadian Forces Volume 4: Operational Flying Squadrons*.

35. A-AD-267-000/AF-004, 2-223 to 2-224.

36. For an excellent example of current trends analysis see Department of National Defence, *The Future Security Environment 2008–2030, Part I: Current and Emerging Trends* (Ottawa: Chief of Force Development, 2009) and the RCAF’s own futures study: Andrew B. Godefroy, ed., *Projecting Power: Canada’s Air Force 2035* (Trenton: Canadian Forces Aerospace Warfare Centre, 2009). For work on strategic shocks see Nathan Freier, “Known Unknowns: Unconventional ‘Strategic Shocks’ in Defence Strategy Development,” November 2008.



It Ain't Easy!



Training a Canadian Fighter Pilot

By Major Ian DeCarlo, CD

One of the most challenging and rewarding accomplishments in my life was completing the Fighter Pilot Course (FPC)—10 months of intense training—and being granted the title of CF18 fighter pilot. It served as the final step toward realizing my life-long dream of joining a tactical fighter squadron as a qualified fighter pilot. But before achieving that goal, I would endure over 250 hours of ground-school instruction, numerous written exams, simulator training under the watchful eyes of instructor pilots (IP) and, of course, approximately 80 hours of flying in the CF188 Hornet (shortened to CF18 by almost everyone). The Fighter Pilot Course is held at 410 Tactical Fighter Operational Training Squadron (Tac F [OT] Sqn) at 4 Wing Cold Lake, Alberta. Since the initial cadre trained on the CF18 in 1982, each FPC has been numbered in sequence. Currently, FPC 52 is in the final phases of the course, with FPC 53 just beginning.

For most, starting any new course brings many emotions—fear and anticipation being at the top of my list. Not fear of the airplane, nor fear of the instructors—the fear that I recall from my course in 2004 was of not living up to my own personal expectations and not succeeding on the course. At the age of 27, I had been in the military for over eight years, having never known anything other than being a “student” or “trainee.” But this time it was different. This was the course that every other course had prepared me for, since the Basic Officer Training Course (BOTC) in Chilliwack, British Columbia. In my personal case, I had dreamed since I was 10 years old that this day would come. I had to be a fighter pilot; it was all I had ever wanted to do. If I could graduate from FPC, I would fulfill my wish to fly in the CF18 and make “fighter pilot” my career title, not just my dream.

As I sat in the 410 Sqn main briefing room in October of 2004 for the Commanding Officer and Wing Commander’s welcoming remarks, I certainly never imagined I would be where I am today as an instructor at the operational training unit (OTU). To be honest, at that point in my life I never wanted to do anything other than fly the Hornet operationally. I recall that I wanted to be a tactical instructor—a fighter weapons instructor—but that I would never want to just teach a bunch of students how to take-off and land the Hornet. Instructing at 410 Sqn was something I could not see myself doing. Like most things in life, you just do not know where your path will take you. I now occupy the office that as a student I recall standing at attention in the doorway of, addressing the major who, at that time, seemed like a long-in-the-tooth veteran of the CF18 at the ripe old age of 32.

And so, now, here I am, the 410 Sqn Weapons and Training Officer. This is exactly where I more recently realized that I wanted to be—teaching pilots and helping them realize their dreams.

I arrived at 410 Sqn in May of 2013 as a fighter weapons instructor with about 1,000 hours in the jet, having never instructed before, except on the operational squadron; something much different. Instructing at the squadron started with teaching wingmen (recent graduates of FPC) and went all the way to instructing on the Fighter Weapons Instructor Course. But 410 Sqn is different. Certain assumptions are made when you teach someone with experience in the aircraft—things like basic aircraft handling, adherence to training rules and an understanding of aircraft systems and how to employ them. Teaching at an operational unit focuses much more on refining technique and developing leadership skills as new element (2-ship) and section (4-ship) flight leads. But as I embarked on my tour at 410 Sqn, my approach to instruction would need to change. Yes the principles of instruction are quite similar, but a distinct mindset adjustment would be in order. I could not expect students with 20 or even 40 hours in the jet to perform to the level I had grown used to over the past 8 years. And make no mistake; fighter pilots expect performance out of themselves and their peers, no matter what their level of experience is.

At first my concern about instructing was how to measure student performance with a limited frame of reference, other than my own experience as a student. Of course, there is the definition of grade levels (anyone who has gone through any military pilot training has experienced the same). 410 Sqn runs every IP through a Fighter Instructor Course (FIC) upgrade to assist in giving the new IP an idea of what to expect from students throughout the phases of the course. My concern was making a mistake in grading—either expecting too much of the students and grading them too low or overcompensating for that and being the “Santa Claus” IP that every student wants to fly with. In the end, it came down to trusting my own judgment and experience, using an analytical yet fair approach to assessment and applying the standard consistently and without bias.

The FPC begins like any other course with intense classroom instruction; exams, including aircraft operating instructions and emergency “red pages” written word for word from memory; and then simulator training. The simulator is a very realistic, state-of-the-art system, which allows multiple aircraft to link together and fly in a virtual environment with or against each other or other computer-generated adversaries and targets, including surface-to-air and airborne threats. One of the students’ first “threats” is learning how to conduct a full procedure VOR IFR (very high frequency omnidirectional radio range instrument flight rules) approach into Prince Albert, Saskatchewan, in instrument conditions (zero reference to the ground, using only on-board systems to navigate); learning to “fight” in the aircraft comes much later in the course.

The FPC is broken down into phases and subphases. Pilots from other communities will recognize terms like clear-hood¹ and instrument, but the Transition phase (which encompasses clear-hood, instrument, formation and air-to-air refuelling subphases) is just the first month or so on the flight line and is a basic introduction to flying and handling the aircraft in various weather conditions. Following a handful of simulator missions and only four instructor-monitored flights in the two-seat aircraft (three clear-hood missions in fair weather and one instrument mission in not-so-good weather), students who meet the required performance levels will take the CF18 flying for their first solo.

With less than six hours in the aircraft, students (albeit Royal Canadian Air Force [RCAF] pilots with wings) are trusted with the fastest aircraft in the country to conduct a solo mission in the local airspace and then “beat up the pattern” at 4 Wing Cold Lake. It is an experience that every fighter pilot remembers for the rest of their life. It is not the hour-long thrill ride that most expect; it is an hour of intensity and focus that goes by faster than any hour the student has experienced before. But as the engines are shut down and the sound of jet noise turns to the quiet clatter of fan blades in the intakes and crackling brakes, there is a realization in every student’s mind—I just flew the CF18 Hornet, BY MYSELF! I AM LIVING MY DREAM! Not much time to celebrate, the very next day the training continues.



CF Photo: Cpl Mathieu St-Amour



With the completion of the Instrument and Formation subphases, the Transition phase is complete, and the similarities to previous courses end. The next step is learning the most critical sensor on the aircraft, the APG-73 radar.² The Air-to-Air phase is divided into three subphases: Basic Fighter Manoeuvres (BFM), Advanced Combat Manoeuvres (ACM) and Air Combat Tactics (ACT). After an introduction on employing the radar and conducting night intercepts against other aircraft, formation take-offs and landings at night (without night vision goggles [NVGs], using only small strips of lights on the aircraft as references), the students progress to learning how the CF18 handles as a FIGHTER instead of just as an airplane.

The BFM subphase is the first time students will employ the aircraft as a weapon system. With BFM simulator missions complete, students learn advanced and slow-speed handling in the Hornet. The Hornet is designed to be a superior fighter in the slow-speed regime. It handles extremely well and is very controllable at speeds not much faster than a Cessna would fly, yet it can be quite unforgiving for the untrained pilot. The BFM subphase immerses the students in a very dynamic three-dimensional environment in which they must manoeuvre in relation to another Hornet (flown by an IP, the flight lead), gain an angular advantage relative to that aircraft and direct the weapon systems on board the aircraft to “shoot” the three main weapons within the allowable parameters at the adversary. Hours of ground school, including scientific analysis of the performance characteristics of the CF18 and techniques for correct tactical manoeuvring, form the foundation for this subphase.

It is challenging and yet extremely exciting for the students. It can also be rather challenging for the instructors, both physically and mentally. Instructor pilots must be hyper vigilant to anticipate errors and intervene (take control from the back seat), if necessary, prior to catastrophe. Closure rates between two aircraft can reach 800 knots [1,482 kilometers per hour]; aircraft will meet head-on in less than 10 seconds from inside of 2 miles [3.2 kilometers]. G-forces will be at the maximum capability of the aircraft, up to 7.5 g (7.5 times the force of gravity), and can leave IPs monitoring from the back seat with aches and pains after multiple high-g sorties in the same subphase.

Training rules are briefed before every mission and must be strictly adhered to by the students. Failure to honour the training rules can, depending on the severity of the infraction, lead to mission failure, which is far better than the alternative—midair collision, near miss or mishandling leading to impact with the ground. In general terms, no messing around; mistakes in this business will kill you.

As if BFM was not dynamic enough, now take a third aircraft—the flight lead—and add that to the mix. During the ACM subphase, students learn to fight a single adversary aircraft as part of a two-ship element. Although it sounds like a tremendous advantage, the set ups begin with the element on defence with the bandit (hostile aircraft) having a distinct positional and altitude advantage. The students must learn to react appropriately, communicate and deconflict with their lead, manoeuvre their aircraft in relation to a threatening adversary, and employ simulated weapons to “kill” the adversary aircraft (of course this is simulated with very specific criteria). The ACM subphase is typically when most students begin to experience the greatest difficulty on the course. Few students make it through this subphase unscathed—without at least one red tick (performance grade below the required level) or worse, an UNSAT (unsatisfactory [failed]) mission.

Failed missions can become a student's worst nightmare. Individually, a failed mission is significant but not the end of the world. Each one results in extra attention—scrutiny from the standards and training officers—and an independent review, which examines the student's performance throughout the course up to that point. As with any other military course, there are constraints on how much time a student has to get it right. There are limited attempts and flying time available to meet the required standard. In the case of FPC, failing two consecutive syllabus missions leads to a progress review board (PRB). That equates to more unwanted attention on the student and further analysis as to whether the student is consistently meeting the standard expected on the course within the given time constraints for training. In some cases, the PRB recommends that the student continue with some limited remedial training. But in most cases, by the time it reaches PRB, the additional training has been exhausted and the board has no choice but to recommend that the student cease training. This is the part of my job that I certainly do NOT enjoy. Seeing the look in a student's eye when they are told that their dream of becoming a CF18 fighter pilot is over is by far the worst part of instructing. Any instructor who takes even a hint of pleasure in telling a student that they have failed, whether it is a sequence on a flight, a syllabus mission or the course itself, has no business instructing students at any level. I remind myself on a regular basis what it was like to be a student on this course and how I felt about the way I was treated by IPs, both good and bad. I use that every day to help me become a better instructor at 410 Sqn, and I try to set an example for other IPs to do the same.

Following ACM, students progress to the ACT subphase. This is the longest subphase of the entire course and develops the students' abilities to employ the aircraft from beyond visual range (BVR) all the way to within visual range (WVR) against adversary airborne aircraft. It covers every facet of the air-to-air mission that a new wingman will be expected to perform.



CF Photo: 19 Wing Imaging



Their training begins with stern intercepts (required in a North American Aerospace Defence Command mission) and progresses to simulated weapons employment, starting at long range against hostile aircraft and then working closer to the threat and defending all the way to the merge to conduct BFM/ACM as previously learned. The culmination of the ACT subphase is the defensive counter-air (DCA) missions. DCA involves manning a combat air patrol (CAP) to defend a section of airspace or area on the ground against threat aircraft and is the first combat scenario on the FPC where students begin to experience all of the previous aspects of the course in one mission. It may involve an instrument departure to transit to the area of operations, air-to-air refuelling, formation procedures, BVR sensor and weapons employment as well as WVR engagement of adversaries to conduct ACM.

Students who make it to ACT have demonstrated their ability in all the required Air-to-Air phase performance categories and now combine all knowledge and skills in a 1.5-hour mission. 410 Sqn typically will run a wartime scenario that will have two-ship formations (with students flying as the wingmen with IPs in the backseat) constantly manning a combat air patrol and taking off in sequence to cover an extended period of time. Adversaries are played by numerous aircraft from a variety of units including other squadrons and, if available, other visiting nations. It makes the last three missions of the ACT subphase very exciting and realistic and gives students a raised level of confidence and understanding of their role as fighter pilots. ACT concludes with a solo mission, flown as wingman of a two-ship, conducting this relatively complex DCA mission. Students at the end of this subphase are deemed Air-to-Air complete, and some will go directly to their newly assigned squadrons for up to six months. Others will continue immediately on to the Air-to-Ground phase to complete the course. In both cases, students will complete the entire syllabus, whether interrupted or not, prior to receiving the ADKH qualification code and being deemed a CF18 fighter pilot.³

The Air-to-Ground phase can be completed in as little as four or five weeks with ideal weather and required resources. It can be completed in a multitude of locations and often occurs while 410 Sqn is deployed to the United States during periods of inclement weather in Cold Lake. Regardless of the location, students on the Air-to-Ground phase will complete additional ground school, simulator missions and flights. These will focus on the remaining three subphases of the course: Conventional Weapons Delivery (CWD), Air Interdiction (AI) and Close Air Support (CAS).

Conventional Weapons Delivery teaches the students the techniques for delivering unguided weapons (dumb bombs) against stationary targets as well as strafing using the 20 millimetre M61A1 cannon. Both of these deliveries are conducted using training rounds that replicate high explosives. Weapons accuracy is scored on an academic range with a 200-foot [61-metre] circular target area. Each student has six modular practice bombs (MPBs) per mission and will normally have 150 to 250 rounds of 20 millimetre ammunition. Strafing scores are calculated using an acoustic sensor on a 20-foot [6.1-metre] banner, which certainly seems a lot smaller when the open fire range for most deliveries is greater than 6,000 feet [1,829 metres]. Although aided by information presented to the pilot in the heads-up display (HUD), the gun is aimed manually through a gun sight called a reticle and requires a steady hand on the controls to effectively attack the target. The gun is fixed in the aircraft, and thus, the entire aircraft must be accurately flown to point the sights at the target. Imagine that you are flying in the rifle and the rifle can only hit the target as accurately as you aim. Each mission includes approximately 24 or more attacks (bombs and strafing) on the scored targets.

During the AI subphase, students learn two-ship and four-ship self-escort strike missions, involving airborne adversary aircraft; radar emitting simulated surface-to-air threats, which students must react to accordingly as if a real SAM (surface-to-air missile) was being launched at them; and surface targets against which they will employ a variety of actual weapons, including conventional (dumb) bombs and precision- (laser) guided training weapons. This is conducted as a wingman while striving to maintain the correct tactical formation, communicate with the flight lead, adhere to safety training rules and successfully employ simulated air-to-air weapons against assigned airborne threats to fight through to the target and back home again. The missions often include air-to-air refuelling with CC130T or CC150T aircraft as operational AI missions would. They also include GCI (ground controller interception) controllers who provide long-range radar surveillance to assist fighters with targeting airborne threats in accordance with the flight lead's brief. A syllabus mission during the AI phase can involve up to 10 or more personnel, all dedicated to one or two students executing this single realistic mission. The final AI mission is flown as a four-ship (section) against multiple adversaries, with students in positions "2" and "4." It is very dynamic and very challenging, yet for students who have worked extremely hard to get to this point on the course, it is extremely rewarding and exciting (and yes, even enjoyable) to complete.

The CAS subphase, although unopposed by airborne threats, adds a new level of complexity to the Air-to-Ground phase. Students learn how to coordinate with troops on the ground via a joint terminal attack controller (JTAC, also known as a forward air controller). Many of the IPs at 410 Sqn have experience as qualified JTACs and served in various roles in Afghanistan over the past several years. The CAS subphase teaches the complexity of employing lethal weapons against ground targets when they are in close proximity to friendly troops or sensitive collateral personnel or buildings. Students must be able to master all systems on board the CF18, including



CF Photo: Cpl Vicky Lefrançois



the SNIPER advanced targeting pod equipped with a laser spot tracker to detect laser target designations on the ground from JTACs or other aircraft. In addition, students must be able to employ all weapons (some of them real) against training targets in strict compliance with JTAC direction and in accordance with clearly defined procedures as in a theatre of operations. Students once again step through a building-block approach during this subphase, learning first how to operate as a single aircraft supporting the JTAC and then as a wingman in a two-ship element in a more complex mission.

The Air-to-Ground phase is the shortest, yet for many students, it is the most challenging phase. It combines every aspect of the course. Every sequence flown from pre-start to shutdown is evaluated, with a high standard of performance expected. The final mission on the Air-to-Ground phase (as students are often reminded) is the last dual (instructor-monitored) flight for a long time. Instructor pilots take this very seriously as students must demonstrate “terminal habits.”¹⁴

The FPC can be an emotional experience for some. I remember hearing while on on-job training (OJT) in Cold Lake that as a student at 410 Sqn you do not know on Monday if you will have a job by Friday. That may be a bit overstated, but the reality is that it does not take long to drift away from the learning curve. Like any other military course, standards must be reached within limited time constraints. By the time students commence training at 410 Sqn, they have spent years in pilot training, not to mention the initial professional development that all officers undergo. The success rate of FPC averages about 90 per cent. For the 10 per cent who do not make it to the end of the course, other career opportunities as an RCAF pilot normally remain open. But for those who graduate from FPC, it is the beginning of an exciting career as a fighter pilot.

Instructing at 410 Sqn is a rewarding and challenging experience. Students often find new and exciting ways to scare you beyond your wildest imagination—not intentionally (at least I hope not!) but due to a lack of experience or understanding of the performance of the aircraft. It demands an incredible amount of vigilance when either observing from the “trunk” (affectionate term for the back seat of the two-seat model CF18B) or while leading a solo student in a single seat jet from another aircraft. Fortunately, the average IP at 410 Sqn has between 500 and 1,500 hours of experience in the aircraft and goes through training to know what to expect from students throughout the phases of the course. I have learned in my first six months instructing that you can never assume that a student has it all figured out. The IP is the aircraft captain, signs for the jet and is responsible for the conduct of the mission in its entirety. The gravity of that responsibility must not diminish over time.

While instruction has its stressful moments, it is incredibly rewarding to see a student progress from their first flight in the aircraft to their final syllabus mission. Knowing that you played an instrumental part in the development of each student that you flew with can give instructors a sense of pride. Every IP at 410 Sqn had their beginning as a student in the same hangar, and watching students graduate brings you back to the emotions experienced as a student not too many years before. In comparison to other fleets in the RCAF, the fighter force is relatively small. Fighter pilots will inevitably work with each other on more than one squadron over the course of a career, which certainly makes you feel like part of a family once you graduate from FPC. It also gives instructors a sense of responsibility to mentor students on FPC as they may one day be your wingman in combat.

When I first joined the RCAF 17 years ago, the last time CF18s had deployed to combat was 1991 during the Gulf War. As an OJT pilot in Cold Lake, there were still a number of pilots who had served in that mission. And then in 1999, Operation ALLIED FORCE—yet another two-way shooting war—saw CF18s deployed to combat. Later as a young second lieutenant in Cold Lake, ironically while on OJT at 410 Sqn, 9/11 happened. Never would I have thought that the events of that day would impact my life so much; it led to a ground tour in Afghanistan and living in a drastically different world where threats came from both inside our borders and out. And then only a few years ago, CF18s once again deployed; this time to participate in combat operations over Libya.

The reality of the world today should weigh on every IP's mind when instructing fighter pilots. We are not training pilots to simply fly the CF18. We are training our future wingmen for the next deployment, wherever that may be. The FPC is an extremely challenging course and rightly so. The demands of operational deployments do not tolerate incompetence and laziness, and when faced with a potential future enemy who will make every effort to bring your aircraft down, fighter pilots must be prepared with the skill set to not only survive but also accomplish the assigned mission. That learning begins at 410 Sqn on day one of FPC but does not stop on graduation day. Successful fighter pilots never stop learning, never stop self-improving. As an instructor at 410 Sqn, I hope to impart that attitude to the students I fly with, knowing that one day we may find ourselves in combat in the same formation.

Noctivaga 🇨🇦



CF Photo: MS Steeve Picard

Major Ian “Duste” DeCarlo joined the Canadian Forces in 1996 under the Regular Officer Training Plan. He attended the Royal Military College of Canada in Kingston, graduating with a Bachelor of Science degree in 2000. Upon completion of Fighter Lead in Training at 419 Tactical Fighter Training Squadron in Cold Lake, he began the Fighter Pilot Course (#36) at 410 Tac F [OT] Sqn in October 2004, graduating in May 2005. Major DeCarlo spent his first operational tour on 441 Tactical Fighter Squadron (Tac F Sqn) in Cold Lake, which merged with 416 Tac F Sqn in 2006 to become 409 Tac F Sqn. He graduated from the Fighter Weapons Instructor Course in 2008 and later that year was chosen to deploy to Afghanistan as a forward air controller with Task Force 3-09. He served on Operation ATHENA as Officer Commanding – Tactical Air Control Party (OC TACP), from October 2009 until April 2010. In July 2010 he was posted to 1 Canadian Mechanized Brigade Group Headquarters in Edmonton, Alberta, as the OC TACP. He was then posted to 410 Tac F [OT] Sqn in Cold Lake in May 2013, assuming the title of Squadron Weapons and Training Officer.

Abbreviations

ACM	advanced combat manoeuvres
ACT	air combat tactics
AI	air interdiction
BFM	basic fighter manoeuvres
BVR	beyond visual range
CAS	close air support
DCA	defensive counter-air
FPC	Fighter Pilot Course
IP	instructor pilot
JTAC	joint terminal attack controller
OC	officer commanding
OJT	on-job training
PRB	progress review board
RCAF	Royal Canadian Air Force
Sqn	squadron
TAC	tactical air control party
Tac F	Tactical Fighter Operational
[OT] Sqn	Training Squadron
Tac F Sqn	Tactical Fighter Squadron
WVR	within visual range

Notes

1. Clear-hood refers to a pilot being able to discern a natural horizon when flying. It originated in the early days of instrument flight training when a trainee was denied any outside reference in an aircraft or simulator by means of a cloth barrier or hood. This forced the individual to concentrate on the aircraft's instruments. Clear-hood indicates the removal of the “hood” and means that the trainee gets their visual cues from the horizon. The aircraft is manoeuvred with visual reference to the horizon.

2. Military avionics equipment comes with its own multi-lettered code depending upon the type, where it is utilized (aircraft, ships, etc.) and what it is utilized for. In this case APG stands for airborne, radar, ground fire control. All systems on-board the CF18 are given a letter/number designation such as this.

3. This “split stream” approach is the operational training unit's on-going effort to increase student production while maintaining given resources and is still in its early stages of implementation. It has created new challenges in managing a fragmented training plan but has the intention of ultimately reducing the training bill per student. Students who return to 410 Sqn after a period on the operational squadron have a slightly reduced flying syllabus for the Air-to-Ground phase, as they have been given an opportunity to gain some experience in the aircraft. The effectiveness of the split stream will be determined after the first Air-to-Air graduates return to 410 Sqn to complete the Air-to-Ground phase in the fall of 2013.

4. Terminal habits refer to the student achieving an adequate level of performance on the course that can be maintained, without supervision, for their entire career. These are the graded performance items that must be demonstrated to an acceptable level in order to succeed on the course. Terminal habits would include basic items such as consistently landing the aircraft safely and properly, up to how the radar in the aircraft is properly interpreted to ensure mission effectiveness.

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Canada

COMMAND OR CONTROL?



**Considerations for the Employment
of Air Power in Joint Operations**

By Major Pux Barnes, CD, MA

Introduction

Over its nearly 100 years of existence, the air forces of Canada have evolved into the modern, highly capable and battle-tested Royal Canadian Air Force (RCAF) of today. Current members of the RCAF can be justifiably proud of the heritage that previous generations of airmen and airwomen have handed down to us. After decades of experience participating in operations that included everything from United Nations peacekeeping missions to conflicts in the Persian Gulf, the Balkans, Afghanistan and Libya, the RCAF has developed an effective way of operating, defined by our tactics, techniques and procedures, widely known as TTPs. Aircrew and ground crew both know the value of “following the checklist,” adhering to standard operating procedures and using tactics that are proven.

While the tactical lessons have endured, the same cannot be said of the operational-level art of command and control (C2). Although it once possessed a detailed and effective capability to plan, coordinate and command at the operational (or theatre) level, the post-Cold War RCAF has experienced a dramatic erosion in the general understanding of the principles of command and control. With the experiences of recent joint, combined operations providing the impetus, the RCAF has begun to resurrect its understanding of operational-level C2.

Putting that knowledge into practice will, however, take some time to accomplish. Several successful operational-level C2 education initiatives are currently gaining momentum. These include the Air Force Officer Development (AFOD) Program and the Air Component Coordination Element (ACCE) Seminar. At the heart of this education process is the key message to planners, staff officers and commanders at all levels of air operations—understand how command differs from control and how much of each must be delegated. Getting this right before we head out the door pays off quickly ... even in 400 BC, Chinese general and military strategist Sun Tzu knew this: “[T]he victorious army first realizes the conditions for victory, and then seeks to engage in battle. The vanquished army fights first, and then seeks victory.”²

RCAF C2 doctrine—A short history

During the Cold War, the RCAF participated in the development of C2 doctrine used by our allies in the North Atlantic Treaty Organization (NATO) and the North American Aerospace Defence Command. The operational-level headquarters, known as the group, ensured that staffs worked theatre-level issues for different flying communities across the country. Several generations of 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. There was an accepted framework of which officer commanded what force and who assigned missions to be flown. How we fit into the overall plan was reasonably well understood.

Following the Cold War, the RCAF ceased development of C2 doctrine and began to fall behind other Western air forces in the understanding of the effective employment of air power at the operational level. This changed following the publishing of the revised B-GA-400-000/FP-000, *Canadian Forces Aerospace Doctrine* by the Canadian Forces Aerospace Warfare Centre in 2010. With the follow-on B-GA-401-000/FP-001, *Canadian Forces Aerospace Command Doctrine*³ in March 2012, the RCAF established, for the first time in decades, operational-level C2 doctrine that was applicable across all RCAF operations.

In order to be relevant to the RCAF, the B-GA-401 had to do several things properly at the same time. It had to provide a place where the everyday air force could find its structure and its various missions defined from the perspective of those involved in operations. Ostensibly a force employment (FE) C2 manual, the B-GA-401 also had to help organize the thinking of all those involved in the employment of air power. Further, the doctrine had to be consistent with Canadian Forces (CF) operational-level joint doctrine⁴ and that of our allies.⁵ These commonalities had to begin with the way that command, control and C2 are defined.

Command, control and C2 defined

Most importantly, the B-GA-401 opens the door to a more complete understanding of what command and control really means. Part of the military vernacular that evolved during the Cold War, “C2” is often used but not fully understood.⁶ How many times have you said “C2” without really breaking it down and thinking it through? Appreciating how different “command” and “control” can be, yet how inextricably linked they must be, is at the crux of understanding the most fundamental concepts in the employment of air power. In order to best function in joint operations with land and maritime forces, the RCAF must first fully understand and put into practice the concepts of command, control and C2.

Command. The concept of “command” has been around since ancient times and is generally well understood. Command is defined as “[t]he authority vested in an individual of the armed forces for the direction, coordination, and control of military forces.”⁷ Further, all or part of this authority may be delegated to subordinate commanders in the chain of command. For example, a wing commander (W Comd) delegates their command authority to a unit/squadron commanding officer (CO) assigned to that wing. In its most basic form, all command authority exercised by personnel in a unit/squadron is delegated by that unit/squadron CO.

Control. How do those with command authority actually go about exercising it during force employment operations? The answer lies in the concept of “control.” Control is “[t]he authority exercised by commanders over part of the activities of subordinate organizations, or other organizations not normally under their command, which encompasses the responsibility for implementing orders or directives. Note: All or part of this authority may be delegated.”⁸ In short, control provides a means of exercising effective command. During air operations, control typically manifests itself in the authority to assign missions via the air tasking order (ATO), a document that organizes and coordinates the collective effort of a potentially complex air campaign. An ATO permits a single commander to efficiently task a large number of units/squadrons, normally dispersed at locations both inside and external to a theatre of operations.

Command and Control. C2 is “[t]he exercise of authority and direction by a commander over assigned, allocated and attached forces in the accomplishment of a mission.”⁹ In practice, C2 is a *process* that is performed through an arrangement of personnel, equipment, communications, facilities and procedures. The C2 process is employed by commanders when directing, coordinating, monitoring, assessing and planning operations to accomplish the mission. The concept of C2 is summarized in Figure 1. During complex air operations, exercising effective control can be a much more complicated process than exercising effective command. As a result of this reality, air forces require a very focused view of C2, known as the fundamental tenet of air power—centralized control and decentralized execution.

COMMAND:	CONTROL:
• constitutes formal authority	• is derived by delegation from command
• provides oversight, unifying all action	• supports command in detail
• is focused on establishing common intent	• is focused upon the details of execution
Together as “C2” the following five activities are performed:	
MONITORING • ASSESSING • PLANNING • DIRECTING • COORDINATING	

Figure 1. Command and control¹⁰

Centralized control and decentralized execution

Air forces must be organized on sound C2 principles with the purpose of achieving operational effectiveness across the spectrum of conflict. Centralized control is required to ensure the most efficient use of limited air assets, permitting air power activities to be refocused quickly to exploit fleeting opportunities, to respond to the changing demands and priorities of the operational situation, and to be concentrated at the critical place and time to achieve decisive results. Decentralized execution of air power operations permits assigned activities and missions to be performed simultaneously by lower-level commanders at different locations across the theatre. This concept, used in every major conflict since the Vietnam War, was first codified during the 1991 Gulf War and is still evolving, adapting and improving.

Centralized control gives coherence, guidance and organization to the employment of air power. It is achieved through a single officer, referred to as air component commander (ACC) who, having a theatre-wide perspective, has the authority to assign missions to air forces to best achieve objectives. The ACC is responsible for the control (to include planning, direction, prioritization, allocation, synchronization, integration and deconfliction) of all air forces assigned or temporarily made available. Importantly, the ACC does not normally need to *command* assigned or made-available air forces, for it is *control* that enables the tasking of air power missions.¹¹

Decentralized execution is the delegation of authority to subordinate commanders to execute assigned missions and is subject to the commander’s intent, the rules of engagement and the other parameters established by higher command. Decentralized execution fosters initiative and situational responsiveness and provides subordinate commanders with the authority to apply their expertise and understanding of local conditions to accomplish the mission within the guidelines and overall intent of the commander. Generally speaking, the more decentralized that command can be in an air operation, the more likely that the myriad tasks, details and variables that must be seen to will be accomplished, no matter what friction is experienced. Commanders at all levels must take necessary actions to ensure they execute their assigned missions and “fly the frag.”¹²

Finding the balance. An ACC must consider the characteristics of air power when deciding the degree to which control will be centralized or decentralized and the degree to which execution will be centralized or decentralized. Some factors greatly affect this decision and others will tend to support an argument for either a higher degree of either centralized or decentralized control. Factors that support centralization of control include unity of command, concentration of force and economy of effort. For example, an operation that involves a complex targeting process

of the enemy while in close proximity to friendly forces might lend itself to more centralized control, permitting the ACC to better manage a dynamic and changing situation.

In contrast, a lesser degree of centralized control may be suitable in some operations. Factors that support this decentralization include freedom of action, flexibility and mission command.¹³ Operations that are relatively simple, such as an air mobility operation involving only several deployed aircraft and crews, might be best controlled by a deployed C2 entity. While the ACC can maintain overall control of such operations, factors such as distance, different time zones and limited communications may limit the ACC's situational awareness sufficiently that delegation of control might make sense.

Commanders must analyse the situation and then centralize or decentralize their control measures as appropriate to the circumstances. It is important to bear in mind that generally speaking, the principles of war, principles of command and the characteristics of air power reinforce the fundamental tenet of centralized control and decentralized execution. Figure 2 summarizes the factors to be considered in the centralization of control.

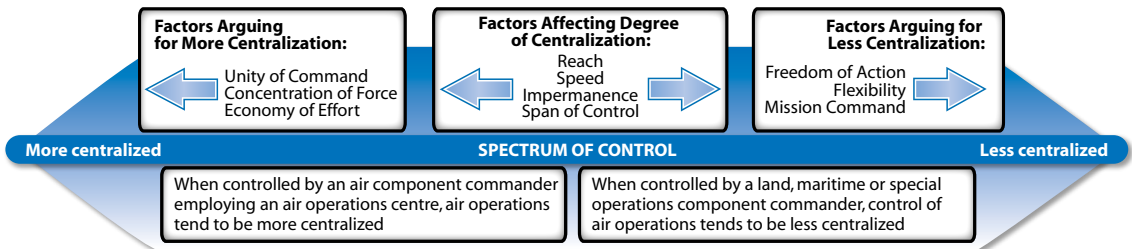


Figure 2. Spectrum of centralized control in air operations

So ... command or control?

Once commanders at all levels appreciate the concepts of command, control, C2, centralized control and decentralized execution, the decision can now be made as to what the appropriate C2 organization should be for any given operation. Above all else, commanders must see command as separate from control, exercised by different officers with significantly different responsibilities and focus. The traditional practice of simply “dual-hatting” the most senior officer in an operation with both command *and* control authority is often not the best decision, causing that commander to become overloaded while simultaneously dealing with the issues of command and a span of control that is too great to be effectively managed.

Commanders must continually think of command and control not as inseparable twins but as closely linked, separate concepts. Effective air power operations require increasingly specialized commanders to exercise control over assigned forces. More often than not, commanders must separate the command authority from the control authority and delegate them to separate officers. In a sense, commanders of air power operations must increasingly think of C2 as “command *or* control.” Consider the following with respect to air-power operations.

Command. Given that all elements of the CF will be under the command of Canadian officers at all levels, the issue of delegating *command* is actually a pretty simple one. The Chief of Defence Staff (CDS), who possesses full command¹⁴ authority, delegates command authority downward through various commanders in the chain of command, right down to officers at

the tactical level who are executing air operations. In a typical operation, the CDS delegates operational command (OPCOM) authority to an FE commander, either the Commander of Canadian Joint Operations Command (Comd CJOC) or the Commander of Canadian Special Operations Forces Command (Comd CANSOFCOM).

For domestic operations and global air mobility / intelligence, surveillance and reconnaissance (ISR) operations, Comd CJOC will normally delegate OPCOM authority to the standing joint force air component commander (JFACC) located at the combined air operations centre (CAOC) in Winnipeg.¹⁵ The JFACC will normally further delegate tactical command (TACOM) authority to commanders such as a W Comd or a detachment commander (DETCO) who execute air operations. This chain of command is shown in Figure 3.

During expeditionary operations, FE commanders normally delegate OPCOM authority to the designated joint task force commander (JTF Comd), who further delegates OPCOM authority of the deployed air task force to the air task force commander (ATF Comd). The ATF Comd delegates TACOM authority to the air expeditionary wing commander (AEW Comd).¹⁶ At the bottom of the command chain, yet closest to “the fight,” is the DETCO, who exercises command at the tactical level. This chain of command is depicted in Figure 4.

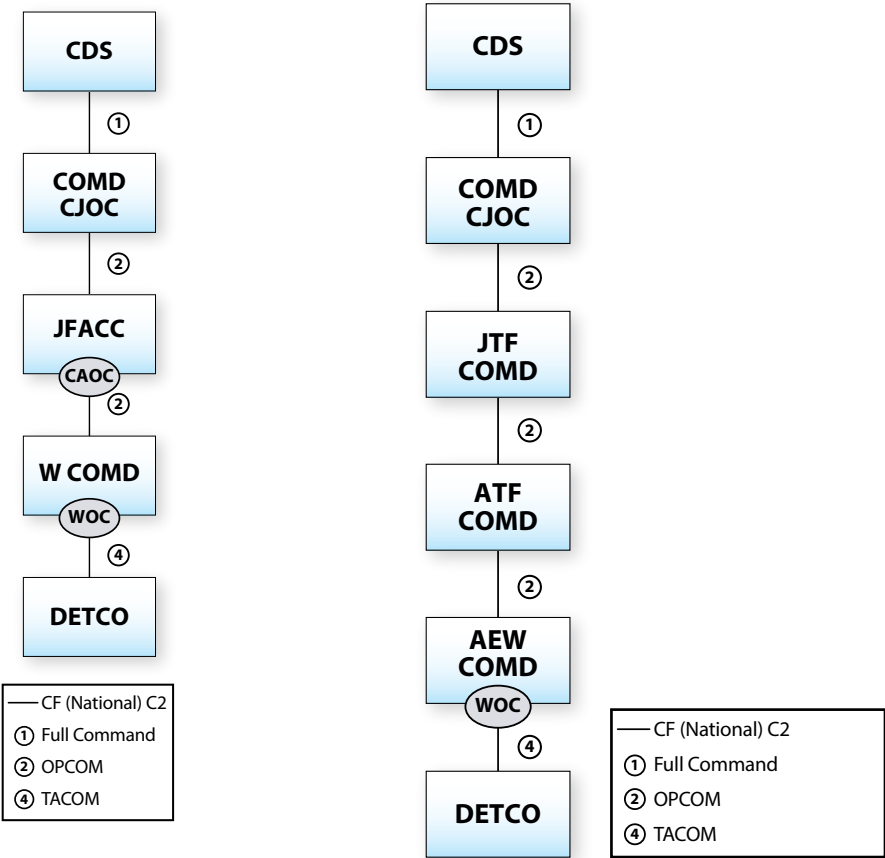


Figure 3. Chain of command for domestic operations including global air mobility and ISR operations

Figure 4. Chain of command for expeditionary operations

Control. Once the question of delegating command is sorted out, the far more challenging question for commanders of air operations is this: “*Who is best suited to exercise control?*” The answer need not be a complicated one. Commanders must determine, ahead of time, which elements of the theatre air control system (TACS) will be required to effectively plan, coordinate, task and retask air power on a continual basis during the operation. Controlling air power has come a long way since the Second World War when commanders watched bombers as they departed on missions and counted them six hours later when they returned. In order for air power to be relevant to the modern joint force commander, it must be agile and flexible, able to be quickly redirected where needed, no matter what part of the mission an aircraft might currently be in. Ensuring this happens is more the realm of *control*, not *command*. The successful centralization of control of air power relies upon the control specialists within the TACS.

Theatre air control system.¹⁷ RCAF operations are controlled through the overarching TACS which is centred on the JFACC, who employs the CAOC to direct, coordinate and control theatre-wide air-power operations. In principle, any ACC (including the variations of CFACC, JFACC and CJFACC)¹⁸ exercises (at a minimum) operational control (OPCON) of assigned and made-available air power on behalf of the JTF Comd. To be clear, the ACC *commands* the combination of staff and air operations centre (AOC) that together comprise the air component headquarters (ACHQ) but *controls* assigned and made-available air power. When the JFACC in Winnipeg (or an ACC deployed for a given operation) requires an operational-level presence forward, the tailor-made air component coordination element is employed. This team, led by an ACCE director,¹⁹ is responsible for conducting operational-level planning and coordination on behalf of the JFACC, in order to facilitate the integration of air effects into joint operations. See Figure 5 for the depiction of this “chain of control.”

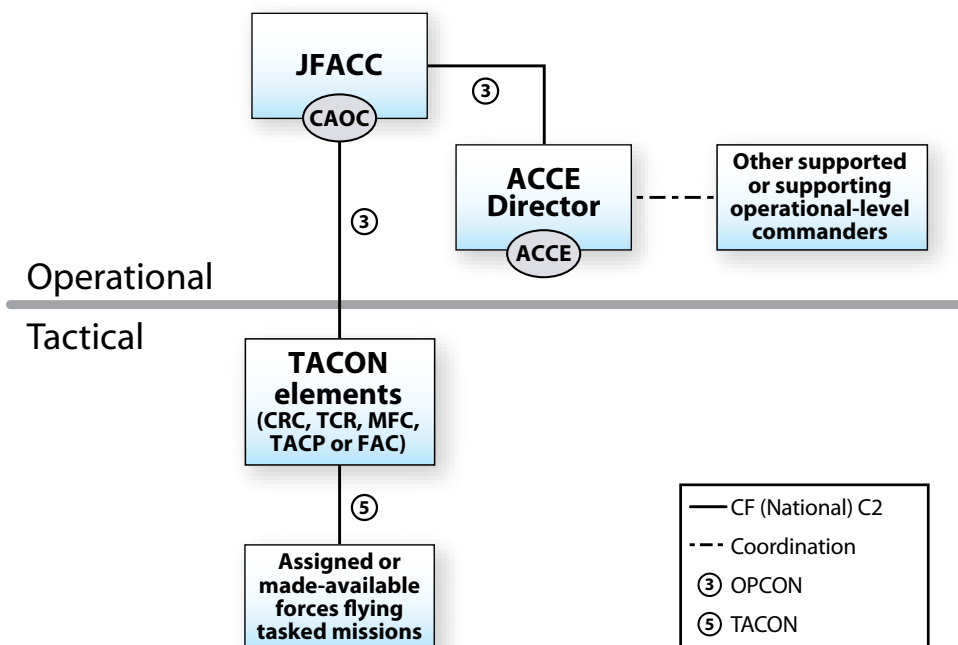


Figure 5. CF TACS as part of the RCAF “chain of control”

At the tactical level, the ACC relies upon a network of control entities to exercise tactical control (TACON) and ensure the plan is executed effectively, managing the many variables that are both anticipated and unexpected. What the TACS does well for a commander is permit the rapid retasking of aircraft to a new or revised mission while they are airborne. Examples of TACON elements include a control and reporting centre (CRC), tactical control radar (TCR), airborne warning and control system (AWACS), maritime fighter controller (MFC), tactical air control party (TACP) and, at the very end of the control chain, the forward air controller (FAC). If you are not considering the employment of these elements of the TACS in your operation, your ability to *control* air power will be significantly limited. The good news is that the RCAF possesses all of these TACS elements (with the exception of AWACS), and they are, on the whole, ready for deployment.

Summary

Critical to the success of any force employment operation is the understanding of the differences between command and control. Air-power operations, due to their complex nature, require that both planners and commanders carefully consider how they will structure their C2 system. In order for the tenet of “centralized control and decentralized execution” to be successfully exploited, command must be considered separately from control. It is through this lens that the RCAF can effectively employ a C2 process that permits commanders at all levels to effectively execute a centrally controlled and agile plan. Commanders must employ specialist units from the TACS to ensure control of air power is exercised smoothly on their behalf. The goal will always be to create a C2 process that permits a commander to efficiently run a theatre-wide air operation, measurably streamlining coordination and reducing confusion.

In the end, the RCAF has all the required elements to make the command and control of air power work. All that remains is to continue educating personnel about sound C2 principles, the same ones, incidentally, that our allies are currently using. By asking the question, “command or control?” during the planning stages of an operation, we can stack the odds in our favour before we even deploy, once again proving Sun Tzu correct. 🌀

Major Pux Barnes is an aerospace controller (AEC), currently posted to the Canadian Forces Aerospace Warfare Centre as a C2 doctrine analyst. Born and raised in Toronto, he earned a Bachelor of Arts in History from Glendon College before joining the Air Force. He subsequently earned a Master of Arts in War Studies from The Royal Military College of Canada in 2007 and is a graduate of the United States Air Force’s Air Command and Staff College. Major Barnes has accumulated over 3,000 flying hours in the E-3 Sentry AWACS aircraft in various operations including NATO’s Implementation Force and Kosovo Force, Operation ALLIED FORCE, Operation IRAQI FREEDOM, Operation ENDURING FREEDOM and Operation NOBLE EAGLE. Major Barnes is an associate lecturer at the University of Oklahoma, where he has taught graduate-level courses in history and international relations since 2008.

Abbreviations

ACC	air component commander	ATF Comd	air task force commander
ACCE	air component coordination element	ATO	air tasking order
ACHQ	air component headquarters	AWACS	airborne warning and control system
AEW Comd	air expeditionary wing commander	B-GA-401	B-GA-401-000/FP-001, <i>Canadian Forces Aerospace Command Doctrine</i>
AOC	air operations centre		

CAOC	combined air operations centre
CDS	Chief of Defence Staff
CF	Canadian Forces
Comd CJOC	Commander Canadian Joint Operations Command
CO	commanding officer
CRC	control and reporting centre
C2	command and control
DETCO	detachment commander
FAC	forward air controller
FE	force employment
ISR	intelligence, surveillance and reconnaissance
JFACC	joint force air component commander
JTF Comd	joint task force commander
MFC	maritime fighter controller
NATO	North Atlantic Treaty Organization
OPCOM	operational command
OPCON	operational control
RCAF	Royal Canadian Air Force
TACOM	tactical command
TACON	tactical control
TACP	tactical control party
TACS	theatre air control system
TCR	tactical control radar
W Comd	wing commander
WOC	wing operations centre

Notes

1. This is the first 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 29, 2013).

2. Sun Tzu, *The Art of War*, trans. Ralph D. Sawyer (New York: Barnes and Noble,

1994), 184. The author appreciates that you knew full well Sun Tzu or Carl von Clausewitz would get quoted at some point in this article.

3. B-GA-401-000/FP-001, *Canadian Forces Aerospace Command Doctrine* will be abbreviated as B-GA-401.

4. Principally the B-GJ-005-300/FP-001, Canadian Forces Joint Publication, CFJP 3.0, *Operations*.

5. Generally the AJP-3.3(A), *NATO Joint Air and Space Operations*.

6. The same can be said for its offspring such as command, control and communications (C3); command, control, communications and computers (C4); and command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR).

7. *Defence Terminology Bank*, record 27866.

8. *Ibid.*, record 375.

9. *Ibid.*, record 5950.

10. Department of National Defence, B-GA-401-000/FP-001, *Canadian Forces Aerospace Command Doctrine* (Trenton, ON: Canadian Forces Aerospace Warfare Centre, 2012), 4.

11. Normally, the ACC only *commands* the air component, comprised of the necessary staff and AOC personnel assigned to the ACHQ of a given operation.

12. “Flying the frag” 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. The “fragmentary flying order” was the forerunner of the modern ATO.

13. The CF philosophy of mission command, which emphasizes that only the requisite amount of control should be imposed on subordinates, argues in general for less centralized measures of control.

14. For detailed definitions of the various levels of command and control authorities, see *Canadian Forces Aerospace Command Doctrine*, 6–8.

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

16. W Comds and AEW Comds both employ a wing operations centre (WOC)

to coordinate upwards with the CAOC, laterally with other wings and downwards with assigned units/squadrons/detachments/elements to coordinate the details associated with command of air power at the tactical level.

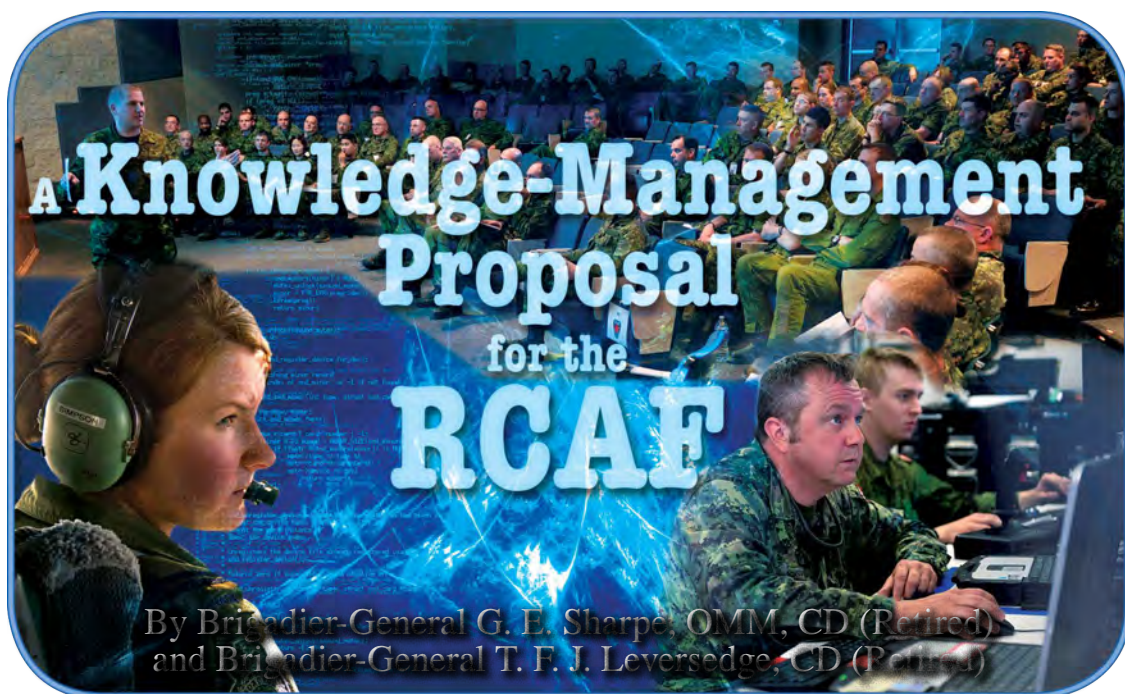
17. Detailed descriptions of the element of the TACS can be found in *Command Doctrine*, 22–25.

18. CFACC – combined force air component commander; and CJFACC – combined joint force air component commander.

19. For a detailed description of the duties/responsibilities of an ACCE and ACCE Director, see *Command Doctrine*, 27–29.



CF Photo: MCpl Robert Bottrill



Background

Knowledge management (KM)¹ and active learning are core competencies for an effective organization, especially if the organization is as heavily technology dependent as the Royal Canadian Air Force (RCAF). Lessons learned (LL) are, in reality, a subset of the broader knowledge-management area and have been a particular niche for militaries for many years. Perhaps more so than other government organizations, militaries exist in constantly evolving strategic and operational environments, and for them to be successful, managing accumulated knowledge and learning from the full range of experience should be considered a mandatory competency.

Perhaps not surprisingly then, the RCAF has repeatedly had a stated vision/objective of “being a learning organization.” And indeed, the latest version of the RCAF strategic plans, *Air Force Vectors*,² once again includes the following statements under the “Strategic Objectives – Agile, Learning Organization” heading:

Intent. The Air Force will enhance or develop means to gather, analyse, and integrate lessons learned throughout the organization, to reward innovation, to better manage knowledge and corporate memory, and to promote formal and informal learning and professional development.

Description. The Air Force has some elements of a learning organization—for example, a maturing lessons-learned process—but no systematic means of measuring progress, and few of the foundations such as sound knowledge-management practices. A learning organization is one that can modify its behaviour through the practice of adaptive team learning, underpinned by such processes as lessons learned, after-action reviews, and knowledge management. A learning organization also “facilitates the learning of all its members and continuously transforms itself.”³



The stated goals for this objective under the heading “Develop Knowledge Management Standards and Practices” are:

Intent. The Air Staff will analyse and support the introduction of new processes and practices to identify and capture knowledge, know-how, expertise, and other intellectual capital, and to make that knowledge available for transfer and reuse across the organization.

Description. Underpinning organizational and individual agility as well as accountable governance, management, and learning, is knowledge management. The knowledge management system is described by the DND [Department of National Defence] and the CF [Canadian Forces] as comprising a “range of practices used by organizations to identify, create, represent, and distribute knowledge for reuse, awareness and learning across organizations.”⁴

Similarly, for more than six years,⁵ the CF and DND have intended to be a learning organization. The stated goals of the latest Vice Chief of the Defence Staff–approved “Department of National Defence & Canadian Forces Organizational Learning Strategy”⁶ are as follows: to enhance collaboration, to manage content effectively, to learn from our own experience, to learn from other organizations, to leverage our knowledge and to foster a culture of continuous learning and innovation.

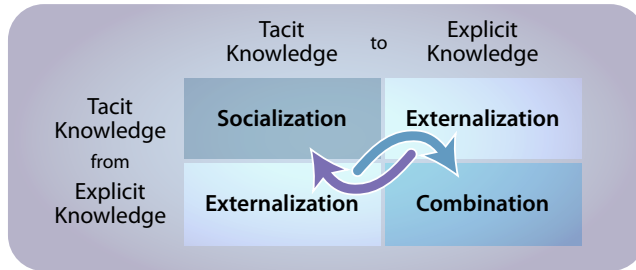
Knowledge management in a military context

Much good theoretical work has been done on the subject of knowledge management. One of the more germane articles to our discussion is “Knowledge Management in the Military Context” by S. G. McIntyre, M. Gauvin and B. Waruszynski.⁷ Rather than re-word their work, we have chosen to quote the article at length.

“Knowledge management is a multi-disciplinary field that draws from theories in economics, sociology, philosophy and psychology”⁸ and then combines them with applied disciplines such as information technology and library science. KM is intended to be more than a theoretical concept. It should reflect a pragmatic approach that is concerned with real solutions and the ability to accurately analyse and measure applications.

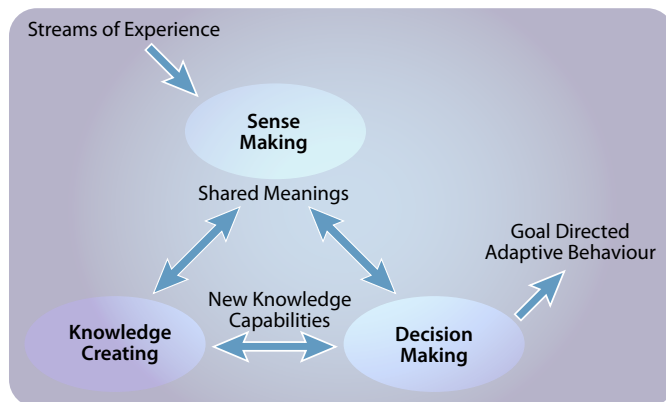
Knowledge is defined as “the fact or condition of knowing something with a considerable degree of familiarity through experience, association or contact.” It has also been defined as “a dynamic human process of justifying human belief toward the truth.” [More than] forty years ago, Michael Polanyi provided an explanation of knowledge upon which models of knowledge creation have been built. He differentiated between explicit, tacit and implicit forms of knowledge. Explicit knowledge is that which is stated in detail and leaves nothing merely implied. It is termed “codified” or “formal” knowledge because it can be recorded. Tacit knowledge is that which is understood, implied and exists without being stated. It is informal, experiential, and difficult to capture or share. It is knowledge that cannot be expressed. For example, an individual knows how to reach with his arm to grasp an object, but cannot describe how he knows how to do it. Implicit knowledge is that which could be expressed, but has not been. It is most often thought of as existing within the minds of individuals or in social relationships.

[Proponents of knowledge-management techniques have argued] that effective organizational knowledge creation occurs best through the spiral process where knowledge is converted from tacit to explicit in a continuous and dynamic cycle



[—the Nonaka model] ... It is when tacit knowledge and explicit knowledge interact that innovation occurs. Knowledge creation is facilitated by deliberately managing the cycle. Organizational knowledge creation begins with socialization, where individuals share experience and mental models. It develops into externalization when individuals use metaphors or analogies to articulate hidden tacit knowledge that is otherwise difficult to communicate. It moves into the combination phase for knowledge to be articulated, shared and expounded. Finally, individuals learn by doing and internalizing the new knowledge. The spiral begins again as the experience-based operational knowledge learned in the first cycle provides a larger knowledge base for continuous innovation and growth. It is this model that demonstrates how knowledge is actioned [and how lessons are learned].

[This model has been further combined] with two other strategic information processes to create ... the “knowing organization” [concept] ... Initially, through sense-making, an organization interprets the ongoing environmental data and establishes a shared understanding. If the experience is routine and known, then the organization can go directly into the process of decision-making. In this stage, the organization searches for more information and selects alternatives.

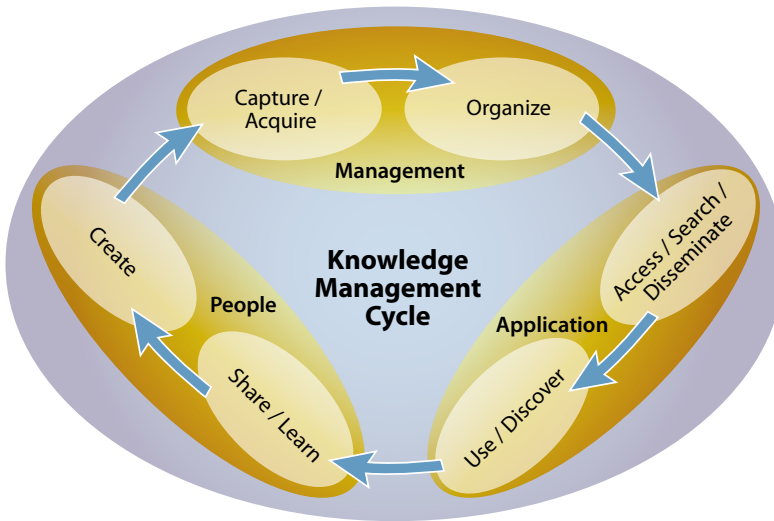


[The knowledge-creation model] is engaged when the sense-making process has determined that new knowledge is required or that the situation is novel and requires new responses. After the sense-making process, the organization then calls upon a knowledge-creation process that will give it additional input to move into the final stage of decision-making.

This cyclical model is reminiscent of the command and control OODA loop (Observe, Orient, Decide, and Act) in which information and then knowledge are transformed into action. ...

Knowledge-management cycle

How knowledge processes in a KM environment are managed to convert knowledge for action and to achieve the desired results of increased value in an organization or specific operation [is referred to as the knowledge-management cycle] There are three general perspectives on this cycle: management, application and people:



- Management focuses on capturing, organizing and facilitating knowledge. Many of these activities span the externalization and combination quadrants of the Nonaka model.
- Application focuses on effective retrieval of relevant content through advanced searches and mining to conduct knowledge-related work and tasks and on the use of the results for discovery. It relies on the knowledge combination portion of the model.
- People focuses on learning, sharing and collaboration. This is the education component of the cycle that is within the internalization quadrant, moving into the socialization portion. ...

A [past] study within the Department of National Defence suggested that [while] knowledge management in the military [does not vary much] in premises or theory from corporate versions, [it does vary significantly] in terms of context, content and pace. Whereas corporate KM tools can depend on a more sedentary infrastructure, military operational settings require mobile solutions with corresponding issues of security, bandwidth, robustness and reliability. The content varies as well, often more targeted to the particular operation. Finally, most corporate situations do not need the comparable, quick reaction time required in conflict situations.



KM in the military context [consequently] requires:

- knowledge processes that are robust and reliable within operational contexts;
- knowledge content and intellectual assets that are focused, precise, reliable, with suitable recall levels; and
- knowledge creation and conversion processes that match the pace of operations. ...

Knowledge management and the knowledge cycle within the context of military operational environments, therefore, require emphasis on these additional requirements of robustness, content and speed.⁹

The hard reality in all this, however, is that real knowledge management is mostly about people and getting individuals both to learn and also to pass their hard-earned knowledge to someone else in the most efficient and effective means possible. This is very easy to say and very challenging to accomplish.

Current status

Our objective assessment of both the CF knowledge-management programme and the stated goal for the RCAF to be a learning organization is that, despite repeated emphasis on the subject from senior management and the commitment of considerable time and resources, neither DND/CF nor the RCAF have made any substantive (or even measurable) progress in having a viable knowledge-management programme or in truly becoming a learning organization.

Generally speaking, at the present time, the RCAF has not developed a broad-based “learning” organizational culture; although, considerable efforts are being made at the tactical level to formalize the Air Force Lessons Learned Programme (AFLLP).

Without recognizing it as such, the irony is that, in at least two specific areas, the RCAF has already developed very effective knowledge-management approaches—the Flight Safety (FS) Program¹⁰ and the AF9000 Program, an engineering and maintenance quality-management system. In spite of these notable successes, the general approach to learning in the RCAF is very short term and based largely on individual experience—an approach that is vulnerable to the creation of significant knowledge gaps if experience levels fall. Overall, with the exception of operational lessons at the tactical level, the RCAF approach to knowledge management can be characterized as one of missed opportunities in failing to recognize, understand and formally pass on the valuable knowledge gained from experience. This is a pronounced gap in the Air Force’s ability to manage change intelligently and to be agile.

A flourishing knowledge-management process relies first and foremost on the organizational culture, recognizing the necessity of carefully observing how the organization functions across the entire spectrum of activities.¹¹ Secondly, based upon the knowledge assimilated from that experience, behaviour must be altered. In essence, in order to successfully become the “learning organization” that the senior leadership desires that it be, the RCAF must fully develop the ability to observe, analyse and implement changes based on experience across the full spectrum of force generation, force employment, force development and governance activities.



While force-employment lessons observed in the tactical environment—particularly during operations and exercises—are often noted and analysed and changes are subsequently implemented, this seldom happens at higher levels. Indeed, even knowledge gained at the local level is seldom widely shared across the RCAF. This area of lessons learned will improve significantly with the introduction and maturation of the AFLLP under the leadership of the Canadian Forces Aerospace Warfare Centre (CFAWC), provided senior-level support for the programme continues. However, at the operational level of the Air Force, there is a less rigorous approach to lessons learned, and at the strategic level, no substantive formal process exists. In order to thrive in demanding and rapidly changing times, the RCAF needs to become a genuine learning organization at all levels; a culture change that would have a major positive impact on the entire RCAF.

To achieve a successful organizational culture change in any environment, the transformation must begin at the top, and that is particularly true in the military. Simply issuing direction to change will not achieve the goal of changed behaviour. Despite the Chief of the Defence Staff emphasizing lessons learned as a priority for the CF¹² for several years and the Commander RCAF doing the same,¹³ knowledge management / lessons learned have not progressed substantially in either the CF or the RCAF. Ultimately, recognizing that resources are an essential component of authority, until sufficient resources are dedicated to knowledge management and lessons learned and the process formalized through explicit direction, the approach will remain sporadic.

The RCAF “Annual Planning Directive” acknowledges the role of the AFLLP in focusing planning efforts; however, the AFLLP has not yet matured to the point where the process is fully functional. As indicated by individual experiences from recent air operations that were described during the research for the Optimize Air Force Phase III project, integrating lessons learned is simply not yet part of the Air Force culture—nor will it be until it is resourced and supported by the senior leadership.

During the research conducted for a case study on the Libyan operation, it was evident that many of the command and control (C2) lessons observed during Operation MOBILE were very similar to those observed during the Kosovo air campaign and the first Gulf War. Indeed, some of them were virtually word for word. Given the less-than-positive assessment of the approach to the AFLLP within Task Force Libeccio,¹⁴ it is probable that the products of the AFLLP from Op MOBILE may not prove to be any more enduring.

By contrast, the FS Program ensures that the RCAF leadership does not tolerate the same flight-safety mistake being made time after time. Similarly, the AF9000 Program reduces the chance that the same maintenance error will be repeated. Obviously, the RCAF knows how to integrate these lessons learned into the way it operates. A similar approach to the remainder of the RCAF’s force-generation and force-development business, including at the operational and strategic levels, would help create a truly learning organization.

A viable and effective lessons-learned approach is beneficial not only in the traditional fields of operations and exercises but also in the framework of how the staff functions in Ottawa and Winnipeg. For example, we have observed that a systematic method to capture, analyse and integrate lessons learned based on staff experience is almost entirely lacking within the Air Staff.¹⁵ An example that is particularly troublesome is the loss of practical lessons learned from major capital projects;¹⁶ when individual project personnel are transferred or replaced, virtually all of their expertise goes with them.¹⁷

Understandably, given the shortage of people to handle the urgent daily pressures on the staff, the reason that lessons learned are not collected is primarily a lack of capacity. However, neither the lack of a simple methodology nor the availability of dedicated personnel lessens the reality that problematic issues recognized during normal or operational activities and exercises are not consistently identified and analysed, and opportunities to integrate changes into ongoing and future staff activities and operations are lost. As a result, the RCAF foregoes opportunities to enact positive change and enhance both effectiveness and efficiency.

While this situation reflects the generally less-than-rigorous knowledge-management and lessons-learned culture in the CF as a whole, it is both inefficient and ineffective from an organizational learning perspective. It leads to the same or similar problems resurfacing and creates significant frustration for both the staff and senior leadership.

From the perspective of application, there is currently no efficient approach within the RCAF to access databases or to collate information. The previous, highly structured approaches to paper-based filing systems have, for the most part, been superseded by largely haphazard electronic documentation, websites, “sharepoints” and databases with widely varying degrees of version control, data capture and even access. Similarly, anyone who has recently used the Canadian Forces Knowledge Management System database on the Defence Wide Area Network (DWAN) will recognize its lack of user-friendliness and slowness, which frustrates users and complicates the retrieval of relevant material.

Previous attempts to routinely capture best practices in areas such as project management and other strategic-level programmes have largely been overtaken by events and particularly by recent cutbacks in staff levels and/or reprioritization of activities within National Defence Headquarters. Similarly, mentoring and coaching programmes are sporadic at best and/or suffering from a lack of funding.

Gaps

From our study, the gaps that have been identified in the knowledge-management and lessons-learned approach currently in use in the RCAF are:

- a. The RCAF has **not** developed a broad-based “learning” organizational culture, despite senior direction to do so (recognizing that efforts at introducing lessons learned at the tactical level are now being undertaken).
- b. The RCAF does **not** have a coordinated and consistent approach to knowledge management and lessons learned at the strategic, operational and tactical levels.
- c. At the strategic level, the RCAF has no substantive formal process in place to capture the experiences, best practices and lessons learned in the governance, force-development or force-generation processes and **no** personnel resources identified to improve the status quo.
- d. The RCAF has **no** consistent programme in place to capture existing personnel expertise or to mentor inexperienced personnel.
- e. The RCAF lacks a simple methodology to rapidly identify, analyse and integrate changes into staff activities and operations.

- f. The RCAF lacks available, trained and dedicated personnel to consistently populate the lessons-learned process during normal activities as well as for operational and exercise activities.

An “optimized” approach

As mentioned earlier, a notable KM exception within the RCAF is the FS Program—a mature, effective methodology to collect, analyse and implement change when it impacts the safety of flight. Similarly, the AF9000 Program has been improving the quality management of aerospace engineering and maintenance since 1996. The RCAF—having developed, nurtured and resourced these programmes—has an excellent model to build upon in order to move towards becoming a learning organization, and with the stand-up of CFAWC, it also has an organizational means to oversee such a move. However, as with any major cultural change, developing a learning culture within the RCAF will require senior leadership to become champions of knowledge management.

Although the LL concept has traditionally been applied to operations and exercises, in knowledge-based organizations—such as the RCAF strives to become—lessons can be drawn from virtually any activity the Air Force is involved in, assuming an appropriate degree of preparation and planning precedes the activity. For example, the potential value added to the Air Force by adopting a KM approach to strategic-level interactions between the Air Force staff and, in particular, the central staffs cannot be overstated. Both the central staff and the Air Force would benefit if this relationship and approach didn’t have to begin anew every posting cycle.

Frequently, a major impediment to the successful adoption of changes associated with lessons learned is the reality that organizations and agencies beyond those under the control of the RCAF are often involved in approving and implementing them. One very simple method that is useful in reducing the impact of this problem is simply classifying issues according to the degree of control or influence that the Air Force has over them—an approach illustrated in Figure 1.

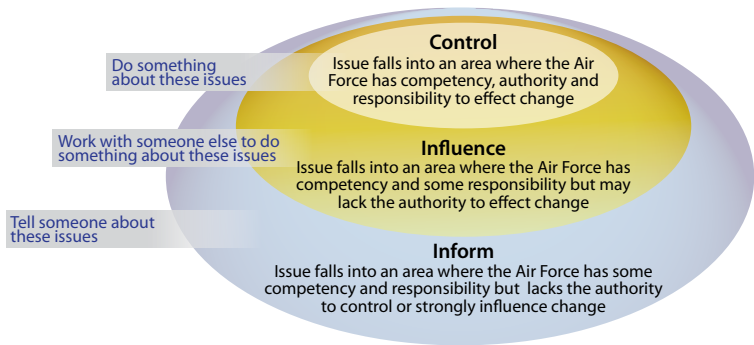


Figure 1. Categorization of issues


Once a determination has been made that an issue falls into the control, influence or inform area, a somewhat different mechanization process is necessary for each category. In the case of issues that are fully within the authority of the RCAF to control, the Air Force process could be run internally (at the tactical, operational or strategic level), resulting in an action plan that outlines the change management, validation and promulgation requirements.¹⁸ In the case of issues where the RCAF can influence other organizations and agencies, they can be processed

in a joint or interdepartmental environment (through an issue-focused seminar, for example), resulting in an action plan that feeds the follow-on stages. In the circumstance where the RCAF has little influence to effect change, these issues can be passed with as much information as appropriate to the external agency or organization.

Perhaps most importantly in the area of application, the introduction of the Air Force Integrated Information and Learning Environment (AFIILE) into the training environment means there is now potential to literally reach all Air Force personnel at the desktop level with simple, easy-to-use, distributed learning tools, databases, targeted training, best practices and shared intent/knowledge.

Recommendations

In order to optimize the RCAF of the future and build towards establishing a mature knowledge-management culture, it is essential that:

- a. A knowledge-management champion be identified from within the senior leadership of the RCAF who would become actively involved in the lessons-learned process.
- b. The RCAF continue to evolve the AFLLP through CFAWC and broaden its scope to include a wider range of Air Force activities, including at the operational and strategic levels.
- c. Resources be earmarked at all levels to populate an effective lessons-learned process.
- d. The RCAF consider moving Air History and Heritage either to CFAWC or to the Air Staff and task it (authority and responsibility) with capturing “strategic issues” and strategic lessons learned.¹⁹
- e. The RCAF institute a process (or perhaps even “hire consultants”) to debrief project staff to capture lessons learned / best practices for each major Crown project and other selected projects as required.²⁰
- f. Interview all key/experienced staff (colonels, chief warrant officers and selected others²¹) as they retire or relinquish key appointments to capture observations, best practices and recommendations.²²
- g. Leverage AFIILE to assist with knowledge management for all Air Force personnel and to capitalize on KM and LL.
- h. Use AFIILE-based version 2.0 “architecture” for user-friendly KM and LL databases.²³
- i. Review all C2, support and communications lessons, in particular, from the previous Gulf War as well as the Aviano and Libyan operations and create an action plan.²⁴ 

Brigadier-General (BGen) G. E. (Joe) Sharpe joined the RCAF in 1965, graduated from the Royal Military College in 1969 with a degree in Applied Science and trained as an air navigator on CF101 Voodoo aircraft. He served in the CF for the next 32 years in various operational, instructional, Air Force and joint staff positions. He graduated from the Aerospace Systems Course and the Canadian Forces Command and Staff College and was a distinguished graduate from the National Defence College. Post-retirement, BGen Sharpe (Ret'd) served as a special

advisor to DND/CF Ombudsman on operational stress injuries and as the deputy chair of the Afghanistan Detainee Board of Inquiry. He works with Dr Allan English on research into command and control, leadership and military culture. He chaired the CF / Veterans Affairs Canada / Royal Canadian Mounted Police Mental Health Advisory Committee and currently advises Veterans Affairs Canada on mental health issues. He is currently the Colonel Commandant of the CF Military Police Group.

During a distinguished 35-year career as an aerospace engineer in the Royal Canadian Air Force, Brigadier-General Terry Leversedge enjoyed multiple command tours. His career highlights include serving as the Program Manager for the Incremental Modernization Program for the CF18 Hornet, being the Chief of Staff for the Director General Aerospace Engineering and Program Management Division, being a deputy commander in 1 Canadian Air Division Headquarters and serving as the Chairman of the NATO Flying Training in Canada programme. He is currently an aerospace and defence consultant and an associate editor at *Airforce* magazine. BGen Leversedge (Ret'd) graduated as a mechanical engineer from the Royal Military College and also holds a master's degree in Aircraft Design from the Cranfield Institute of Technology in the United Kingdom. He is a graduate of both the Advanced Military Studies Course and the National Securities Studies Course at the Canadian Forces College. He is an honorary Snowbird and a commercially published author on Canadian military aviation subjects.

Abbreviations

AFIILE	Air Force Integrated Information and Learning Environment
AFLLP	Air Force Lessons Learned Programme
C2	command and control
CF	Canadian Forces
CFAWC	Canadian Forces Aerospace Warfare Centre
DAR	Director Air Requirements
DND	Department of National Defence
FS	flight safety
KM	knowledge management
LL	lessons learned
NATO	North Atlantic Treaty Organization
RCAF	Royal Canadian Air Force

Notes

1. The official Canadian Forces definition of knowledge management is: “An integrated systematic approach which when applied to an organization enables the optimal use of timely, accurate and relevant information; it also facilitates knowledge discovery and innovation, fosters the development of a learning

organization and enhances understanding by integrating all sources of information, as well as individual and collective knowledge and experience.” *Defence Terminology Bank*, record 18879.

2. Royal Canadian Air Force, *Air Force Vectors* Version 1.0 (Ottawa: Royal Canadian Air Force, 01 March 2012).

3. Ibid., 38.

4. Ibid., 39.

5. The earliest efforts in formal CF knowledge-management initiatives appear as far back as 2000. See Susan McIntyre, “Why Do We Need Knowledge Management? A Defence R&D Canada Perspective,” DST Pol 9, September 2000, accessed April 9, 2014, <http://cradpdf.drdc-rddc.gc.ca/PDFS/unc41/p518438.pdf>.

6. “Department of National Defence & Canadian Forces Organizational Learning Strategy” Revision 1, 13 October 2010, 6, accessed April 9, 2014, http://hrciv-rhciv.mil.ca/assets/HRCIV_Intranet/docs/en/dnd-cf-organizational-learning-strategy.pdf.

7. S. G. McIntyre, M. Gauvin, and B. Waruszynski, "Knowledge Management in the Military Context," *Canadian Military Journal* 4, no. 1 (Spring 2003), accessed April 9, 2014, <http://www.journal.forces.gc.ca/vo4/nol/command-ordre-02-eng.asp>.

8. Ibid.

9. Ibid.

10. The Flight Safety Program has been listed as an example of a successful coherent approach both to knowledge management and lessons learned in various CF academic papers and articles.

11. This involves observing activities from the tactical through to the strategic level as well as operational, support, training and programme management activities.

12. See for example, 3120-2 (D Air SP), 30 June 2011, Commander Air Command Annual Planning Directive, 6/37, accessed April 9, 2014, http://airforce.mil.ca/caf/vital/dairsp/dmcs27462_annual_planning_directive_pdf_-_adobe_reader.pdf. This document includes the Chief of Defence Staff's direction for managing change. The third of four lines of operation was "institutionalize Lessons Learned and associated capabilities."

13. For examples see, Ibid., 3/37, "We must be clear on what core capabilities and characteristics we wish to retain, and take active steps to secure that base, and be equally clear on how we should change to meet new challenges, or to leverage emerging opportunities using the principles of continuous improvement and the Air Force Lessons Learned Program (AFLLP)." and 21/37, "An institutionalized lessons learned program is essential in a military organization focussed on continual improvement."

14. From 1630-1 (Comd TF LIB), 7 November 2011, End of Tour Report – Task Force Libeccio, Annex O, Lessons Learned (labelled Annex N), O-2/7, <http://kms.mil.ca/>

[kms/FileView.aspx?Id=4687&fulltextid=5861](http://kms.mil.ca/kms/FileView.aspx?Id=4687&fulltextid=5861), "The release of this directive [LL directive for TF LIB] met with mixed reaction from subordinate Comds as they had little or no knowledge of the Air Force Lessons Learned Program (AFLLP) and their force structure establishments had not been manned to support the requirements outlined in the directed program."

15. When the incumbent Director Air Requirements (DAR) assumed his position, he had approximately eight hours of handover with his predecessor to capture the major issues. There were no written lessons learned or best practices passed on. Interview with current DAR, December 13, 2011. Subsequent discussions with past DARs also indicated that this is the norm.

16. There is, in fact, a lessons-learned approach within the Assistant Deputy Minister (Materiel) organization with respect to programmes; although, it does not appear to be comprehensive or well established.

17. The Deputy Project Manager for the Next Generation Fighter Capability observed that all of his approximately 10 years of project experience had been gained through on-job training. He also acknowledged **not** writing down notes or lessons learned in his current job due to the fast pace of activities. Interview with Deputy Project Manager, Next Generation Fighter Capability, January 18, 2012.

18. See the Change Management section of Chapter 4 of B-GA-005-780/AG-001, *Air Force Lessons Learned Programme Manual*.

19. This would mirror the Royal Canadian Navy's current approach, in which the Command Historian (based in Ottawa) is involved in strategic-level activities providing corporate memory and strategic advice.

20. The absence of any effective lessons-learned process in project management is particularly glaring. Staff handovers

are haphazard; best practices are non-existent, and previous LL efforts are defunct or badly out of date. Recent personnel cuts suggest that alternative service delivery means to capture this information will need to be used. Project funds could also be used to hire the requisite assistance in this regard.

21. Another example of individuals with potentially key information and best practices are those officers and non-commissioned members serving in exchange/liaison billets with allies. In current practice, very little information is drawn from these staffs.

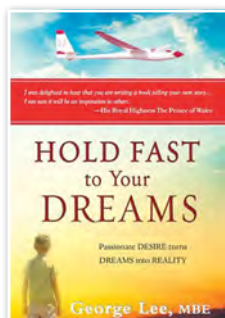
22. The wealth of information garnered by staff at these rank levels is precious and often unique. Efforts at mentoring, best practices and

skills development would each be enhanced by the adoption of this practice and the development of a practical programme for information dissemination.

23. The existing knowledge-management database for lessons learned is not user-friendly, as it is difficult to access, navigate and modify. AFIILE's desktop-compatible open architecture should provide a much better approach.

24. Key lessons for deployed operations in these areas, in particular, are constantly being relearned despite comprehensive after-action reports. An action plan to quickly institutionalize the best approaches to C2, communications as well as close and integral support should be undertaken.

BOOK REVIEWS



HOLD FAST TO YOUR DREAMS: PASSIONATE DESIRE TURNS DREAMS INTO REALITY

By George Lee, MBE

Città Sant'Angelo, Italy: Evangelista Media, 2013

184 pages

ISBN 978-8897896210

Review by Lieutenant-Colonel Ken Bailey, CD

The themes of personal inspiration and professional success continue to captivate readers and sell stories. Like the tales of rags-to-riches, people enjoy reading how others overcome adversity and create better lives for themselves. George Lee's 184-page autobiography, *Hold Fast to Your Dreams*, purports to be a story of this calibre. And, for the most part, it lives up to this claim. How else would one label a life in which the author sets numerous endurance and distance records on his way to consecutively defending his World Gliding Championship title twice, flies over 2000 hours in the McDonnell Douglas F-4 Phantom IIs for the Royal Air Force (RAF), and ends a second career as a senior check captain for Cathay Pacific on the Boeing 747?

Born in the post-war years and raised in a suburb of Dublin, Lee describes his early life as less than perfect. From a family of limited financial resources, a victim of assault and a recipient of bullying at school, the author's story tells how he changed his circumstances and rose above the victimization to pursue his dreams, but as the story evolves, it becomes evident that there is much more to the story than that. He won a scholarship to a major secondary school in Dublin. He joined the RAF as an engineering apprentice and worked his way through three years of electrical fitter training. After completing additional education, Lee was selected for training and commissioning as an officer.



Illustrating his determination to become a pilot, Lee focused on his flying career during his apprenticeship and took up gliding at a local RAF club. Through hard work and dedication, the author would eventually glide solo—only four months and 49 flights later! And, a year before earning his aviator wings in November 1968, he became a gliding instructor. As an RAF pilot, Lee's account of his progression through the Jet Provost, to the challenges of flying the Hawker Hunter, to his conversion to the interceptor McDonnell Douglas F-4 Phantom II only serves to further highlight his self-discipline and passion to achieve his dream.

It seems Lee wrote his story because he wanted to explain his experience for others to learn and gain knowledge from so that they might use it to better themselves. Lee's account of the trials and tribulations of gliding, in general, and his unequalled insight into competitive gliding at an elite level throughout the United Kingdom and Europe, specifically, certainly attest to this experience. By August 1981, he had already won three World Gliding Championship titles, taken Prince Charles for his inaugural glider flight and had lunch with Queen Elizabeth II and Prince Philip! In a short time, he had accomplishments that many of us might not even entertain—much less plan to achieve.

Throughout *Hold Fast to Your Dreams*, Lee shares his penchant for taking calculated risks. This is exemplified in his decision to retire from the RAF in search of a career change. The outcomes of this choice were the relocation of his family to Hong Kong and flying the Boeing 747 for Cathay Pacific. After 15 years at Cathay Pacific, he and his spouse moved to Queensland, Australia, where he built a gliding facility and training centre to give advanced coaching to experienced juniors. A businessman and dedicated member of the global gliding community spanning four continents, Lee's story speaks to how he has embraced challenge in the air and on the ground.

Although this book accomplishes quite a few things, the conversational writing style is, at times, a little hard to follow. There is a paucity of definitions of key gliding terms, which for those not familiar with the sport can make following the narrative a bit challenging. For example, the use of flying and gliding acronyms and theory leaves the casual reader to either independently research terminology or unable to visualize how his experience played out. Moreover, in some instances, the text is disjointed and poorly organized. There are several cases where ideas are introduced without further elaboration. The paragraphs of information sometimes feel disconnected and material is repeated, making it appear that the editing process has let down both the author and the reader.

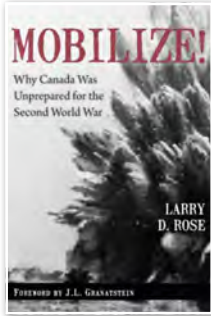
Overall, however, reading about Lee's life and his passion for flying will probably be a special treat for most readers. The author provides plenty of anecdotes to sort through and glean wisdom from. *Hold Fast to Your Dreams* also offers countless technical tidbits, photographs and flying stories that passionate military history buffs and pilots will undoubtedly enjoy. The author leaves it to the reader to resolve the secrets to inspiration and success and to recognize the passions to power their dreams. 🍷

Lieutenant-Colonel Ken Bailey is a construction engineer who has served in a variety of command and staff positions since joining the Canadian Forces in 1980. His career highlights include a posting as the first commanding officer at 14 Airfield Engineering Squadron in Bridgewater, Nova Scotia, from 1996 to 1998; a tour with a Civil-Military Cooperation House in Banja Luka, Bosnia-Herzegovina, in 1998; and an exchange posting as Chief,

Contingency Training with the United States Air Force Civil Engineering Support Agency in Panama City, Florida. In 2012, after completing a tour as the Doctrine Development Branch Head and Chief of Staff in the Canadian Forces Aerospace Warfare Centre, Lieutenant-Colonel Bailey became the Royal Canadian Air Force Liaison Officer to the Royal Australian Air Force Air Power Development Centre in Canberra, Australia.

Abbreviation

RAF Royal Air Force



MOBILIZE! WHY CANADA WAS UNPREPARED FOR THE SECOND WORLD WAR

By Larry D. Rose

Toronto: Dundurn, 2013

336 pages

ISBN: 978-1-4597-1064-1

Review by **Captain Liz Allard, CD**

Mobilize is an entertaining account of the period following World War I (WWI) up until December 1939, when Canada finally started getting troops en route to Britain. Unlike many Canadian military history accounts, Larry Rose has made his contribution an engaging and human look at the desperate state of affairs of the Canadian military at the outset of World War II. Woven within the typical historical facts and figures are individual stories of the men who answered the call to mobilize. Rose refers to many of these individuals as their personal histories move along with the overall account.

Presenting the period chronologically, the author investigates what occurred from various perspectives. The reader is given an understanding of the international geopolitical situation of the period as well as the national political scene within Canada. Using numerous quotes from William Lyon Mackenzie King's diary, we are provided insight into the private thoughts of the Prime Minister as he grappled with national interests and the international situation. It became quite evident that King was far more concerned about national unity than armament, even as the storm clouds of war were brewing over Europe.

Throughout the book, the author recounts the deplorable condition of Canada's military from the aspect of all three services. Highlighted were the significant cuts to defence spending following WWI that precluded the services from maintaining adequate manning levels, replacing or modernizing equipment, and conducting training. If the eventual consequences of such unpreparedness had not been so costly in human life, some of the anecdotes cited throughout the book would have been comical. Personal motor vehicles used to simulate tanks because we had none and non-commissioned members teaching about weapons they had never seen are just two examples.

The state of military leadership was also explored by the author. Twenty years from the close of WWI meant that many of Canada's military leaders were too old for active duty or

had joined during the interwar period and did not have the proper training to command troops in battle or to function as effective staff officers. Rose also alluded to the notion that some military leaders were still following the WWI dogma of trench warfare instead of embracing new tactics.

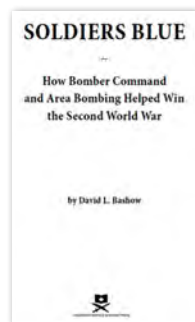
Citing author J. L. Granatstein, Rose postulates that the disasters of Hong Kong and Dieppe were a result of poor military leadership (the same person, General Harry Crerar, committed troops to both), poor training and the political push to finally get Canadian troops involved in the fighting, all situations created as a result of Canada's lack of military preparedness. At Hong Kong, 550 men were killed in the fighting or died in the prisoner-of-war camps. Dieppe, described as the worst disaster in Canadian military history, saw more Canadians killed on 19 August 1942 than on any other day of the war.

The research Rose put into his book is evident from cover to cover. *Mobilize* is a cracking good read and is highly recommended with respect to the perils of slashing defence spending as a primary way to balance the federal budget. The lessons learned that are identified in *Mobilize* should be required reading for all military leaders. 🇨🇦

Captain Liz Allard, CD, a CC130 air combat systems officer, is currently stationed at the Canadian Forces Aerospace Warfare Centre as the Information Management Officer. She has a degree in Political Science and has twice deployed to Haiti with Canada's Disaster Assistance Response Team.

Abbreviation

WWI World War I



SOLDIERS BLUE: HOW BOMBER COMMAND AND AREA BOMBING HELPED WIN THE SECOND WORLD WAR

By David L. Bashow

Kingston, Ontario: Canadian Defence Academy Press, 2011

101 pages

ISBN 978-1-100-18028-1

Review by Colonel P. J. Williams, CD

With each passing year, so it seems to me, one can expect a new biography of Lawrence of Arabia to arrive on store shelves. Another certainty in military history is that one can also anticipate yet another study on the Combined Bomber Offensive (CBO), waged by Royal Air Force Bomber Command and the United States Strategic Air Force during the Second World War.

This debate on the campaign continues to this day and was subject to much criticism in the Canadian Broadcasting Corporation (CBC) documentary series *The Valour and the Horror* in the early 1990s. Later that decade, under pressure from veterans and others, a plaque at the Canadian War Museum in Ottawa, which commemorated the efforts of Bomber Command, was rewritten to make it less controversial. Ultimately, Canadian veterans of the strategic

bombing campaign had to wait until summer 2012 to be awarded the Bomber Commander Bar to their Canadian Volunteer Service Medal.¹ My own fascination with the CBO has not waned; my personal library on it runs to some 30-odd volumes, including the book under review and which is available (for free, as I recall) from the Canadian Defence Academy Press in Kingston. Full disclosure here: an uncle of mine was shot down and killed along with his crew during a mission to Munich in April 1944 while serving with 83 Squadron, Royal Air Force.

David Bashow, currently Editor of the *Canadian Military Journal*, is well qualified to write on this subject, having already produced two scholarly books on the CBO and the Royal Canadian Air Force's role within it. He produced this shorter volume in order to "provide some positive balance to what I believe has become a widespread ignorance and lack of appreciation of a formidable contribution to victory for the Allied cause during the Second World War."² He reserves his main criticism for Professor Randall Hansen's book *Fire and Fury: The Allied Bombing of Germany, 1942–45*, a work which has been reviewed in this journal and elsewhere.³

Bashow traces the development of mostly British, but also American, bombing doctrine and the evolution of the former, in particular, from the pre-war period through the war itself. Some discussion is also provided on the American campaign against Japan in the latter stages of the war. The author does not contend that the bombing campaign was the most decisive of the war (certainly, Allied victory in the Battle of the Atlantic and Soviet efforts on the Eastern Front cannot be excluded from the "decisive" category). Instead, he concludes that, inter alia, it forced Germany to divert resources from other areas of its so-called "Total War" effort to protect its homeland; and denied her precious resources such as fuel; and in the absence of other alternatives, provided what he calls a "poor man's second front"⁴ to take some pressure off and to reassure the Soviets.

While this may appear to be nothing new to those familiar with the history of the CBO, what some may find new are areas in which Bashow criticizes Hansen's work. Specifically, Bashow contends, in opposition to Hansen, that Bomber Command did indeed regularly attack "oil targets" throughout the war; that Bomber Command contributed greatly to disrupting transportation networks; and that Hansen demonstrated an incomplete understanding of United States' bomber tactics, normally popularized as relying only on "precision bombing," whereas Bomber Command is normally associated with "area bombing." What may be revealing to some is that, according to statistics Bashow researched, the CBO occupied a maximum of 12 per cent of the Allied war effort and that less than half the tonnage delivered by Bomber Command during the war was directed at industrial cities. In this way, he concludes that it was not an excessive use of Allied resources.

The moral and legal aspects of the CBO are perhaps those which continue to raise most of the controversy surrounding the campaign, and Bashow discusses these as well, though the latter merits only a short paragraph. He concludes that when judging events such as the strategic bombing campaign, it can only truly be done within the context of the time. Indeed, he states that the CBO did have much public and political Allied support (something which is now reflected on the revised plaque at the War Museum). Bashow's conclusions may not satisfy some, who might review them as a case of "victor's justice." The author frequently references an earlier work by noted British historian Richard Overy to support his conclusions.⁵ To give an idea of the extent of the continued debate on the bombing campaign, I also note that Overy has published a more recent book on the CBO, which, according to reviewers, is highly critical of the campaign.⁶



So what is the continuing value of books such as this and indeed of the expanding torrent of literature on the strategic bombing offensive? At a time when the Canadian Forces is exploring new capabilities, including unmanned aircraft, the decision to ultimately arm them (or not) will no doubt raise many of the questions that still surround the strategic bombing campaign. With the Coalition campaign against Libya in 2012 led by a Canadian as the joint force commander, how will the history of that campaign and the Royal Canadian Air Force's key role within it (and where our aircraft dropped many bombs) be written, and how will that history be received?

The revised Bomber Command plaque at the Canadian War Museum used to read, in part, "The value and morality of the strategic bomber offensive against German cities remains bitterly contested." The text now reads, "The effectiveness and the morality of bombing heavily-populated areas in war continue to be debated." In a democratic society, where we rightfully accept civilian control over the military and where we are bound by the law of armed conflict and rules of engagement, these debates are necessary and books such as this continue to contribute to those discussions. Therein lies their enduring value. Well illustrated with 10 useful pages of notes; this book is highly recommended. 📖

Colonel P. J. Williams, an artillery officer, is Director, J5 Global on the Strategic Joint Staff.

Abbreviation

CBO Combined Bomber Offensive

review in *The Canadian Army Journal* 12, no. 2, (Summer 2009), 118–19.

Notes

1. Veterans can apply for the bar via the Veterans Affairs Canada website, accessed January 15, 2014, <http://www.veterans.gc.ca/eng/collections/cmdp/mainmenu/group04/cvsmbcb>.

2. David Bashow, *Soldier Blue: How Bomber Command and Area Bombing Helped Win the Second World War* (Kingston, ON: Canadian Defence Academy Press, 2011), i.

3. *The Royal Canadian Air Force Journal* 2, no. 2 (Spring 2009), 50–51, accessed January 15, 2014, http://airforceapp.forces.gc.ca/cfawc/eLibrary/Journal/Vol2-2009/Iss2-Spring/Books/Fire_and_Fury-The_Allied_bombing_of_Germany_1942-45_e.pdf. See also my own

4. Bashow, iii.

5. Richard Overy, *Bomber Command 1939–1945-Reaping the Whirlwind* (London: Harper Collins, 1997).

6. Richard Overy, *The Bombing War: Europe 1939–1945* (London: Allen Lane, 2013). See the review in *The Guardian* (United Kingdom), accessed January 15, 2014, <http://www.theguardian.com/books/2013/sep/27/bombing-war-europe-richard-overy-review>; *The Telegraph* review, accessed January 15, 2014, <http://www.telegraph.co.uk/culture/10372306/The-Bombing-War-Europe-1939-1945-by-Richard-Overy-review.html>; and the *Financial Times* review, accessed January 15, 2014, <http://www.ft.com/cms/s/2/d843d990-1fb1-11e3-aa36-001444feab7de.html#axzz2pHgLOuO5>.

Subjective Impressions in the Archives: Britain's National Archives as a Source for Personal Accounts, and Personal Opinions, of Air Warfare, 1914–1918

By A. D. Harvey

Editor's note: The author's British writing conventions have been maintained.

Most writers of books on First World War aviation—a recent example is Ian Mackersey's *No Empty Chairs*¹—pay fulsome tribute to the Imperial War Museum, the Royal Air Force (R. A. F.) Museum at Hendon and, above all, the Liddle Collection at the Brotherton Library at the University of Leeds, with its “amazing trove”² of letters and diaries by aviators of the 1914–18 period. By contrast, very little use ever seems to be made of the much larger quantity of original material in Britain's National Archives at Kew. Much of this consists, of course, of official returns and reports which still await the exhaustive analysis that will be needed before we can count on a really balanced picture of how work like artillery spotting and coastal patrolling fitted in with the much more celebrated exploits of the fighter pilots. There is, however, a surprising amount of material comprising first-hand accounts of personal experiences. The fact that this material was originally written for official purposes, with the expectation of its being read by impartial or perhaps even ill-disposed senior officers, does not make it necessarily less subjective or self-revealing than private letters sent home to relatives, for young men only rarely have a practised knack of being personal and intimate in their private writings and had both professional and personal reasons for suppressing details of their more stressful military experiences when writing to their families. Some of the papers in The National Archives at Kew have, indeed, a painful honesty and directness rarely met with either in family letters or post-war memoirs, together with all the readiness to address technical issues that one would expect from the context in which the material was written.

Most of the files relating to both the Royal Flying Corps (R. F. C.) and the Royal Naval Air Service (R. N. A. S.), along with all those of the R. A. F. after its establishment on 1st April 1918, were collected together in class AIR 1 during the preparation of the R. A. F.'s official history of the 1914–1918 conflict, *The War in the Air*.³ There is, however, a considerable amount of interesting documentation remaining in other classes. Class ADM 273 (Admiralty 273) consists of 31 volumes of the R. N. A. S.'s “Register of Officers' Services,” which, for example, testifies to the high esteem in which Canadian ace Raymond Collishaw was held by his superiors within weeks of his arrival at No. 3 Wing: “Recommended for promotion” (30 August 1918); “Exceptionally capable Flt. Cdr. [flight commander] with exceptional ability to command & organize” (30 June 1918); and “Great command & capable organizer. Marvellous fighting pilot whose energy never tires” (1 January 1918).⁴ These reports on naval aviators, not available for their counterparts in the R. F. C., often have the flavour of a boarding school housemaster's reports on promising fifth formers. C. D. Booker, who twice destroyed three German aircraft during



a single mission, was noted down as “Steady & quiet although very young” (31 March 1916) and later as “Most keen & reliable officer in every way, & quite suitable for a command. Has the gift of tact & attention to detail, & is a most gallant Scout Pilot” (25 September 1917).⁵ R. A. Little, the most successful Australian fighter pilot of the war, began badly: “As an officer he is quite hopeless & likely to remain so” (12 April 1916); “This officer has been reported on unfavourably, & he is to be informed that if a further adverse report is received, his commission will be terminated” (5 May 1916); and “Has conducted himself satisfactorily As soon as he learns to be less irresponsible, & when flying, to use his head to better advantage, I shall feel confident that he will do exceptionally well on Active Service” (9 June 1916).⁶ Once in action with No. 8 Wing, however, Little’s talents became better appreciated: “A most loyal capable & keen young officer with few, if any, equals as a fighting pilot” (1 August 1917).⁷

ADM 1/8449/39A is a file on the operation of the Luxeuil bomber wing in 1916. It contains an interesting minute by Rear Admiral C. L. Vaughan-Lee, the Admiralty’s Director of Air Services, which indicates that the distinction between the tactical and strategic employment of air power was already understood, by the Royal Navy at least, as early as February 1916:

As regards attacks on German Military bases the Admiralty are better able to develop the type of flying machine required than the W. O. [War Office, i.e., Army], the engine power being the principal factor, & the operations of the Navy are not restricted like those of an army in the field to a particular front or zone.⁸

Vaughan-Lee was not alone, incidentally, in considering that that R. N. A. S. was superior to the R. F. C. regarding technical matters, and it is a pity that so little work has been done on the naval service’s role in the 1914–18 war.⁹

AIR 10/451 is a report on the much-vaunted Fokker Triplane by Lieutenant Colonel J. G. Weir, Department of Aircraft Production at the Ministry of Munitions, and states:

The designer appears to have employed considerable ingenuity (or exhibited considerable mental slackness) in devising schemes whereby slight increase of manufacturing speed has been purchased at the price of grave structural weakness or increased weight [T]he design shows evidence that it has been carried out hastily and in a slovenly manner [T]he cantilever construction is not only weak, but essentially non-rigid All control surfaces are balanced, but the method of balancing is inferior to that employed on the Albatross. Ailerons are fitted to the top plane only, a type of construction which has been shown to be ineffective.

Six months later, Weir, by now promoted to brigadier general, wrote a considerably less supercilious report on the Fokker D. VII, accompanied by neat drawings.¹⁰

AVIA 6 [Aviation 6] includes a number of rather skimpy and indigestible reports on the spinning characteristics of different aircraft and on engine performance. The Cabinet papers (especially CAB 23, 24 and 42) and the records of the Ministry of Munitions (MUM) contain material equally impersonal. WO [War Office] 339 and WO 374, comprising the personal files of army officers—which includes R. F. C. officers—are, after AIR 1, the most important classes for students of First World War aviation. Some of these files include alarming personal details, including the originals of petitions sent from prison written by officers convicted of

homosexual activity, but generally they are thin and routine and of the better known aviators of the period.¹¹ Perhaps only Duncan Grinnell-Milne, author of the classic memoir *The Wind in the Wires*,¹² managed to generate a file that is worth a close look. Having been commissioned into the Rifle Brigade shortly before the outbreak of the war, he caused his commanding officer to report two weeks after the commencement of hostilities: "He appears to me to have no sense of responsibility and to be incapable of taking any sort of initiative, or command of men."¹³ Grinnell-Milne was lucky to be given the chance to prove himself as a combat pilot and, a little ironically, survived to serve as a staff officer in the Second World War.

With regard to first-hand accounts of personal experiences, a number of WO 339 and WO 374 files contain an item that was specifically intended to be personal and first-hand: the explanation of the circumstances of his capture, which each officer taken prisoner was required to submit on his repatriation after the armistice. Unfortunately the explanations remitted by aviators (written on a separate R. A. F. form but processed by the same War Office department as army officers' explanations) tend to be rather brief and predictable, like the combat reports in AIR 1, of which more are below:

- Cut off & engaged by about 8 E. A. [enemy aircraft] when on trial flight. Two E. A. destroyed: shot through petrol tank, lost pressure, wounded, observer also wounded & forced to land. Duty: trial flight to test guns.
- Attacked by 2 E. A. whilst on line patrol. Controls shot away came down out of control. Not wounded but injured in crash.
- Wounded, ground strafe & shot down by machine guns on ground. Engine & both tanks shot.¹⁴

Only occasionally did an officer ignore the discouraging layout of the R. A. F. form and give a really circumstantial account:

While on a bombing expedition to Dou [Douai?] railway junction (in connection with the Neuve Chapelle battle) I came under very heavy hostile rifle fire while flying at 800 feet [243.8 metres] (clouds at 1000 [feet, 304.8 metres])—a bullet must have penetrated the magneto (several hits were observed on other parts of the machine e. g. the wings were hit in a great number of places) as the engine stopped, and on tearing off the switch wires I could feel no current at all.

... When it appears almost hopeless that the engine would restart I liberated two of my 3, 20 lb [pound, 9.1-kilogram] bombs, causing, as far as I could tell, considerable casualties amongst the Germans who were collected underneath me (I was then about 400 feet [121.9 metres] up) retaining one in case the engine could be made to restart. On nearing the ground, I allowed the petrol to flood to the front part of the machine from the carburettor, and scattering the Germans in front of me I landed. They had ceased firing when I was a short distance from the ground (as they would have hit each other) and rushed to the machine. By getting out over the front of the bottom plane I managed to strike a match and dropped it into the petrol which was running freely. I was immediately seized on arriving on the ground and rushed away. The Germans made no attempt to put out the conflagration but appeared to be

frightened of the machine exploding. I managed to glance back when some distance away and saw the machine burning fiercely.¹⁵

The somewhat rudimentary technology of the day must have added considerably to airmen's sense of existential insecurity in combat:

Separated from patrol in scrap, attacked by 2 seater Hun. Gun jammed, spun down to escape. Engine went dud and forced to land having got into a spin at 150 ft [feet, 45.7 metres] up. Landed (crashed) at Boing les Dames 4 kms [kilometres] from front line trenches. Taken prisoner by the Hun Light artillery men.

... Used patent lighter in attempt to burn the machine but unsuccessfully as petrol falling too slowly & into shell hole & flames did not reach engine before Huns came up.

In this instance, the writer's nearness to panic did not cease with his forced removal from the combat zone; repatriated by the Germans because suffering from a paranoid delusion that his captors were carrying out experiments on him, including the use of hypnotism, he shot dead one of the British army orderlies at the hospital where he was being treated and was obliged to write this report from Broadmoor, the government's notorious high-security psychiatric hospital.¹⁶

Officers' explanations of the circumstances of their capture also provide an account of how aerial operations appeared to the troops on the ground. The majority of the surviving explanations given by officers taken prisoner in the course of the German counteroffensive at Cambrai on 30 November 1917 mention low-flying German aircraft, a particular feature of the German attack:

I assembled the remaining two platoons at Cox's Road, preparatory to occupying the official support line which was known as Wog Loop. The line commanded a good field of fire However we never reached this position as, before we could breast the Bank alongside the road, a very large number of enemy 'planes' flew over at low altitude, firing their M. G.s [machine guns], & causing many casualties. My men were temporarily scattered by this¹⁷

I ... quickly got Lewis gun and Rifle fire to bear on the enemy as he advanced from the N. E. [north east]. For a time we inflicted heavy casualties but several very low flying enemy aeroplanes appeared and kept a continuous stream of machine gun fire on our position causing us serious losses, disorganizing our line, and enabling the enemy to advance right up to our position.¹⁸

The War Office files also include the report of a court of enquiry into the reverse at Cambrai, which of course was unable to benefit from the recollections of those captured at the battle since they were still in German prisoner-of-war camps:

The morale effect of these [i. e., low-flying German aircraft] was very great and no doubt tended to facilitate the enemy's success. Our men did not seem to know what to do to minimise the morale effect of these low-flying machines. Witnesses stated that fire on them produced no results.¹⁹

There is also a report of the court enquiry, written after the war, in AIR 1.²⁰

AIR 1 is, of course, where one will find most of the official material relating to aviation from 1914 to 1918. The numerical listing fills three sizeable folders, and there are also nine cumbersome folders of photostatted file cards by way of index: each file card is filled with references, some typed but most manuscript. However, most of the documents have been weeded and now that the Archives' numerical listings have been computerized, it is much easier to use the computer catalogue for search purposes. When ordered up, documents arrive in their storage boxes, along with numerous other files, and one quickly obtains the impression that the bulk of the material is either of little interest, or else meaningless without long and patient analysis. There are, however, little pockets of gold. Christopher Cole's biography *McCudden V. C.*²¹ printed a memo entitled "Fighting Notes – August 1917," prepared by fighter ace James McCudden and presumably preserved in his personal papers, but AIR 1 also contains a later paper by McCudden headed "Fighting the S. E. January 1918":

Having been requested to write some notes under the above heading, I ask Pilots to consider them as the method of an individual (myself) and not as an effort to lay down anything like hard and fast rules when fighting the S. E. [Scout Experimental, i. e., the British S. E. 5A single-seat fighter]

SCOUTS.

Enemy scouts are not often seen above 15,000 feet [4,572 metres] during the winter months, the reason being I suggest, that the Albatross Scout, which constitutes the bulk of enemy Scouts, is a very cold machine in comparison with the S. E. 5. so that enemy Pilots do not go up high during the cold weather unless for some good reason; therefore, I usually take my patrol over the lines at anything over 14,000 feet [4,267.2 metres].

Nine times out of ten I am above enemy scouts during the whole of my patrol. In attacking enemy scouts, surprise is usually aimed at, but the sun and wind direction are a great help when intelligently used.

If you think the E. A. have not seen you, try to attack from the E. [east] and when going down give the rear machines of your own formation plenty of time to close up, so that each member can attack one E. A. simultaneously.

While attacking E. A. Scouts, one should keep plenty of engine, so as to keep zooming above the formation of E. A. the whole time. I find that if S. E.s attack E. A. from above, that soon as we attack Scouts, one of them, more likely than not their leader, flies off out of the fight and climbs his utmost until he is above the top S. E. and then he comes back, and it is just the thought that there is one Hun above you that divides your attention and nullifies your advantage in height, so as soon as I see one Hun going off I climb as well and this usually frustrates his intentions.

I consider it a patrol leader's work to pay more attention to the main points affecting a fight, than to do all the fighting himself. The main points are (1) arrival of more E. A. who have tactical advantage, i. e. height. (2) patrol drifting too far East. (3) patrol getting below bulk of enemy formation. As soon

as any of these circumstances occur, it is time to take advantage of the S. E.'s superior speed over E. A. Scouts and break off the fight, rally behind leader and climb West of E. A. until you are above them before attacking them again.

When any of the above circumstances occur I fire a red light, which is a signal to my patrol to break off the fight and follow me, and we find that this is very effective.

I think it is bad policy to stay and fight when E. A. are above you, because there is no disguising the fact that an Albatross Scout turns more quickly than an S. E. S. And the Hun certainly put up a more skilful and determined fight when he is at an advantage than otherwise.

TWO SEATERS.

I have had more combats with 2-seater E. A. than Scouts, so hope I am able to give a few tips.

I think a lot of Pilots over-estimate the death dealing qualities of the 2-seater's rear gun; at the same time however, one should not become careless, because enemy observers are usually highly trained and can shoot very accurately, especially at quite long range. Therefore when attacking a 2-seater, it should be a Pilot's main object after surprise, to get to close range (100 yards [91.4 metres]) without letting E. A. gunner shoot at you. This is quite possible, because in December I shot down 6 two-seaters in succession without any E. A. gunner getting a single shot at me, although in each case the E. A. had seen me approaching and had good time to make up his mind what to do. The 6 E. A. were not shot down in one fight but were successive combats on different days.

Two-seaters keep a very good look out above but pay very little attention under their level. Therefore try to surprise them from underneath and climb up under their fuselage and tail plane. The position from which a pilot can do most damage to a 2-seater at the least risk to himself and machine, is 100 yards [91.4 metres] behind it and 50 feet [15.2 metres] below. If however you are in this position and E. A. turns, you will at once come under his fire, and your object is to keep out of his field fire as much as possible, so therefore keep in a direct line behind his fuselage, so that if he turns to the right, you turn to the left and vice-versa. To do this manoeuvre successfully, one must have superior speed to do the outside circle, which is the inevitable position if one is to use E. A.'s tail and fuselage as cover to the best advantage whilst E. A. is turning. As soon as E. A. gunner sees he cannot fire at you from this position he will try the other direction.

Now whilst changing from one bank to the other, E. A. will be in a good position to fire at if you are quick enough. Try a short burst to confuse the Pilot. His tendency when alarmed is usually to dive, which is just what you want him to do. No gunner can stand upright in a machine that is doing over 130 m.p.h. [miles per hour, 209.2 kilometres per hour] and do accurate shooting, because the wind pressure against him at this speed is enormous. In several cases I have seen a 2-seater dive so steeply and fast that the gunner has been blown flat on the fuselage. When this happens you need not worry about E. A.'s rear gun.

I find that when diving on the tail of a 2-seater, one usually does not need to allow a deflection, but just shoot straight into him. The chances of a decision when fighting a 2-seater are greater W [west] of the line than E, because when a 2-seater is attacked W of the line, 9 times out of 10, he will push his nose down and do S turns, shooting at you as opportunity offers, but after you have had some practice you will be able to seat under his tail as safe as anywhere provided you do not become careless. On the contrary a 2-seater attacked E of the line only needs to keep going round in one direction for any length of time and he can do all the shooting whilst you do practically none. Whilst turning like this, help for the E. A. is practically certain to arrive in the form of E. A. Scouts. In fighting 2-seaters W [he means E] of the line [that is, over German-held territory] pilots should think before attacking what the E. A.'s work is, so as to let E. A. get as far W as he wishes to, so that you will then have ample time to shoot him down before he gets W [he means E] of the line. Most 2-seaters will stand a lot of shooting about [sic] before giving any evidence of damage.

The above method of attacking a 2-seater is what I advise, but a good deal of practice is necessary before you [are] able to keep up with a 2-seater at close range without being shot at.

I find that it is very difficult to shoot the pilot from directly behind because you probably hit the gunner first, who collapses in a heap in his cock-pit, and you go on shooting and simply filling the gunner with lead, and also a huge petrol tank which is usually situated between Pilot and gunner, and the pilot gets off without a scratch; so once you have shot the gunner you can afford to close right up and shoot the pilot at your leisure.

I have had a lot of combats with 2-seaters and have only been hit by their fire very seldom indeed, and then only a few bullet holes.

The advantages and possibilities of this form of attack should be obvious to anyone who gives the subject thought. Even at 50 feet [15.2 metres] below E. A. at 100 yards [91.4 metres], one has to zoom over so slightly to get one's sights on E. A., and it is to be remembered that the S. E.'s guns fire at an upward angle to the line of flight.

In conclusion I wish to point out that although I have achieved good results with this method of attack, I think the guns [i. e., gunners/observers] will take measures to repel this form of attack in one way or another, and I also contend that a 2-seater in which the pilot and observer co-operate is more than a match for a Scout, no matter how well handled.

As a final tip, one should be very alert when firing at E.-A. at close range, so that when E.-A. falls to pieces as they very often do, after being fired at a lot, that one does not fly through the wreckage. I narrowly missed flying through a pair of E.-A.'s wings recently.

J. B. McCudden.
Captain.²²

Fighter pilots, incidentally, were told to believe they were the key element in the Royal Flying Corps even while they were in training at the Central Flying School, being instructed to copy into their notebooks a kind of confession of faith:

As a single fighting unit, I have the means of doing more damage to the enemy than any other in the whole Army

Never forget that the fighting pilot is the most important fighting man in the war, for the superiority of the air rests entirely with him, and it is now a solid fact that any force in the field fighting *without* the supremacy of the air cannot hope to win.²³ [emphasis in original]

Fighter pilots' routine combat reports (including those of Manfred von Richthofen, obtained from Germany after the war)²⁴ tend to be less illuminating than one might have hoped:

Patrol dived on E. A. who were making hard East firing bursts in dive at long range, E. A. were not diving steeply.

Patrol concentrated on the more westerly E. A. Firing bursts from above and behind at ranges from 150 to 300 yards [137.2 to 274.3 metres].

E. A. continued to dive but then appeared to stall and go down vertically from 1000' [feet, 304.8 metres] out of control.

Fire from 2nd E. A. and A. A. [anti-aircraft] Barrage rendered it inadvisable to search for crash as patrol was at 1000' [304.8 metres] and 3 miles [4.8 kilometres] East of DROCOURT Line.

G. E. H. McElroy, Capt[ain].
I. L. Roy, Lieut[enant].
G. J. Strange, Lieut.

"B" Battery saw this E. A. out of control at 500' [152.4 metres], and think it would probably crash.

J. P. R. Napier, Capt.,
T [Temporary]/Commanding No 40 Squadron, R. A. F.

E. A. was pointed out by A. A. Saw 2 S. Es. dive and pull out, a third after following E. A. for a short distance turn and come West.

Dived on E. A. from above and behind firing a long burst. Continued dive and came up underneath E. A. fired another burst, upon which E. A. dived vertically into ground near an avenue of trees SE of ARRAS.

I. L. Roy Lieut.²⁵

Perhaps more interesting are special reports on particular operations, such as an early ground attack mission by No. 23 Squadron carried out on 20 September 1917:

2/Lt. [Second Lieutenant] J. F. N. Macrae: I crossed the lines at the Northern Boundary of the Southern Area, as farther to the South the clouds and mist were very low and bad. I saw a party of men outside the large white chateau in O. 36, sheet 20 [map coordinates]. I dived and fired a burst of about 50 rounds and they ran into the house. I then followed the road from O.29.a.3.0. to HOUTHULST Village, where I engaged a party about 12 men, who scattered and got into the ditch at the side of the road. I also fired about 150 rounds at various targets in the village of HOUTHULST. I then made my way back into the Southern Area and flew down the WESTROOSBEKE - PASSCHENDAELE - BECELAERE road. I saw no movement on the road until I got to BECELAERE, where I fired into parties in this village, who replied with M. G. fire. My machine being shot and having fired all my ammunition, I returned to the aerodrome. I engaged the above ground targets from 500-700 feet [152.4-213.4 metres].

2/Lt. A. R. Paul: at 8. 50 a. m. I fired 150 rounds on a party of troops on the POELCAPPELLE - HOUTHULST FOREST road from 1000 feet [304.8 metres], which I dispersed. A little later I got a No. 3 stoppage and returned to the aerodrome. Mist and rain prevented me from working south.

2/Lt. R. Fielder: 8. 45-9. 45. I fired 100 rounds at small parties of troops at the cross roads and Chateau about O. 33, sheet 20, from about 100 feet [30.5 metres], who scattered. I also fired about 150 rounds at troops at crossroads east of our barrage and east of ZONNEBEKE. I then fired about 100 rounds into BECELAERE and at small parties of troops in the neighbourhood, from about 1000 feet [304.8 metres]. It was very cloudy over the Southern Area at first.

NOTE. The patrol altogether fired about 1650 rounds at ground targets. No E. A. were seen.

In the field,

E. O. Grenfell. Major,
20/9/17
Commanding No. 23 Squadron,
R. F. C.²⁶

There are also reports, considerably lengthier, obtained from Germany after the war describing first-hand attacks carried out on British targets by Zeppelins, including a chilling picture of how a Zeppelin coming down in flames looked to an officer in another Zeppelin several miles [5-15 kilometres] away:

By dropping bombs, our ship had been lightened by quite 2,000 kg., and we could now rise to 3300 metres, and this suited us very well, in view of the hefty firing of the anti-aircraft guns. Of course, we now turned as quickly as possible towards the coast. To the north we could again distinguish L. 34, which apparently had taken part in the raid and was brilliantly illuminated by the searchlights. The ship stood quite 4,000 meters high, as it carried a much greater useful load than our L. 22. Heavy firing was directed against it. A short time after, we saw above the airship a red light appear, and immediately the searchlights went

out and the artillery fire ceased. The red light must have been a pre-arranged signal, shown by an English aeroplane ready for the attack, so as not to be endangered by their own artillery and searchlights. We had already heard of this signal through our agents' reports, and I had therefore taken care that we too should have a few red signalling cartridges on board. This precaution should be very useful later on. A few minutes later, we suddenly saw on our stern, high up in the sky, a mighty blood-red flame appearing, and we very soon had to recognize, unfortunately, that it was L. 34 which had been set on fire by the English aeroplane. A gruesome picture of destruction then unfolded itself before our eyes. As hydrogen gas can only burn when mixed with air, the airship first burnt right along the whole top, because the air could reach there. Owing to loss of gas, it slowly became heavier and fell stern downwards on account of its construction, so that it finally stood vertically in the air. And so it sank to the ground. The heat caused by the burning of the gas had made the entire framework red-hot and this showed the form of the ship sharply against the dark sky. We could thus follow the crash to the very end.

The enormous framework of the airship offered so much resistance to the air, that the crash did not proceed so quickly as one would have imagined. It certainly lasted several minutes, before the airship reached the ground. It crashed in the sea near the coast, and we could clearly see how it broke in two pieces. The brave commander, capt-lieut. of the reserve Dietrich, and his observer, first lieut. von Nathusius, R. N. Reserve, together with the whole of the brave crew, who had already gone through many raids on England safely, and whom we all knew well at Nordholz, thus met the death of heroes. But we had no time to mourn over our dear comrades, as we had to give the whole of our attention to our own airship.²⁷

Another file contains the views of the brigadier general commanding the R. F. C.'s 3rd Brigade regarding some of his less satisfactory squadron commanders: "lacks judgement and organizing ability" (K. P. Atkinson); "lacks necessary initiative and dash" (A. G. Moore, Military Cross); "not getting as much work as possible out of his Pilots ... frequently [does] an especially dangerous piece of work himself instead of ordering one of his officers to do it, when his presence was more needed on the ground" (H. S. Walker).²⁸ But perhaps the most interesting group of documents in AIR 1 is a collection of essays recounting and analysing their war experiences, written by students at the Royal Air Force's Staff College at Andover during the 1920s. There are 187 of these, and the authors include Charles Portal and a number of other officers who held very senior positions in the R. A. F. during the Second World War.²⁹ The essays are full of invaluable insights and personal details, for example, R. M. Hill's reminiscences of Albert Ball:

At Hesdin we had exchanged one flight of Morane Biplanes for Nieuport Scouts, and it was everyone's ambition to fly a Nieuport. This splendid little aeroplane was better than any single-seater the Germans then had, and Ball, who was with us, was doing fine work. He used to sit in his hut on the aerodrome, and with the help of his gramophone hatch out his schemes. He had but one idea; that was to kill as many Huns as possible; and he gave effect to it with a swiftness and certainty that seemed to most of us uncanny. He nearly always went out alone; in fact he would not let anyone fly with him, and was intolerant of proffered assistance. To surprise his enemy he made clever use of the Lewis gun

mounting on the Nieuport Scout. There was a curve rail down which the gun had to be run to change drums [of ammunition]. By exerting pressure on one side of the stock of the gun, he held it rigid when nearly down, and pointing upwards at about 80° [degrees]. By skilful manoeuvre, and incidentally by pluck and determination, he was able to 'zoom' up beneath his intended victim; and then, by slight oscillation of the control stick to cause his guns to rake the target fore and aft, at a range of 30 feet [9.1 metres] or so. So astute was he at reaching the underneath position that he flew most of the way to Cambrai just underneath one of the Moranes, quite unsuspected by its pilot. I found that my own efforts to reach a favourable position beneath a Hun so irritated it that a melee ensued in which I soon lost any idea of what was its underneath and what was its top.³⁰

William Shoto Douglas, later head of Fighter Command, in a 43-page typescript, discussed the frequently canvassed issue of the merits of the S. E. 5A relative to those of the Sopwith Camel:

The S. E. has often been criticised as being heavy on controls for single-seater, and so insufficiently manoeuvrable. In the days when aerial fighting was a series of combats between individuals, it is true that the manoeuvrability of the individual machine was all-important. In 1918, however, it was no longer the individual pilot but the flight flying in close formation that was the fighting unit: and the distinction will, I think, become more and more pronounced in future wars. In the present development of aerial fighting it is the flight that fights as one unit. Therefore it is the manoeuvrability of the flight that counts, not the manoeuvrability of the individual machine. If then a machine is sufficiently handy (as was the S. E.) to keep its place in the formation in any flight manoeuvre, it is of minor importance whether that machine is individually of a high degree of manoeuvrability or not.

Again in 1918, it was found that supremely quick manoeuvring was nearly always a defensive measure: when attacked the pilot escaped the immediate consequences by swift manoeuvre. The attack on the other hand was usually delivered by a flight formation diving at high speed: so that in attack it was the manoeuvrability of the flight that counted. Now if you have a machine superior in performance to the enemy (as was the S. E. till autumn 1918), and your patrols are well led, you should very rarely be attacked or thrown on the defensive. Instead, you should be able so [sic] to manoeuvre your formation, that, by virtue of your superior speed and climb, you yourself are always the attacker: which leads us to the conclusion that if your machines are superior in performance to those of the enemy, manoeuvrability is a very secondary consideration.

The reason why so many pilots insist on supreme manoeuvrability as an essential quality of a fighting machine is usually because they have only flown on active service fighting machines of inferior performance to those of the enemy. For instance the Camel in 1918 was distinctly inferior to the German fighting machines. Camel pilots therefore often found their only salvation in the manoeuvrability of their machines. For they could not usually refuse combat when the enemy threatened to attack; they could not retire in order

to return and fight under more advantageous conditions; by reason of the inferior speed of their machines they often had to submit to being attacked. They defended themselves by manoeuvring. Thus it is, I think, that some pilots have an exaggerated idea of the importance of manoeuvrability. To me it seems that it is performance that counts—performance is the all important factor.³¹

Of course, air fighting was not the only task required of the R. F. C., though pilots assigned to other duties were well aware of the superior glamour of the fighter pilot:

While serving in France during 1915-16 I could not help feeling how unfair was the attitude of some of those in the higher commands in the R. F. C. to the pilots and observers in Corps Reconnaissance Squadrons. The primary work of the R. F. C. in those days was aerial observation. The Corps Reconnaissance pilots and observers were the infantry of the air, carrying on their work for hours on end over Archie [anti-aircraft fire] and at the mercy of any marauding enemy scout. Scouts were essential. Scout pilots performed their work magnificently. Their work, however, was spectacular with the result that when a scout pilot brought down an enemy aeroplane he was immediately decorated. The Corps Reconnaissance pilots and observers seldom got a word of appreciation or praise. I was in two Corps Reconnaissance Squadrons. There was one decoration given in each of them at the end of six months and they were only secured by the strenuous representations of the Squadron Commanders. The spectacular sight of a Hun in flames in the air had captivated the minds of some of the higher command. This state of affairs had a depressing effect on all officers in Corps Reconnaissance Squadrons. They felt that no matter how conscientiously they worked a word of appreciation would not come their way. The result was a general desire to leave artillery work and share in the glory and distinction that was accorded to Scout pilots. When H. Q. [Headquarters], R. F. C. sent out circular letters asking Corps Reconnaissance Squadron to recommend officers for Scouts, nearly every officer wanted to be recommended. They felt they could gain no distinction for as long as they remained in Corps Reconnaissance Squadrons. I used to fly the Bristol Scout in the Squadron before it was withdrawn. The squadron Commander was willing to recommend my transfer to a Scout Squadron, but at the same time hoped I would not leave his Squadron. Loyalty to the Squadron Commander compelled me to remain a Corps Reconnaissance pilot.³²

Ferdinand West, who was later awarded the Victoria Cross as a pilot flying on a close support mission, described the kind of work involved from the viewpoint of infantry officer, observer and pilot, having had experience in all these capacities:

In August 1914 I joined the Army. Early in 1915 I was ordered to France and was posted to the 2nd Battalion of the Royal Munster Fusiliers. My rank of Lieutenant and Acting Captain of an Infantry battalion in the Line did not give me the opportunity of learning the Army Staff Opinion of the R. F. C. and on the co-operation of Aircraft with the Infantry. My experiences so far therefore are only connected with the work and knowledge I gained in an Infantry Battalion.

The soldier of the line in 1915-16 did not attach much importance to the military value of aircraft. The Air [sic] fights which we occasionally saw from the trenches were looked upon as an interesting diversion from the monotonous routine of trench life. Often at dusk, a few German fighting machines would suddenly sweep over our trenches, creating a good deal of excitement and uneasiness but causing very little damage. Our men, would then deduce from these sporadic attacks, that the fighting was adverse to the R. F. C. They failed to realise that the battles for Air superiority were fought at great altitudes and far away from the front line. The Press also unfortunately often used the expression 'British Air Superiority' instead of 'Air Superiority' and this of course made the soldier, in view of his daily experiences, rather sceptical about the success of our Flying Force.

In 1916 I took part in two daylight attacks carried out by the 1st Division and in which Aircraft co-operated. My experience was, that our men, in response to the aeroplanes' calls on the Claxons, lit up a certain number of regulation flares but generally I found that these flares were unpopular, because they drew the enemy's fire, they were an additional burden to the already bulky equipment and also because they were especially difficult to operate in wet weather.

During the second attack our battalion was held up by a nest of German machine guns, which were inflicting rather heavy losses amongst the ranks. One of our aeroplanes was flying at the time rather low, and immediately over our battalion. We were all hoping that the airman would attempt to destroy these hostile machine guns as the task appeared to us, on the ground, to be rather an easy and obvious one. In the light of my later experience as a pilot, I now realise that the airman co-operating with us probably never saw the machine gun emplacements in question. The man on the ground had but a vague notion of the limitations of aircraft, and believed that the man in the air could see everything. Naturally enough, the soldier expected the airman to help him overcome his ground difficulties and could not understand the latter's apparent inertia and lack of interest in what was going on the battlefield

... When I joined, No. 3 Squadron was a 'Corps' [i.e., army co-operation] Squadron and was equipped with MORANE [sic] Parasols. These aeroplanes were ideal ones for artillery duties as they gave the observer a splendid field of view. The average observer could carry out a shoot effectively after about one month's training, with more experience he could engage simultaneously two batteries on two different targets. The secret of a successful shoot lies in the careful study of the hostile target. On the photo itself, circles, representing varying distances, were drawn in order to facilitate the observer's judgement. But these distances, the North of the target, certain prominent objects near it should be well impressed in one's hand [he means head] before taking the air.

Experience taught us, that to look at the photograph after the fall of each round, entailed a loss of valuable time, in giving corrections to the batteries at irregular intervals, this affecting the temperature of the guns and their accuracy in shooting.

Experiments were carried out, to discover the practicability of the pilot and observer conducting simultaneously separate shoots. The following scheme was attempted, though it proved unsatisfactory. The pilot was allotted the task of ranging, say, 'A' Battery on 'Z' target, the observer of ranging 'B' Battery on a target near 'Z.' The pilot would wireless [radio] the signal 'fire' to 'A' Battery, and ten seconds later, the observer would signal to 'B' Battery to fire. The former would then transmit to 'A' Battery the correction of the observed round followed by a new signal to fire, whilst the observer was watching for the fall of the round fired by 'B' Battery. The observer had near his wireless key, a miniature bulb, which lit up every time the pilot pressed his key, so that he always knew when the latter was transmitting, and jamming was thus avoided.

The following combination proved for a short time satisfactory; the observer carried out the artillery shoot whilst the pilot watched for fleeting opportunities, flashes of hostile guns, position of balloons and the general activity on the front. The adoption of this system unfortunately resulted in the loss of several officers, mainly because the observers became so absorbed in their artillery duties that they occasionally forgot to keep a look-out for hostile aircraft. Later this policy was reversed and the observer was employed solely as an aerial gunner.

During the period I was with No. 3 Squadron, my pilot and I were involved in three aerial combats. In each case we were attacked by one German single seater fighter, who hoped, I think, to catch us unawares but apparently with no determined intention to carry out a sustained engagement. The tactics adopted by my pilot in these engagements are, I consider, worth mentioning.

The first time he was attacked he carried out some excellent acrobatics which enabled him to get away from a less skilful airman, but which prevented us both from using our guns. On the other two occasions my pilot kept his height and every time the Hun got on the tail of his aeroplane he carried out a succession of flat turns, which compelled the enemy to bank steeply to starboard and port whilst giving me a splendid field of fire. The E. A. on these two cases broke off the combat.

Our squadron was diverted from 'Corps' work [during the German offensive of March 1918] to carry out bombing and low flying attacks in order to stem the German advance. As a result of this we found ourselves in ignorance as to the position of the enemy and worse still of the location of the Headquarters of our own formations. In a crisis of such magnitude it was only natural that every available aeroplane should have been employed in harassing the Germans in order to prevent them from cutting off our Army from the French. The work done by the R. A. F. during the retreat was undoubtedly great, but I beg to suggest that one of the lessons gained was that the employment of Army Corps Squadrons on 'harassing' duties is a wrong policy.³³

It really cannot be argued that material of this sort is less accessible, less comprehensible to a lay readership, than the private letters and diaries of the period. Even if it was, thriller writers from Ian Fleming a generation ago to Lee Childs or Stephen Hunter today have shown that there is a large lay readership that loves professional arcana. Latter-day researchers'

preference for private letters as a source seems to relate to a fashionable mawkishness, which emphasizes the contrast between the tender subjectivities of combatants drawn or dragged willy-nilly from their families and their civilian avocations to face the horrors of modern warfare and the impersonality of the vast process of mutual destruction that they were obliged to participate in. This, in turn, implies some sort of distinction between the subjectivities of war-only officers and the dispassionate professionalism of those who make their career in the military. The material quoted here shows how unprofitable such a distinction really is. ☉

A. D. Harvey was educated at St John's College Oxford and University (now Wolfson) College Cambridge, where he obtained his PhD in 1972. His books include *Collision of Empires: Britain in Three World Wars 1793–1945* (1992) and *Body Politic: Political Metaphor and Political Violence* (2007). He has also contributed to *Air Power History* and to the Royal United Services Institute *RUSI Journal*.

Abbreviations

'	foot/feet
2/Lt.	second lieutenant
A. A.	anti-aircraft
ADM	Admiralty
Capt.	captain
E	east
E. A.	enemy aircraft
Lieut.	lieutenant
M. G.	machine gun
R. A. F.	Royal Air Force
R. F. C.	Royal Flying Corps
R. N. A. S.	Royal Naval Air Service
S. E.	Scout Experimental
W	west
WO	War Office

5. ADM 273/7, 102.

6. ADM 273/8, 70.

7. Ibid.

8. ADM 1/8449/39A, minute dated 25 February 1916.

9. AIR 1/2386/228/11/14, from Staff College essay on war experiences by Squadron Leader C. W. H. Pulford, 9, "The R. N. A. S. due to having Naval officers, whose whole training was technical, appeared to be more fitted to deal with many of the questions that arose over technical matters than did the R. F. C. ... [O]ur machines were better, our engines, bombs, gun mountings, compasses were all superior."

10. AIR 10/468. Weir, despite his promotion to general's rank by the time he was 30 or 31, seems not to have been a professional soldier; his background was in heavy engineering.

11. Ibid., and see A. D. Harvey, "Royal Flying Corps Fighter Aces in the British National Archives," *Journal of the Society for Army Historical Research* 88, no. 354 (2010): 199–200. See note 1886 on page 200. See also A. D. Harvey, "Personal Accounts," *Times Literary Supplement* 16 May 2003, 13; and A. D. Harvey, "Homosexuality and the British Army during the First World War," *Journal of the Society for Army Historical Research* 79, no. 320 (2001): 313–19.

Notes

1. Ian Mackersey, *No Empty Chairs: The Short and Heroic Lives of the Young Aviators Who Fought and Died in the First World War* (London: Weidenfeld & Nicholson, 2012).

2. Ibid., 339.

3. Walter Raleigh and H. A. Jones, *The War in the Air: Being the Story of the Part Played in the Great War by the Royal Air Force*, 7 vols. (Oxford: Clarendon Press, 1922–37).

4. The National Archives, Kew, ADM 273/8, 147.

12. Duncan Grinnell-Milne, *The Wind in the Wires* (London: Mayflower, 1966).

13. WO 339/36276.

14. WO 339/60241 (Second Lieutenant V. C. Coombs); WO 339/683 (Second Lieutenant J. S. Heagerty); WO 339/33141 (Captain T. S. Sharpe). All three of these “kills” (including Sharpe’s!) are credited to Manfred von Richthofen.

15. WO339/28309 (Oswald Mansell-Moullin).

16. WO 374/35596 (Sidney Stewart Hume). This officer was also unusual in that, having grown up in Argentina, he had served in the cavalry bodyguard of the President of the Argentine Republic.

17. WO 374/60157 (Captain A. T. Salvidge, 1/10 K. L. R [King’s Liverpool Regiment]).

18. WO 339/48034 (Captain F. G. Fison, 10 K. R. R. C. [King’s Royal Rifle Corps]). See also WO 339/11310; WO 339/37121; WO 339/89464; WO 339/97525; WO 374/24730; Imperial War Museum, Department of Documents; and W. R. Taylor “Diary and Reminiscences of the War” 01/60/1 and George McMurtrie, McMurtrie typescript, 78/23/1.

19. WO 158/153.

20. AIR 1/678/21/13/1942, “The Battle of Cambrai 20th Nov.–7th Dec. 1917.”

21. Christopher Cole, *McCudden V. C.* (London: William Kimber, 1967).

22. This is in a file captioned “Development of Aerial Fighting,” AIR 1/725/97/4. See also Cole, 99–101 for “Fighting Notes – August 1917.” In the memorandum printed here McCudden uses the word “fighting” in a sense customary in military and naval circles, meaning “operating a weapon” rather than “struggling with.”

23. AIR 1/1625/204/89/8. This file is labelled “Notes on Air Fighting from Royal Flying Corps September 1916 – December 1916.”

These exhortations are quoted from a lecture by L. A. Strange, dated 23 May 1917.

24. AIR 1/2397/262/1. In many cases the number of rounds fired in a particular combat was stated: 800 rounds on 17 March 1917, only twenty on 1 Sept. 1917.

25. AIR 1/1222/204/5/2634/40, report by George McElroy, G. J. Strange and the Bengali air ace Indra Lal Roy, 8 July 1918 and by Roy 18 July 1918. Roy’s personal file is in WO 339/115198. See also AIR 1/498/15/319/5, combat reports by various American pilots.

26. AIR 1/863/204/5/487.

27. AIR 1/2397/267/9, account of the loss of L. 34, shot down over Castle Eden by Second Lieutenant Ian Pyott in a British Experimental 2c during the night of 27–28 November 1916, written by former *Oberleutnant* Richard Frey of L. 22 and published in *Deutsche Zeitung* on 8 May 1927. An account by *Oberleutnant* Hans Gebauer of L. 40’s mission on the night of 16–17 March 1917, at AIR 1/2398/267/12, from an unidentified German source, is printed in full in *Air Power History* 57, no. 2 (Summer 2010): 14–21.

28. AIR 1/1515/204/58/56, notes by Brigadier General J. F. A. Higgins.

29. Portal’s essay, at AIR 1/2386/228/11/1, is printed in full in *Air Power History* 56, no. 4 (Winter 2009): 36–41.

30. AIR 1/2387/228/11/31, 8–9. A version of this text, broken up into shorter paragraphs and with slight differences of punctuation, is quoted, without citation of source, in Chaz Bowyer, *Albert Ball* (Wrexham: Bridge Books, 1994), 81.

31. AIR 1/2386/228/11/13, 25–26.

32. AIR 1/2386/228/11/28, 5, staff college essay by J. C. Quinnell, whose career seems to have come unstuck as Senior Air Staff Officer to the R. A. F.’s Advanced Air Striking Force in 1940.

33. AIR 1/2386/228/11/16, 1–4.

Precision Approach Radars Decommission in Trenton, Bagotville and Comox

By Captain Arash Ghasemzadeh-Mojaveri

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On 23 April 2013, 8 Wing Trenton was the first of the three Royal Canadian Air Force (RCAF) wings to recently decommission their legacy precision approach radar (PAR) system. On this date, Colonel Sean Friday, the Commander of 8 Wing, attended a ceremony at 8 Wing where technicians and controllers gathered to mark the last PAR-guided touchdown. Sergeant Chris Zevenbergen, a senior PAR controller, guided a CC150 Polaris from 437 Squadron to mark the last AN/FPN-503 (V) employment in Trenton. With an average of 60 to 80 approaches every month the past few years, Trenton's PAR was just as busy as Bagotville's or Comox's for guiding in aircraft. Corporal Murray, an 8 Wing aerospace telecommunications and information systems technician (ATIS Tech), explained how the system went through many modifications over its years of service. From upgrading the transmitter modulators to changing the gearbox motors, our technicians drastically improved the system's performance to the point that the switching capability from one runway to another was reduced from 15 to only 4 minutes. 8 Wing Telecommunications and Information Services Squadron (WTISS) technicians in the Instrument Flight Rules Control Centre officially switched off the unit on 23 April 2013.

On 15 May 2013, 3 Wing Bagotville also hosted a special ceremony to commemorate years of PAR service there. The final touchdown was completed by RCAF Commander Lieutenant-General Yvan Blondin in a CF188 Hornet. The Commander officially switched off the PAR in a ceremony shortly after his landing. This radar was also quite busy during the last few years, with approximately 700 flights each year. PAR controllers at 3 Wing successfully provided bilingual service until the "beach ball" was retired.

On 28 June 2013, 19 Wing Comox also bid farewell to 32 years of PAR operations. The system guided a CF188 to a safe landing in its last mission. 19 Wing Commander Colonel Jim Benninger opened the ceremony by addressing a crowd of past and present PAR operators and technicians who were joined by local civilian dignitaries.

The AN/FPN-503 (V) PAR systems were initially purchased from ITT Gilfillan in the late 1970s to replace the Quad-radar systems at most air bases. Its hydraulic turntable allowed the

PAR to be remotely switched between separate runway approaches within minutes. “Despite the fact that we decommissioned PAR in Comox, this radar is still being manufactured. The radar upgrade is a NATO requirement, spurred in part for its use in specific airframes such as the P3 [the United States’ version of the Aurora]. This is a system that could be utilized practically anywhere in the world due to its mobile capabilities,” explained the 19 Wing Operations air traffic control supervisor, Warrant Officer Dwayne Earle, during a group table talk.

CF Photo: Cpl L. McDonald, 8 Wing Imaging



PAR radar technicians and controllers at 8 Wing Trenton.

“[The] flying community in this area was lucky to have the system. It helped numerous troubled aircraft guiding them to a safe landing,” said Sergeant Sylvain Houde, an experienced PAR operator with 30-plus years behind the radar scope. “As PAR operators, our voices were a relief to pilots, assuring them a safe landing using the most primitive yet reliable way of communication: a basic radio frequency to tell pilots up-down [elevation] or left-right [azimuth] no matter how broken the aircraft instruments were or [if] an emergency happened inside the cockpit,” added Sergeant Heather Moss, another experienced PAR controller.

Not only did this mark the end of an era for the flying community and its operators but also for ATIS Techs. More than 1000 technicians had gained their 503 maintenance qualification over the system’s lifespan. Air Reserve ATIS Tech Master Corporal Rob Slonski, a PAR-qualified WTISS member, recalls the day when controllers reported that birds were being mistaken for aircraft because of the inexplicably overachieving receiver on one of the channels. He was able to resolve the disparity issue with some initiative.

“After going through numerous checks all confirming that it met the same specifications as the other channel and aligning and realigning the receivers for countless times, we were finally forced to detune it, dropping the STC [sensitivity time control] baseline by a whopping two volts direct current [VDC]; the STC curve is six VDC in total so this is quite the adjustment. This had the desired effect, finally reducing the size of the birds so that they were no longer mistaken for an uncooperative aircraft on PAR approach.”



CF Photo: LS Roy, 3 Wing Imaging

RCAF Commander, LGen Y. Blondin, standing by PAR control unit in 3 Wing Bagotville.

“The new automated technology will never replace the advantage of having a human operator; take for example when no instruments are working on an aircraft that needs to land,” said Sergeant Jeff Cyr, the Airfield Radar and Communications Systems Supervisor and one of two PAR-qualified technicians. “Besides, I had my kids convinced that Daddy had a ‘Bouncy Castle’ at work,” he added, in reference to the orange and white inflated radome that houses the PAR.



CF Photo: Cpl J. Chiasson of 19 Wing Imaging

WO D. Earle and Sgt J. Cyr, 19 Wing Comox ATC and Air Field Supervisors.

The Aerodrome Precision Approach and Landing Systems project was initiated to replace aging PAR systems, as they were no longer economically supportable due to obsolescence issues and dwindling parts' availability. Technical and operational requirements of each unit across Canada, along with financial restraints, were among the factors used to decide where and when to replace the legacy PAR systems or switch to an instrument landing system. There are five units that continue to employ PAR technicians and operators with the new MPN-2000 PARs: 12 Wing Shearwater, 14 Wing Greenwood, 15 Wing Moose Jaw, 4 Wing Cold Lake and 8 Air Communication and Control Squadron at 8 Wing Trenton.

CF Photo: Cpl J. Chiasson, 19 Wing Imaging



From Left: MCpl A. Mazgabu, WO D. Earle, Sgt J. Cyr, Sgt H. Moss and Sgt S. Houde.

As we gradually shifted from Quad to AN/FPN-503 (V), and now to MPN-2000, the newer systems increasingly rely on software rather than specialized hardware and physical controls. Master Corporal Peerenboom, a corporal in Cold Lake at the time, was among a group of technicians who received the initial training on PAR 2000. He was amazed with the new system in which several computers were used to process the signals. This gave the technicians the capability of narrowing down the troubleshooting into subsystems, which, in turn, reduced maintenance and repair time considerably.

In addition to Comox, Bagotville and Trenton, the AN/FPN-503 (V) PAR was operated out of Greenwood, Goose Bay, Chatham, Ottawa, North Bay, Moose Jaw, Cold Lake and Edmonton. The end of PAR operations at 19 Wing Comox marked the end of a 38-year association between the AN/FPN (V) and the RCAF. During this period, approximately 1000 radar technicians were trained at Kingston (1975–1982), the Terminal Radar and Control Systems Support and Training Unit (TRACS STU), and the Aerospace and Telecommunications Engineering Support Squadron (1983–2011).



The AN/FPN-503 (V) PAR was officially declared obsolete and surplus to requirement by the RCAF on 16 August 2013, as it was no longer required for air traffic operations. Thanks to everyone and for the old techs out there, we say goodbye to a component repairable system—a true radar technician’s system. 📡

With seven years of experience as a professional engineer prior to immigrating to Canada, Captain Arash Ghasemzadeh-Mojaveri joined the RCAF in December 2009. After one year of on-job training with 1 Wing Headquarters, Kingston, he completed his Communications and Electronic Engineer training at the Canadian Forces School of Communications and Electronics in July 2011. Posted to 19 Wing Comox as the Radar and Communication Systems Officer, he switched to Projects and, in August 2013, took over the airfield as the Technical Maintenance Officer. Additionally, Captain Ghasemzadeh-Mojaveri performs the duties of the Wing Telecommunications and Information Systems Safety Officer and the Officer Commanding the 19 Wing Telecommunication Emergency Response Team. Captain Ghasemzadeh-Mojaveri graduated from the University of Northern British Columbia with a major in computer science and a minor in information systems.

Abbreviations

ATIS Tech	aerospace telecommunications and information systems technician
PAR	precision approach radar
RCAF	Royal Canadian Air Force
STC	sensitivity time control
VDC	volts direct current
WTISS	Wing Telecommunications and Information Services Squadron