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IN THIS ISSUE:

Photo: Cpl Karen Livingstone

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THE CANADIAN AIR FORCE JOURNAL is an official publication of the Chief of the Air Staff 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 Air Force 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 Air Force. It serves as a vehicle for the continuing education and professional development of all ranks and personnel in the Air Force as well as members from other environments, employees of government agencies and academia concerned with Air Force affairs. ■

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NOTE TO READERS

As a bilingual journal, readers should take note that where quotations are translated from their original language, we will use the term [Translation] at the end of the quote to indicate that readers can find the original text in the other language version of the *Journal*.

THE CANADIAN AIR FORCE JOURNAL

SUBMISSION REQUIREMENTS

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

JOURNAL SECTIONS

Item	Word Limit*	Details
Letters to the Editor	50-250	Commentary on any portion of a previous *Journal*.
Articles	3000-5000	Written in academic style.
Book Reviews	500-1000	Written in academic style and must include: • the book's complete title (including sub-title); • the complete names of all authors as presented on the title page; • the book's publisher, including where and when it was published; • the book's ISBN and number of pages; and • a high resolution .jpg file (at least 300 dpi and 5 by 7 inches) of the book's cover.
Points of Interest	250-1000	Information on any topic (including operations, exercises and anniversaries) that is of interest to the broader aerospace audience.
Pushing the Envelope	250-2000	Forum for commentary, opinions and rebuttal on *Journal* articles and/or issues that are of interest to the broader aerospace audience.

* Exclusive of endnotes

AUTHORS ARE ASKED TO NOTE THE FOLLOWING GUIDELINES

- Submissions may be made in either official language.
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- Selected articles that have been peer reviewed have a  to the left of the title or at the beginning of the text of the article.
- The Senior Editor will notify contributors on the status of their submission. It may not be possible to publish all submissions.
- All text submissions must be digital, in Microsoft Word or rich text format. Files must not be password protected and must not contain macros. Files may be submitted by mail or email at the addresses provided below.
- All supporting tables, images and figures that accompany the text should be sent in separate files in the original file format (ie., not imbedded in the text). Original vector files are preferred; high resolution (not less than 300 dpi) .psd or .jpg files may be submitted.
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- The Senior Editor may select images or have graphics created to accompany submissions.
- Authors should use *Oxford English* or *Petit Robert* spelling. When required, reference notes should be endnotes rather than footnotes and formatted in Chicago style. For assistance refer to *The Little, Brown Handbook, Le guide du rédacteur* or CFAWC Production Section at Francoise.Romard@forces.gc.ca
- Acronyms and abbreviations should be used sparingly:
  - If they are required in the text, the term is to be written out in full the first time it is used and then followed by the abbreviated form in brackets.
  - If they are required in tables or figures, each table and figure will contain a list of abbreviations.
  - A list of all abbreviations (and their terms) used in the text will be included at the end of each submission.
- The Senior Editor reserves the right to edit submissions for style, grammar and length, but will not make editorial changes that will affect the integrity of the argument without consulting the author.

FOR FURTHER INFORMATION OR TO MAKE A SUBMISSION PLEASE CONTACT THE EDITOR AT:

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CALL FOR SUBMISSIONS

For the **Fall 2010** issue: **30 July 2010**
For the **Winter 2011** issue: **30 October 2010**
For the **Spring 2011** issue: **30 January 2011**
For the **Summer 2011** issue: **30 April 2011**

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IN THIS ISSUE

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SUMMER 2010 • VOL.3, NO.3

ARTICLES

Photo : Sgt Frank Hudec

BOOK REVIEWS

Photo : WO Carole Morissette

POINTS OF INTEREST

EDITOR'S MESSAGE

The Canadian Navy is 100 years young this year, and on behalf of everyone at the Aerospace Warfare Centre: Happy Anniversary! You have a history and record of service second to no other navy in the world below, on, or above the seas.

In 1918, Canada's first permanent air service came into being with the formation of the Royal Canadian Naval Air Service (RCNAS). Although short-lived, the RCNAS, combined with the experience gained by Canadian air personnel in the Royal Naval Air Service (RNAS) and Royal Air Force during the Great War, ensured that maritime aviation, albeit shore-bound, would persist in Canada. By the end of the Second World War, the Royal Canadian Navy (RCN) had re-established an air arm in all but name by crewing a small number of escort carriers and by providing personnel to the Royal Navy's Fleet Air Arm. One of these individuals, Lieutenant Hampton Gray, Royal Canadian Navy Volunteer Reserve, remains one of Canada's premier aviation heroes, having won both the Distinguished Service Cross and the Victoria Cross.

During the cold war, Canadian carriers adapted to an anti-submarine warfare (ASW) role and provided fighter aircraft for fleet defence, a role they would fulfill until the last carrier, Her Majesty's Canadian Ship (HMCS) BONAVENTURE was retired in 1970. In the 1950s and 1960s, the RCN were pioneers in the marriage of helicopters and smaller warships providing an indigenous air capability. Initial trials led to the recommendation in 1963 that the CH124 Sea King be purchased as the standard naval ASW helicopter. Shore-based maritime air plied their ASW trade in platforms that evolved from the Lancaster Mark X to the Lockheed P2V7 Neptune to the Canadair-built Argus.

The unification of the three services into the Canadian Forces in 1968 meant that Canadian fleet air personnel and assets became part of the Air Element. For some this meant a change in uniforms, a change in customs, but, for the most part, it was business as usual as both ship-borne helicopters and shore-based patrol aircraft continued to hunt Soviet submarines. In 1980, the Argus was replaced with the CP140 Aurora; however, the Sea King soldiered on.

The end of the cold war in the early 1990s meant more varied employment for maritime air personnel. Sea King aircraft, crews, and support personnel found themselves in combat during the Gulf War, enforcing embargoes off the coast of Yugoslavia, supporting the Army in Somalia, in combat once again in Southwest Asia, and, most recently, combating piracy off the Horn of Africa. And this does not take into account the numerous humanitarian missions such as the ongoing Op HESTIA in Haiti. The Auroras too have been busy with deployments in support of the North Atlantic Treaty Organization (NATO) in the Adriatic, Op APOLLO in Southwest Asia, and the Army in Afghanistan.

The last twenty years have been... most interesting! And there are more changes ahead as the Sea King... wait for it... is being replaced by the Cyclone, and the Aurora adapts to a

growing over-land intelligence, surveillance and reconnaissance role. Who knows what the next twenty years will bring.

Therefore, in recognition of the contribution that maritime air has, is, and will continue to make to the nation, and as a small part of the Naval Centennial commemoration, the main articles of this issue of the *Journal* look at elements of naval aviations past, present, and future. Enjoy the read.

However, to get things started, I thought that I would set the atmosphere with the following paragraph written in navy-speak, and, on that note, with apologies to the English language...

Remember when you first stepped aboard the Grey Funnel Line as a tadpole and an airdale at that? Even though the *Maggie* and the *Bonnie* had set the precedent for bird farms in the Navy, the Shellbacks never let the Zoomies forget that they were merely to be tolerated until they lay prostrate before the court of King Neptune and joined the Order of the Blue Nose. So you slinked along Sesame Street and the Burma Road, figured out the difference between bulkheads, deckheads and just plain heads, and prayed that you wouldn't become known as a rack monster. And as you plied your trade in the skies from Newfie John to Rosie and beyond, you came to enjoy the copious quantities of scran, with the occasional critter fritter thrown in, all washed down with kye. Never a drip to the Sin Bos'n did you make, even when things were so acockbill that it seemed like life was nothing but a goat rope. No matter how jagged you were, you carried out your duties buster and never lost the bubble. Not that it was all bad. Every once in a while there was a banyan to enjoy and in port there were opportunities to splice the main brace when the Jimmy would call sliders. And there was always a minute to be ganked here and there to make and mend. Crabfat you may be, but you always acquitted yourselves handsomely and for that, before you swallow the anchor, no duff, you deserve a heartfelt Bravo Zulu!

Major William March, CD, MA
Senior Editor

List of abbreviations			
ASW	Anti-submarine warfare	NATO	North Atlantic Treaty Organization
HMCS	Her Majesty's Canadian Ship	RCN	Royal Canadian Navy
		RCNAS	Royal Canadian Air Service

LETTERS TO THE EDITOR

To the Editor:

The Spring issue of *Air Force Journal* is a superb to be envied publication. It is uniquely informative and timely and throughout covers a first class easily read and illustrated series of articles and stories. I even agree with the Reviews of the books--both of which I had read! Am I just mellowing in my dotage to be so generous in my comments, or are you guys just getting better and smarter? Congrats, you make us proud(er).

Sincerely **Bill Carr**

Editor's Response:

Sir:

Thank you very much indeed for your kind words. I will make sure I pass them on to the production and editoral staff who do all of the really hard work.

Bill

To the Editor:

Sir:

I was just reading the latest *Air Force Journal* Spring 2010 Vol. 3, No. 2 and was curious about the post nominal's of Capt Brent Peardon, GSC, CD (page 27). My comment is there is no post nominal's for the General Campaign Star or GCS authorized for that medal, unless there is something new I am unaware of. I am one of these people that notice things out of place.

For your information, sir.
Sergeant Mark Finucan

Editor's Response:

Sgt Finucan: Good eyes! And you are absolutely right, there is no post-nominal authorized for the General Campaign Star (GCS). A mistake on our part that I humbly acknowledge and will try not to let happen again.

Bill

Letters to the editor are welcomed and must include the author's name, rank and position. Include a phone number for verification. We reserve the right to edit while preserving the main objective of the writer. We cannot guarantee that any particular letter will be printed. Mail, e-mail or fax to the *Journal*'s Senior Editor.

For further information please contact the Senior Editor at: William.March@forces.gc.ca

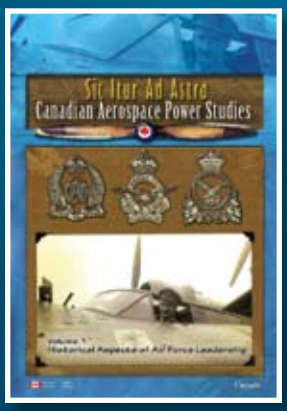
POINTS OF INTEREST

2010 Air Force Historical Workshop

The theme of the 2010 Air Force Historical Workshop is "De-Icing Required: The Historical Dimension of the Canadian Air Force's Experience in the Arctic". Held during the first week of June 2010, the workshop featured papers from a variety of academic / air force personnel culminating in a panel discussion. Papers from the workshop will be published in 2010/11.

Projecting Power: Canada's Air Force 2035

The Canadian Forces Aerospace Warfare Centre (CFAWC) has just published *Projecting Power: Canada's Air Force 2035*. The purpose of this document, within the context of the Department of National Defence/Canadian Forces (DND/CF) requirements, is to examine the true security and operating environments as well as their implications for the application of aerospace power. Specifically, it offers a detailed first look at how the Canadian Air Force may be conducting missions a generation from today as well as what capability requirements will be needed to operate within this environment. It is available electronically at http://trenton.mil.ca/lodger/cfawc/index_e.asp or hard copies may be requested from Anne.Pennington@forces.gc.ca.



Canadian Aerospace Power Studies, Vol. 1, Historical Aspects of Air Force Leadership

The Canadian Forces Aerospace Warfare Centre (CFAWC) has published the first volume of the "Sic Itur Ad Astra" series focusing on Canadian aerospace power studies. The purpose of the series is to examine aerospace issues of interest to the Air Force from a broad perspective (past, present and future) and to encourage the academic study of aerospace subjects. The first volume, entitled *Historical Aspects of Air Force Leadership,* contains the proceedings of the 2008 Air Force Historical Workshop held in Ottawa. It is available electronically at http://trenton.mil.ca/lodger/CFAWC/eLibrary/Publications_e.asp or hard copies may be requested from Anne.Pennington@forces.gc.ca

FOULED DECK: [1]

PART 1, 1945-56

THE PURSUIT OF AN AUGMENTED AIRCRAFT CARRIER CAPABILITY FOR THE ROYAL CANADIAN NAVY

BY **MICHAEL WHITBY**

Photo composite by CFAWC, CF photos

Introduction

The Second World War fundamentally changed the role and outlook of the Royal Canadian Navy (RCN). It transformed the service from what was essentially a coastal defence force into a "blue-water" navy that was capable of carrying out a variety of operations around the globe in concert with its Allies. The concept of a blue-water navy survived—indeed thrived—after the war, and the navy continues to fill that role to this day. Operating as an effective blue-water navy requires certain capabilities, which, of course, change over time. For most of the first half of the twentieth century, blue-water capability centered around battleships, battle fleets and—for global operations—cruisers, but from the early years of the Second World War and into the decades that followed, aircraft carriers and naval aviation supplanted those platforms and were recognized as the most potent weapons that could be wielded at sea.[2] In the Pacific war in particular, the United States Navy's (USN) fast-carrier force had demonstrated the strategic flexibility, tactical mobility and sheer power associated with naval aviation, both defensively during battles like Coral Sea and Midway and offensively in the Philippine Sea and off Okinawa.[3] Although the USN fast-carrier force became the embodiment of naval power, the Royal Navy's (RN) Fleet Air Arm also provided important lessons in the conduct of naval aviation in operations such as the raid on Taranto, the Home Fleet's operations in northern waters and the activities of the British Pacific Fleet. Still recovering from a failed pre-war marriage with the Royal Air Force and also suffering a degree of internal institutional inertia, the Fleet Air Arm nonetheless grew into a fairly effective force, although never to the level of the USN in terms of equipment, leadership and experience.[4]

Canadian naval officers observed the growth of naval air power with interest. Although Canada had flirted briefly with naval aviation at the end of the First World War, it had died quickly from lack of support, and there were no attempts to resuscitate it during the interwar years.[5] There was simply neither the resources, nor the need. That changed during the Battle of the Atlantic, when two RCN officers, Captains H. N. Lay and H. G. DeWolf, recognized the importance of naval aviation in the trade protection and antisubmarine warfare (ASW) role and sold the concept to their senior officers and political masters. The RCN went on to man all but the air departments of the RN escort carriers HMS NABOB and PUNCHER, but their goal of the CVEs (aircraft carriers, escort) working with their own escort groups in Canadian Northwest Atlantic Command was frustrated when the British deployed them with the Home Fleet to conduct operations against German forces in Norway. Even as those missions were under way, RCN leaders convinced the Mackenzie King government to contribute to the Pacific war a task group built around two light fleet carriers[6] (CVL) with newly formed Canadian air squadrons embarked. It was an ambitious plan that had as much to do with building up the post-war navy as it did contributing to victory, but the war came to its dramatic conclusion before the task group could deploy. As a result, the RCN went into the post-war as a one-carrier navy centred on HMCS WARRIOR.[7]

Running a navy with just one of any type of platform is a precarious proposition. There is simply no redundancy. This is especially true of aircraft carriers since all fixed-wing aviation assets rely upon that platform to operate at sea. If it is sunk, damaged or requires a long refit or even routine maintenance, flying squadrons are left stranded ashore. Simply maintaining flying proficiency requires the carrier, since taking off and landing from shore bases is significantly less demanding than from the restricted, pitching deck of a carrier.[8] Naval planners generally assume that ships can be operational about one third of the time, thus three becomes the magic number in generating force requirements. This was well understood within the RCN, but that did not mean the ideal quota was attainable, or even realistic, and in the Canadian context, two became the goal. This study will discuss the RCN's efforts to augment its carrier force by acquiring either a larger carrier or a second

carrier, and at times, both options were pursued.[9] Most of this activity took place within the years 1952–1956, when decisions of a permanent choice of carrier were being made and when the shortcomings of the actual choice—HMCS BONAVENTURE—became apparent, but the dream remained pervasive throughout the relatively brief life of the Canadian naval aviation branch and is even occasionally resurrected to this day.

This is not a story that came to a successful conclusion. It is easy to attribute this failure to limited financial support for defence, and although that was a contributing factor, there were other reasons as well. Factionalism, which featured conflict between competing viewpoints and elites, played an important role. These included the RCN versus the Royal Canadian Air Force (RCAF),[10] the traditional sea-going navy versus naval aviators, naval leaders versus defence bureaucracy and American influence versus British. These flashpoints were not unique to the RCN, and with the exception of the United States–United Kingdom aspect (which was largely limited to Commonwealth navies), they existed to some degree in any nation with a naval aviation component.[11] The Canadian case, however, had five unique characteristics:

- The Canadian naval aviation branch was immature and lacked history as well as experience. As a result, aviators had to prove themselves and build a tradition at the same time that they had to defend their existence.
- From the late 1940s, the RCN specialized in an ASW role in support of North Atlantic Treaty Organization (NATO) and bi-lateral defence agreements with the United States. This limited options and played against the inherent flexibility that lay at the core of carrier capability.
- During the 1950s and into the 1960s, the primacy of continental air defence and the spectre of nuclear attack from the air enabled the RCAF to dominate defence planning to an uncommon degree. Not only did the Air Force receive about 50 percent of defence funding, when compared with the other services, its senior officers spoke with greater volume and clarity and had a more receptive audience in the corridors of power in Ottawa.
- NATO force goals, which defined the numbers and type of warships Canada would contribute to the Supreme Allied Commander Atlantic (SACLANT) in war, limited force structure alternatives. In the mid-1950s, the RCN's contribution was designated at 42 ocean escorts and 1 aircraft carrier, and although those numbers could have been amended to include a second carrier (two carriers were included in the RCN Mobilization Plan) senior naval leaders were well aware that such an idea would not be well-received by politicians or the other services.
- Finally, naval aviation absorbed anywhere from one-quarter to one-third of the RCN budget,[12] and its proponents often had a difficult task of persuading their colleagues that they should maintain a significant or even greater part of a pie that was seen as too small to begin with and which shrunk dramatically from the mid-1950s.

These factors, in combination or isolation, frustrated various attempts to augment the RCN carrier force. More than anything, attempts to deal with these factors demonstrate the difficulty that navies the size of Canada's have in achieving balance and flexibility within their force structure and serve as a cautionary tale for small navies with big ambitions.

Original Concept

The RCN's original conception of its air branch was for a two-carrier component. Formulated for the Pacific war, planners envisioned an RCN task group consisting of two light fleet carriers with embarked air groups, two cruisers and two flotillas of fleet destroyers all backed up by a substantial escort force. The war ended before the force came together, but preparation of the naval air component was well under way. Two fighter squadrons—803 and 883—and two

attack squadrons—825 and 826—were formed in the United Kingdom over the summer of 1945 and were designated for the light fleet carriers WARRIOR and MAGNIFICENT, which were to be acquired on loan from the RN. However, the end of hostilities and the return to peacetime fiscal restraint changed everything. WARRIOR was commissioned into the RCN in January 1946 with 803 and 825 squadrons embarked flying Supermarine Seafires and Fairey Fireflies respectively. 883 and 825 Squadrons were disbanded, and plans to accept MAGNIFICENT were placed on hold. But the naval staff did not abandon hope for a two-carrier navy. When faced with severe manpower cuts at the resumption of peace, Commodore H. G. DeWolf, Deputy Chief of the Navy Staff, instructed the Director of Plans "I think we must plan to man the 2nd Carrier—whatever the delay."[13] DeWolf understood that if the requirement for a second carrier was taken off the books, it would be difficult, if not impossible, to resurrect in the more cautious peacetime environment.

It proved impossible to man the second carrier as post-war retrenchment gripped the defence community,[14] and over the next few years, debate about the shape of the air branch swirled through Naval Service Headquarters (NSHQ). Some wanted to retain light fleet carriers with balanced air detachments that could provide fighter defence for the fleet as well as ASW capability; while others proposed obtaining a smaller specialized ASW carrier similar to the escort carriers (CVE) of the Second World War. Commodore H. N. Lay, probably the strongest proponent of naval aviation among senior Canadian officers, promoted a two-carrier navy. WARRIOR, which could not operate comfortably on the North Atlantic because she had not been fitted for cold weather, would be based in the relatively warm waters of the west coast, while MAGNIFICENT, which was ready to commission in early 1947 and had been "arcticized," would operate from Halifax. This, too, proved beyond the RCN's means; therefore, consideration shifted to retaining WARRIOR in reserve until the budgetary situation improved. However, further reductions prohibited even that option, leading to arrangements with the RN to exchange WARRIOR for MAGNIFICENT.

MAGNIFICENT's arrival attracted attention, and Prime Minister Mackenzie King's diary entry about the event illustrates the unease Canadian politicians felt towards major warships like aircraft carriers. "I cannot but shudder," he despaired on 9 April 1948, two days after "Maggie" was commissioned, "each time I think of this enormous aircraft carrier which we are having brought out under the title of MAGNIFICENT. What Canada wants with the largest aircraft carrier afloat under a title like that, I don't know. It is just to

invite an enemy's attack. I venture to say should war come soon, it would be about the first of the large vessels to disappear."[15] Given the fact MAGNIFICENT was actually dwarfed by the USN's new 45,000 ton MIDWAY-class attack carriers, the remark reveals a general ignorance of naval matters, surprising in this case since King had scrutinized the wartime decision to acquire light fleet carriers. From King's perspective, such large ships were not just expensive to acquire but had a disturbingly high profile. Smaller warships, like destroyers and frigates, were not only more affordable but there was less political risk associated with their operations. In short, Canadian politicians were largely comfortable with a small ship, "destroyer" navy—and seem to remain that way. This made it difficult for naval leaders to persuade them to acquire a second or a larger carrier or to make the changes in force structure necessary to make room for one in the budget.

> **"I cannot but shudder, each time I think of this enormous aircraft carrier which we are having brought out under the title of MAGNIFICENT ..."**

HMCS MAGNIFICENT

MAGNIFICENT joined the RCN at a time when naval aircraft were undergoing a significant spurt in size and performance. One cannot look at aircraft carriers without considering the aircraft they can handle. Just as some airfields do not have runways capable of handling certain types of aircraft, aircraft carriers are also unable to support aircraft that exceed their limits. For example, depending on the length of a carrier's flight deck and the amount of propulsion an aircraft self-generates, a certain amount of wind speed is required over the deck to launch an aircraft safely above stall speed; obviously, the heavier an aircraft the more wind speed required to get it aloft. The length of the flight deck is obviously a factor. However, carriers can also "manufacture" wind speed either by the rate of knots they can attain steaming into the wind or by the use of catapults, but those, too, depend upon the capability of the ship and its equipment. Other factors also enter the equation, for example, when there is a lack of internal hangar space, aircraft are stowed on the deck and this in turn restricts the space available for flying operations.[16]

During the Second World War, aircraft generally flew off using rolling take-offs, but that became less of an option as aircraft grew in size. Consider the three fighters that were the mainstays of the RCN carrier force: the Supermarine Seafires that flew off WARRIOR had a maximum take-off weight of about 6,400 lbs; MAGNIFICENT's Hawker Sea Furies were almost double that at 12,500 lbs; while BONAVENTURE's McDonnell F2H-3 Banshees reached 14,200 lbs. The growth of ASW aircraft was even more substantial. The Second World War era Fairey Fireflies and Grumman Avengers had a maximum take-off weight of 16,096 and 17,895 lbs respectively; however the Grumman CS2F Trackers that flew off BONAVENTURE came in at 26,300 lbs. In addition to this growth trend, aircraft performance also increased dramatically, particularly with jet fighters like the Banshee, which, in turn, raised landing and stall speeds. These factors stimulated developments such as angled decks, steam catapults, stronger arrester gear as well as sturdier flight decks and elevators. However, even with these improvements, you could only put so much into a platform the size of a CVL; size did matter.

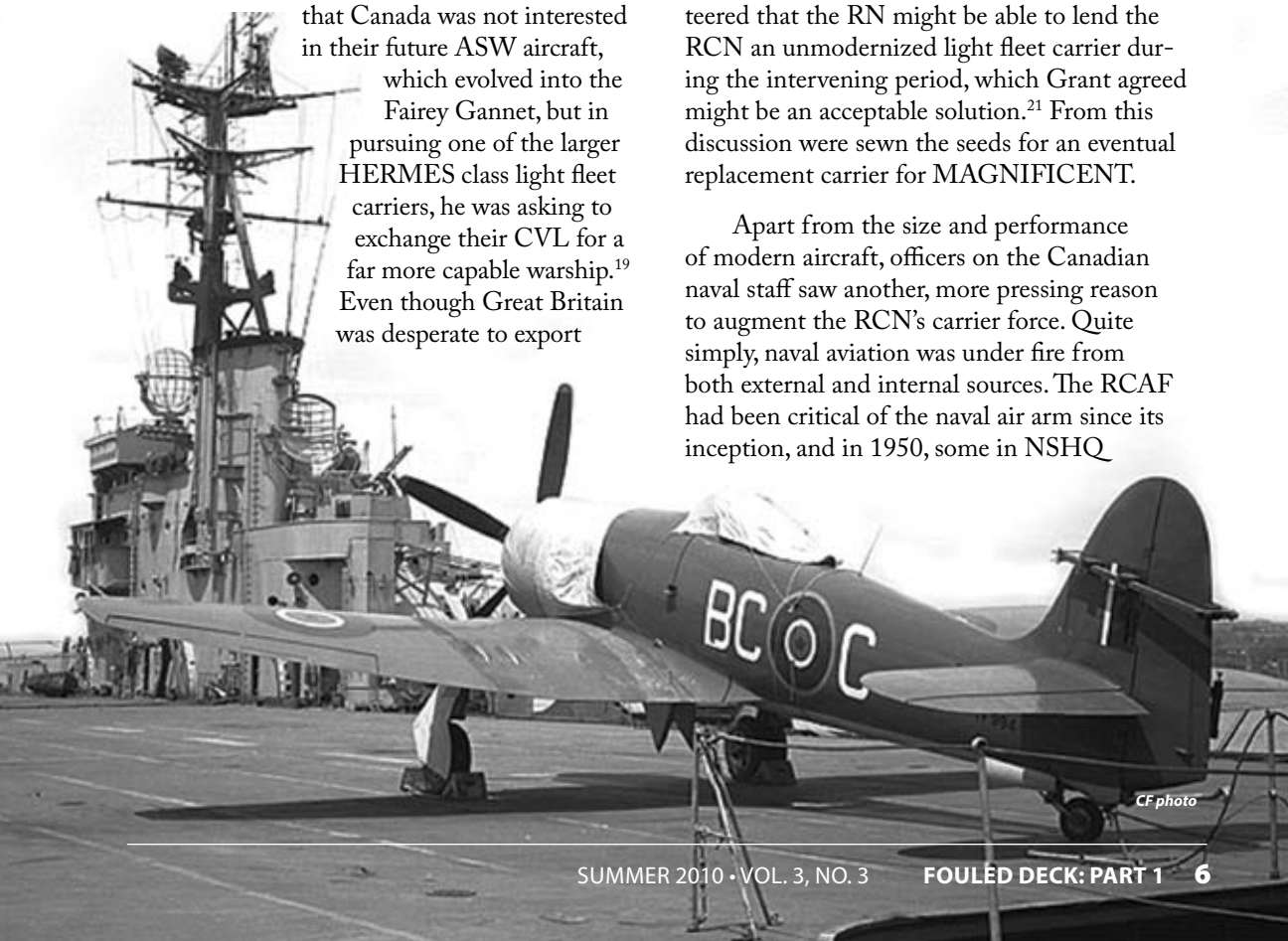
Canadian naval planners were well attuned to these developments. At a meeting in NSHQ in August 1948, the RN's Vice Controller (Air), the impressively named Rear-Admiral The Mackintosh of Mackintosh, explained to senior RCN officers that the weight limit for aircraft operating from unmodernized light fleet carriers like MAGNIFICENT was 15,500 lbs. That could be increased to 20,000 lbs with relatively minor improvements, but he cautioned "Light

Fleet Carriers will be the Escort Carriers of the next war due to the size and weight of aircraft to be carried."[17] There was, in other words, a place for CVLs in modern naval warfare, but their limited complement of smaller aircraft would restrict capability; certainly "as is" they would be unable to handle the next generation of ASW aircraft.

In April 1949, Vice-Admiral H. T. W. Grant, Chief of the Naval Staff, demonstrated understanding of this issue when he met senior British officers at the Admiralty. In what must have been an interesting moment, he informed them that the RCN was looking to the USN—not its traditional supplier the RN—for its future ASW aircraft, which at that moment was projected to weigh 22,000 lbs.[18] Since MAGNIFICENT would be incapable of handling aircraft of more than 20,000 lbs without extensive modernization, Grant queried "whether there was any possibility of exchanging this ship for a HERMES class carrier." This was cheeky to say the least. Not only was Grant telling the RN that Canada was not interested in their future ASW aircraft, which evolved into the Fairey Gannet, but in pursuing one of the larger HERMES class light fleet carriers, he was asking to exchange their CVL for a far more capable warship.[19] Even though Great Britain was desperate to export military equipment and retain strong links with Commonwealth navies, there were limits to their generosity and after what was probably a pregnant pause, the Admiralty's Director of Plans responded with stereotypical understatement that an exchange of MAGNIFICENT for a HERMES class carrier was "unfortunately impossible."[20]

The Fifth Sea Lord, who was responsible for aviation matters in the Admiralty, proposed another solution. A five-month refit to fit more robust arrester gear and brace the flight deck elevators would enable MAGNIFICENT to operate the RN's new ASW aircraft—and in Grant's eyes potential USN aircraft. She would still be unable to support modern jet fighters, but that could be rectified through a lengthier modernization that would include fitting a powerful steam catapult. Pointing to the problems of having just one carrier, Grant complained that a long refit would leave the RCN without a carrier for a significant period of time, which would hamper training. In response, the British Director of Plans volunteered that the RN might be able to lend the RCN an unmodernized light fleet carrier during the intervening period, which Grant agreed might be an acceptable solution.[21] From this discussion were sewn the seeds for an eventual replacement carrier for MAGNIFICENT.

Apart from the size and performance of modern aircraft, officers on the Canadian naval staff saw another, more pressing reason to augment the RCN's carrier force. Quite simply, naval aviation was under fire from both external and internal sources. The RCAF had been critical of the naval air arm since its inception, and in 1950, some in NSHQ



CF photo

thought it was time to take a more aggressive stance against the Air Force. There was also an element within the navy itself that considered naval aviation to be an extravagance. With money tight, naval air advocates thought the branch had to be reinforced if it was not to become vulnerable and wither on the vine. That the situation was serious is demonstrated by an extraordinary message the Chief of the Naval Staff (CNS) distributed throughout Pacific Command in March 1949 to refute scuttlebutt that the naval air branch was about to be disbanded: "There is no repeat no truth in this rumour."[22]

In two memoranda written in February 1950, Captain J. V. Brock, Director of Naval Plans and Operations, who had recently helped Vice-Admiral Grant fend off threats from the RCAF, argued "without vigorous and continual counter-measures, the air branch is in danger since it is attacked by some as an infringement of their rightful sphere of operations."[23] "One direct attempt to discount the Air Branch has been turned back," he continued, "but it is almost certain that further attacks will develop."[24] Brock thought that the best way to counter those threats was to strengthen the air branch through the acquisition of a second light fleet carrier. To accomplish this within the budget, he proposed that the second carrier be used as the training ship on the west coast and that the RCN mothball its cruisers HMCS ONTARIO and QUEBEC, which were then primarily utilized as training ships. Brock argued that not only could a carrier also serve effectively as a training ship, "the maintenance of cruisers in an anti-submarine [sic] Navy constitutes a waste of resources" since they were "not directly integrated with the assumed role of the RCN."[25] Naval aircraft could carry out the air defence and antishipping function of cruisers, and because they could also fulfill an ASW role, they would help the RCN maintain better balance and flexibility. Moreover, "from a public relations stand-point, the position of Naval Aviation would be greatly strengthened by the acquisition of a carrier for employment on the West Coast."[26]

Brock's proposal was received enthusiastically at the 5 April 1950 meeting of the Naval Staff. It is not often that the word "unanimous" appears in the minutes when describing such decisions, but in this case, it appears twice. However, the proposal was not well received at the Naval Board. They decided that the proposal would not be forwarded to the Chiefs of Staff Committee since it had not been included in the recent five-year plan and because no money had been allocated for it in the estimates. Holding the line against ad hoc planning was not the entire reason behind the decision. "It was appreciated," the minutes continued, "that an additional Carrier would constitute a good strategic reserve, but on the other hand, a Carrier would not necessarily be the most suitable training ship for a 'small ship Navy.'"[27] This was more telling. Apart from gaining experience on ONTARIO's and QUEBEC's six-inch guns—hardly weapons associated with small ships—and perhaps more centralized facilities for boat work, it is difficult to see how seamanship training would have suffered unduly in a light fleet carrier. Moreover, it would have introduced new entry sailors to the aviation branch, which may have helped recruiting by making the service more appealing

Photo courtesy of Donald Watson

to a generation of young Canadians still stirred by the romance of aviation. Also, any deficiencies in areas like boat work could be made up in the navy's destroyers and frigates, which also fulfilled a training role. The heart of the issue was that most Canadian senior officers had a conservative vision of the navy that extended back to their pre-war experience. That vision included cruisers, ships they had fought for decades to acquire, and it would have taken a forceful argument to convince the navy's senior leaders to relegate these long-cherished ships to mothball status in favour of an additional carrier. They recognized the importance of naval aviation, but not to the point that they would abandon strongly held attitudes to boost its future. Finally, Grant had recently secured the Minister's and the RCAF's agreement that the air branch would survive, and it was unlikely that he wanted to brandish the red cape of a second carrier at that particular time.

This decision left MAGNIFICENT as the RCN's only carrier, but as we have seen, the RCN understood she would have to be extensively modernized to operate modern aircraft. When it became apparent, however, that her planned modernization would be delayed by a bottleneck in the production of steam catapults, the RCN changed its plans.[28] In 1952, after much negotiation, Canada agreed to purchase the unfinished light fleet carrier HMS POWERFUL from the RN. Over the next four years she underwent a substantial modernization that included a steam catapult, angled flight deck, mirror landing system and modern sensors. This modernization enabled her—as HMCS BONAVENTURE—to operate the CS2F Trackers and F2H-3 Banshees that the RCN was in the process of acquiring.[29]

Seeking an Expanded Capacity

Even as they successfully negotiated the acquisition of a modern carrier, members of the Canadian naval staff looked to expand that capability even further. The issue was fleet air defence. At a June 1952 Naval Board meeting discussing aviation policy for the next five years, Commodore C. L. Keighly-Peach (RN),[30] the Assistant Chief of Naval Staff (Air), reported that the supply of Sea Fury fighters would dry up by 1954. If replacement fighters were required between then and BONAVENTURE's planned commissioning in 1956, the only piston-engined aircraft that MAGNIFICENT could handle was the American Chance Vought Corsair IV, which Keighly-Peach thought unsuitable "to destroy fast enemy reconnaissance aircraft at altitude, and would be powerless in the face of air strikes by jet medium bombers."[31] With SACLANT plans designating the RCN carrier for operations in the Eastern Atlantic (EASTLANT) within range of Soviet land-based aircraft (such as the TU-4 reconnaissance aircraft and IL-28 medium bomber), this concern was valid.

Keighly-Peach saw an opportunity to kill two birds with one stone. He thought that Canadian naval aviators should be introduced to modern jet fighters as soon as possible and that such aircraft should replace the Sea Fury. The problem, of course, was that MAGNIFICENT was unable to operate such aircraft. Keighly-Peach's solution to this was exquisite, if not a little overly ambitious, especially since there appears to have been no real danger of the navy running out of Sea Furies.[32] "In the event of war," he argued, "it would be necessary to obtain an additional aircraft carrier for the RCN, and it would be most desirable to obtain experience with USN carriers observing that this would probably be the only source of obtaining an additional carrier."[33] He proposed that the RCN investigate the possibility of obtaining an American ESSEX class fleet carrier on loan from the USN until BONAVENTURE was commissioned.

ESSEXES were the most sought after prize to augment Canadian naval aviation capability. Designed before the American entry into the Second World War, they had formed the nucleus of the USN fast-carrier force that dominated the final two years of the Pacific war. Twenty-five were ultimately built—the largest class of carriers to be built by any nation—and they remained in service in a variety of roles into the 1970s. They displaced some 34,000 tons, were capable of more than 30 knots and had abundant flight

deck and hangar space. When modernized with an angled deck, mirror landing system and steam catapults, they could operate large strike aircraft like the Douglas A-3 Skywarrior (39,400 lbs empty) and supersonic fighters like the Chance-Vought F-8 Crusader.[34]

In the mid-1950s, the USN began to convert some of its ESSEXES into ASW carriers, or CVS, that typically operated an air group of 8 fighters, 20 Grumman S2F Trackers, 16 antisubmarine helicopters and 4 airborne early warning aircraft.[35] They were the most capable, flexible ASW carriers of their generation. It is not surprising that they appealed to Canadian naval air enthusiasts like Keighly-Peach; indeed, over the next decade they made at least three attempts to acquire such a prize. In this case, the proposal went nowhere since in September 1952 the USN informed Canada that they had no ESSEXES available.[36] Nonetheless, Keighly-Peach ultimately saw one aspect of his proposal reach fruition when the RCN acquired F2H-3 Banshees all-weather jet fighters from the USN. But even though the first Banshees joined VF-870 in November 1955, because of MAGNIFICENT's limitations and a delay with BONAVENTURE, twenty-two months passed before the squadron embarked operationally.[37]

Two Carriers Afloat

As BONAVENTURE neared her 1956 completion date, the RCN found itself in the same position it had a decade earlier when it had one carrier on strength and another about to commission. This time, however, it was MAGNIFICENT, not WARRIOR, they tried to keep instead of returning to the RN. In October 1955 when senior officers presented their "New Look" naval strategy to the Chiefs of Staff committee that was designed to see the RCN into the future, instead of speaking of one carrier or two, they referred to retaining both MAGNIFICENT and BONAVENTURE as if it were a fait accompli.[38] Discussions like these, and there were others, reflected a high degree of confidence among staff officers at all levels that both carriers would be retained. In the event, budget limitations, service intransigence and political expediency put the plans on the rocks.

Whereas five years earlier senior officers had been unwilling to sacrifice a cruiser in order to keep a second carrier, by 1955 there was general agreement that cruisers had a limited role in an ASW navy and could be retired if cuts were required. In September 1955, Grant's successor as CNS, Vice-Admiral E. R. Mainguy, proposed to the Minister of National Defence, R. O. Campney, that the cruiser QUEBEC be placed in reserve so that MAGNIFICENT could be retained at least until BONAVENTURE entered service in late 1956.[39] Instead, the opposite almost occurred. On 14 December 1955, Mainguy informed Naval Board of a "ruling" from the Minister that QUEBEC was "to be retained in commission" and MAGNIFICENT "returned to the RN before BONAVENTURE commissioned," leaving the RCN without a carrier for a considerable period of time.[40] The St. Laurent Liberal Government was under duress at this time, and the symbolism of placing a ship named QUEBEC in reserve—while keeping yet another "enormous aircraft carrier," as Mackenzie King had earlier dubbed MAGNIFICENT—was probably too politically unattractive for the governing party.

Naval officers had no confusion about which ship was more valuable. When Vice-Admiral H. G. DeWolf replaced Mainguy as CNS in January 1956, he persuaded Campney to place QUEBEC in reserve and to retain MAGNIFICENT until BONAVENTURE was completed.[41] Others wanted to go further. Navies were becoming increasingly aware of the potential value of the helicopter as an ASW asset, and planners realized that MAGNIFICENT could be utilized as a helicopter carrier (CVH), while BONAVENTURE flew off fighters and fixed-wing ASW aircraft.[42] In combination with the modern ST LAURENT destroyer escorts just entering service, this would provide a balanced ASW task group. When the 1956 Naval Warfare Study Group presented to Naval Board its conception of how the RCN should fight the nuclear war envisaged under the NATO strategic plan MC-48 it included MAGNIFICENT as a helicopter carrier.[43] DeWolf would have none of it. Hard-nosed, politically astute and likely having

promised the Minister that he would not pursue a second carrier as part of the deal to temporarily retain MAGNIFICENT over QUEBEC, he pointed out that "it was unrealistic to include MAGNIFICENT, as the requirement for a helicopter carrier had yet to be established and support for this addition to the Fleet was remote."[44] Undeterred, the group tried again in a follow-up presentation the next month, but DeWolf admonished, "no case had yet been presented to justify the RCN operating a second carrier within our present limitations."[45]

This intransigence ended attempts from within the RCN to retain MAGNIFICENT, but the British tried one more time to keep her Canadian. The carrier had been given to the RCN on loan, and the British government did not want to have to allocate scarce funds for her upkeep, even if she went into reserve upon return. Better to keep her, and her associated costs, with the RCN. After service-level entreaties went nowhere, Great Britain's Prime Minister Anthony Eden approached Louis St. Laurent about Canada retaining MAGNIFICENT. When that too was rejected, the First Sea Lord, Admiral Lord Louis Mountbatten, asked his Canadian counterpart if, in fact, the door was "firmly closed."[46] DeWolf replied there had been "strong and persistent resistance to any attempt on our part to obtain a second aircraft carrier" and that the Minister had instructed him "the decision must be regarded as final."[47]

Persistence, however, lingered on both sides of the issue. At the same time DeWolf told Mountbatten that the door to a second carrier was firmly shut, a cadre of officers at NSHQ were trying to prise it open; not just to obtain a helicopter carrier but a full-fledged CVS, larger and more capable than BONAVENTURE with a balanced air group. To understand this seemingly relentless zeal in pursuing this cause in the face of continual opposition requires a look at both the threats Canadian naval forces could expect to encounter if war did indeed erupt in the foreseeable future as well as the RCN's role in NATO maritime strategy. ■

CF photo

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List of Abbreviations

ACNS	Assistant Chief of the Naval Staff	HMS	His/Her Majesty's Ship
ASW	antisubmarine warfare	NA	National Archives of Great Britain
CNS	Chief of the Naval Staff	NATO	North Atlantic Treaty Organization
CVE	aircraft carrier, escort	NSHQ	Naval Service Headquarters
CVH	aircraft carrier, helicopter	RCAF	Royal Canadian Air Force
CVL	aircraft carrier, light	RCN	Royal Canadian Navy
CVS	aircraft carrier, antisubmarine warfare	RN	Royal Navy
DHH	Directorate of History and Heritage	SACLANT	Supreme Allied Commander Atlantic
HMCS	His/Her Majesty's Canadian Ship	USN	United States Navy

The conclusion of this article will be published in the Fall 2010 issue.

Notes

1. "Fouled deck" was the expression used by naval aviators when they could not land because their carrier's deck was in use. This paper is based upon a presentation given to the 2005 Air Force Heritage Conference and relies upon ongoing research for the Official History of the RCN (1945–68). The author would like to acknowledge the contribution of his late friend, Dr Shawn Cafferky, who helped to shape his thinking over the course of many conversations about the history of naval aviation.

2. Carriers dominated the field until SSNs (nuclear powered submersible ships) and SSBNs (nuclear powered, ballistic missile submersible ships) entered the equation in the 1960s.

3. See Clark Reynolds, *The Fast Carriers: The Forging of an Air Navy* (New York: McGraw-Hill, 1968).

4. For RN aviation see G. S. Guinn and G. H. Bennett, *British Naval Aviation in World War II: The USN and Anglo-American Relations* (New York: Taurus Academic Publication, 2007); Norman Friedman, *British Carrier Aviation: The Evolution of the Ships and their Aircraft* (Annapolis: Naval Institute Press, 1988); Geoffrey Till, *Air Power and the Royal Navy 1914–1945: An Historical Survey* (London: Jane's, 1979); and John Winton, *The Forgotten Fleet* (London: Michael Joseph, 1969).

5. E. C. Russell and J. D. F. Kealy, *A History of Canadian Naval Aviation* (Ottawa: Department of National Defence, 1965).

6. Escort carriers (CVE) were wartime emergency vessels built on merchant ship hulls. They displaced about 15,000 tons, had a length 495 feet and carried about 20 Second World War-era aircraft. Light fleet carriers (CVL) were purpose built vessels that displaced about 18,000 tons, had a length of 700 feet and carried about 30 Second World War-era or 20 1950's-era aircraft.

7. For the origins of Canadian naval aviation see W. A. B. Douglas, Roger Sarty and Michael Whitby, *A Blue Water Navy: The Official History of the RCN*, Vol II Pt 2 (St Catharines: Vanwell Publishing, 2005); Stuart E. Soward, *Hands to*

Flying Stations: A Recollective History of Canadian Naval Aviation, Volume One, 1945–54 (Vancouver: University of British Columbia Press, 1993); Shawn Cafferky, "Flying High: The Royal Canadian Naval Air Service, 1944–1946" (May 1992); Donald E. Graves, "The RCN and Naval Aviation, 1942–1944" (May 1989); and Michael Whitby, "An Operational History of HMS Nabob and HMS Puncher" (December 1989). The latter three studies are preliminary narratives prepared for the RCN official history and are located at the Directorate of History and Heritage (DHH), 2000/5.

8. When RCN carriers were in refit, it was sometimes possible to arrange for training opportunities on USN carriers to fill some of the gap.

9. The author acknowledges previous work on this subject by two historians. Dr. Jim Boutilier compared the demise of fixed-wing aviation in the Australian and Canadian navies, while Stuart Soward explored the inter-service rivalries and political shortcomings that hampered the growth of Canadian naval aviation. See J. Boutilier, "Get Big or Get Out: The Canadian and Australian Decisions to Abandon Aircraft Carriers," in *Reflections on the RAN*, eds. T. R. Frame, J. V. P. Goldrick and P. D. Jones (Kenthurst, NSW: Kangaroo Press, 1991), 283–408; and Stuart E. Soward, "The Tragedy of Success: How Politics Destroyed RCN Aviation," *Shearwater Aviation Museum Foundation Newsletter*, Spring 2002, 36–42.

10. At certain moments, relations between the two services were particularly intense, but there is a tendency in RCN historiography to be overly critical of the RCAF. In fact, the RCN was often just as aggressive, and some senior officers ignored the sterling record compiled by Eastern Air Command during the Second World War and tried to convince the CNS that the Navy should take over all maritime air in Canada.

11. See for example, Jeff Barlow, *The Revolt of the Admirals: The Fight for Naval Aviation, 1945–50* (Washington: Brassey's, 1998); Thomas Hone, Norman Friedman and Mark Mandeles, *American and British Aircraft Carrier Development: 1919–41* (Annapolis: Naval Institute Press, 1999); Australian Naval Aviation Museum Foundation, *Flying Stations: A Story of Australian Naval Aviation* (St Leonards, NSW: Allen and Unwin, 1998); Malcolm Muir, *Black Shoes and Blue Water: Surface Warfare in the USN, 1945–75* (Washington: Naval Historical Center, 1996); and Eric Grove, *From Vanguard to Trident: British Naval Policy Since World War Two* (Annapolis: Naval Institute Press, 1987).

12. Marc Milner, *Canada's Navy: The First Century* (Toronto: University of Toronto Press, 1999), 265.

13. Director Plans to CNS, 6 September 1945. Library and Archives Canada (LAC), Record Group (RG) 24 (Acc 83-84/167), Box 455, 1650-20 pt 1. Assistant Chief of the Naval Staff (ACNS) minute, n.d.

14. For the impact of the RCN's post-war manpower struggles see Wilfred G. D. Lund, "The Rise and Fall of the Royal Canadian Navy, 1945–64: A Critical Study of the Leadership, Policy and Manpower Management" (PhD dissertation, University of Victoria, 1998).

15. Mackenzie King Diary, 9 April 1948. The diary is available online at the Library and Archives Canada website at: http://www.collectionscanada.gc.ca/databases/king/index-e.html.

16. For the development of carriers and naval aircraft in the immediate post-war era, see Norman Friedman, *The Postwar Naval Revolution* (Annapolis: Naval Institute Press, 1986), 84–109.

17. "Minutes of Special Meeting Held in ACNS Office On Thursday, 19th August 1948," LAC, RG 24 (Acc 83-84/167), Box 575, 1700-913 vol 4.

18. The RCN was investigating three USN aircraft: the Grumman XS2F, later known as the Tracker, which was still under development; the Douglas AD-4N Skyraider; and the Grumman AF-2W Guardian. The weakness of the latter two types was that they could carry either sensors or weapons but not both at the same time, and therefore had to operate in two-aircraft "packages." The S2F could handle both at once. For an authoritative account of the development of USN aircraft in the cold war era see Judith B. (Spangenberg) Currier, "George Spangenberg," www.georgespangenberg.com (accessed June 17, 2009).

19. The four HERMES class carriers were laid down towards the end of the Second World War and were slowly brought to completion in the 1950s. Larger than Colossus class CVLs like BONAVENTURE, they could achieve 28 knots and operate 30,000 lb aircraft. See D. K. Brown and George Moore, *Rebuilding the Royal Navy: Warship Design Since 1945* (Annapolis: Naval Institute Press, 2003), 22, 42–43; and Friedman, *British Carrier Aviation*, 312–4.

20. Admiralty, "Minutes of a Meeting with the Chief of Naval Staff, R.C.N. on Saturday, 23rd April, 1949," 2. National Archives of Great Britain (NA), ADM 1/24842. In 1952, the RN apparently approached the RCN informally with an offer to lend a HERMES CVL to Canada, but by then the Navy was committed to acquiring BONAVENTURE. Dr. Wilf Lund interview with Rear-Admiral A. H. G. Storrs (Retired), 20 June 1995.

21. Ibid.

22. CNS to Flag Officer Pacific Coast, 14 March 1949. LAC, RG 24 (Acc 83–84/167), Box 575, 1700-913.

23. "Naval Development Carrier Requirements," 9 February 1950, 1. Appendix "A" to naval staff minutes, 7 March 1950. DHH, 81/520/1000-100/3.

24. "Plan for Naval Aviation and Acquisition of a Second Carrier for the RCN," 25 February 1950. Appendix "B" to naval staff minutes, 7 March 1950.

25. "Naval Development Carrier Requirements," 1.

26. Naval Staff minutes, DHH, 81/520 1000-100/3, 7 March 1950.

27. Ibid.

28. Friedman, *British Carrier Aviation*, 235.

29. Details of the negotiations to acquire BONAVENTURE are in NA, ADM 1/26684 Pts 1 and 2, while the Staff Requirements outlining the ship's equipment are in DHH, 79/246 Folder 38. For a history of BONAVENTURE see, J. Allan Snowie, *The Bonnie: HMCS Bonaventure* (Erin, ON: Boston Mills Press, 1987).

30. Because there were no senior Canadian officers experienced in aviation, from 1945–57 RN officers on loan to Canada filled the position of Assistant Chief of Staff (Air) at NSHQ.

31. Naval Board minutes, DHH, 81/520/1000-100/2, 24 June 1952.

32. Although manufacture had stopped, the RCN still had some 25 Sea Furies on strength in November 1956. "Report of Ad Hoc Committee on Naval Aviation," 20 November 1956, 1. DHH, 81/520/1700-913.

33. Ibid.

34. For the history and development of the ESSEX class see Norman Polmar, *Aircraft Carriers: A History of Carrier Aviation and Its Influence on World Events, 1946–2006* (Dulles, VA: Potomac Books, 2008), 470–7; Norman Friedman, *US Aircraft Carriers: An Illustrated Design History* (Annapolis: Naval Institute Press, 1983), Chapters 7 and 16; and Reynolds, *The Fast Carriers*.

35. For development of the CVS concept see USN Office of Naval Research (ONR), "Sea-Based Anti-Submarine Warfare, 1940–77, Volume I 1940–60," 117–8 and 143–83. The author thanks Dr. Sean Maloney for providing this important source.

36. Marginal notation based on information from the Naval Member Canadian Staff (Washington) dated 10 September 1952 on file DHH, 79/246 Folder 59.

37. Reports of Proceedings, VF-870, DHH, 81/520 Reports of Proceedings VF-870. For the Banshee's service see Carl Mills, *Banshees in the Royal Canadian Navy* (Toronto: Banshee Publication, 1991).

38. Chiefs of Staff Committee, "Minutes of a Special Meeting," 26 October 1955, 6. DHH, 73/1223 Box 63.

39. Naval Board minutes, DHH, 81/520/1000-100/2, 7 September 1955.

40. Naval Board minutes, DHH, 81/520/1000-100/2, 14 December 1955.

41. Interestingly, if Campney had his way, MAGNIFICENT would have been unavailable to transport the Canadian United Nations Emergency Force contingent to Suez.

42. For an excellent study of the evolution of the helicopter as an ASW weapon see Shawn Cafferky, *Uncharted Waters: A History of the Canadian Helicopter Carrying Destroyer* (Halifax: Centre for Foreign Studies, 2005).

43. See Isabel Campbell, "A Transformation in Thinking: The RCN's Naval Warfare Study Group of 1956," in *People, Policy and Programmes: Proceedings of the 7th Maritime Command Historical Conference*, eds. Richard H. Gimblett and Richard O. Mayne (Winnipeg: Naval Heritage Press, 2008), 165–182. Available online at http://www.navy.gc.ca/project_pride/documents/documents_e.asp?section=2&category=3&title=7 (accessed June 17, 2009). The Warfare Study Group also briefly considered retaining MAGNIFICENT as a platform for Grumman Avenger ASW aircraft fitted with the explosive echo ranging (EER) equipment now known as JULIE.

44. For biographies of DeWolf and others see Michael Whitby, Richard H. Gimblett and Peter Haydon, eds. *The Admirals: Canada's Senior Naval Leadership in the 20th Century* (Hamilton: Dundurn Press, 2006).

45. Naval Board minutes, DHH, 81/520/1000-100/2, 23 May 1956, DHH.

46. First Sea Lord to CNS, 25 September 1956. NA, ADM 205/110.

47. CNS to First Sea Lord, 26 October 1956. NA, ADM 205/110.

A VISION FOR THE FUTURE OF MARITIME AVIATION

BY MAJOR NEIL SCOTT, CD

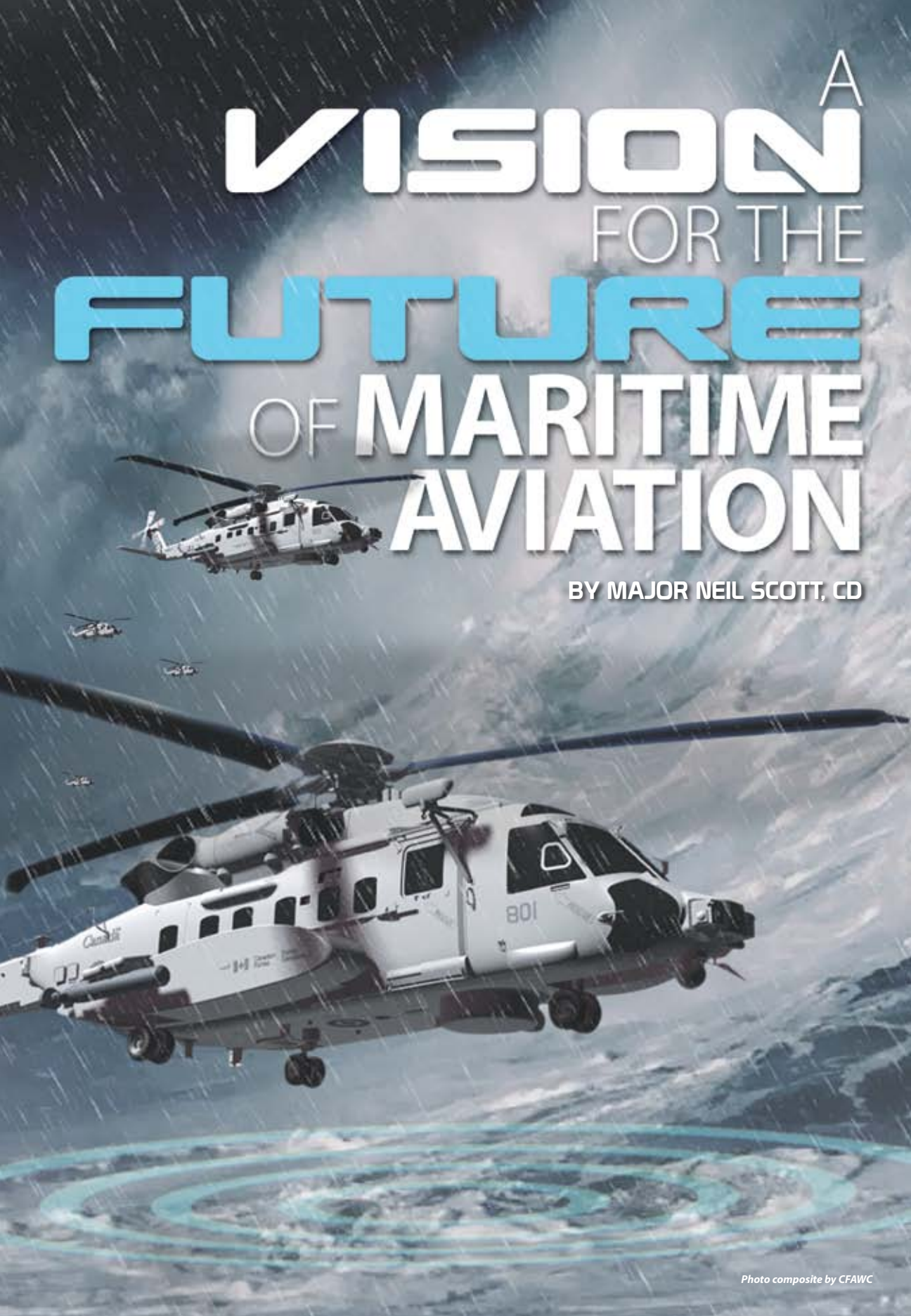


Photo composite by CFAWC

Introduction

The year is 2025 aboard Canada's newest warship of the Province class, HMCS ALBERTA:

The sleeping Cyclone crew is roused from dreams of their next run ashore in St. John's by the deafening sound of the "bong-bongs" over the loudspeaker and the call to action stations by the officer of the watch. The stand-by crew's tactical coordinator (TACCO) springs from his bunk, hurriedly dons flight suit and flying boots and rushes to the operations room while the remainder of the crew proceeds to the aircraft to ready it for launch. Once in the operations room, the TACCO is given a situation report from the operations room officer (ORO). Canada's newly-acquired joint uninhabited air vehicle (UAV) is working in support of the Canadian task group, and using its synthetic aperture radar (SAR), has detected at long range a submarine periscope trailing the task group's joint support ship. The ORO has directed his ship's airborne tactical UAV to the location of the sighting to investigate using its onboard radar and infrared camera. The tactical plot is quickly downloaded from ALBERTA'S combat control system into the Cyclone's mission data management system and the TACCO rushes back to the flight deck to join his crew on the waiting Cyclone.

This short vignette of the Canadian Navy of 2025 is meant to give us a look into the possible (or is it probable?) future of Navy aviation, or more broadly, how all aspects of aerospace power can be employed together in the maritime domain. Unseen in our opening vignette is how space-based platforms will contribute to the maritime picture, enhance communication in high latitudes, and provide reliable and accurate navigation. As we are looking only 15 years into the future, this discussion is not fanciful in nature, but grounded in current technological capabilities. In fact, maritime aviation in 2025 will look rather like the current construct—a mix of fixed-wing and rotary-wing aircraft with satellites to assist in remote sensing, navigation and communications. The most interesting realm and the most ripe for speculation is the degree to which the Canadian Forces (CF) in general and the Navy in particular embrace UAVs. The aim, then, of this article is to articulate vision for the future of maritime and naval aviation and to hypothesize as to how these assets will be employed together to solve the maritime domain awareness problem. It should be noted that this "vision" is that of a low-level Ottawa staff officer, and an Air Force one at that.

Discussion

Naval aviation has always been about using an aircraft's altitude, speed and range to extend the eyes, ears and punch of the ship. These characteristics of maritime air power were evident in May of 1916, when a seaplane from HMS *Engadine* made an enemy sighting report as the British and German fleets approached each other prior to the Battle of Jutland. They were also evident in September of 1914 when four seaplanes, launched from a Japanese carrier, bombarded German-held targets during the Battle of Tsingtao in China.[1] This fundamental raison d'être remains true to this day.

The centrepiece of Canada's naval aviation future, the prime eyes, ears and punch, will be the CH148 Cyclone. This replacement of the venerable CH124 Sea King reached an important milestone on March 24 of this year when it completed the first takeoff from the Canadian warship HMCS MONTREAL. This event provided a sign of tangible progress in the CF's longest acquisition project. Canada is purchasing 28 Cyclones with a view to an operating concept that will provide a Canadian task group with a total of seven aircraft, and the ability to maintain two of them airborne 24/7.[2] While the Cyclone is larger, faster, and brings a greater range than the Sea King, the real leap forward comes in the sensor suite, and more

importantly, the way in which these sensors are integrated and automated to allow a crew of four to extract the aircraft's full capabilities. In the Above Water Warfare role, the Sea King's radar provided the capability to search an area of 10,000 square miles in one hour, complemented by an infrared system for identification with a range of approximately five nautical miles (nm). The Cyclone's inverse synthetic aperture radar (ISAR), by comparison, will allow for a search of 62,000 square miles in one hour[3] aided by an infrared and electro-optical (EO) system that will allow for classification of contacts out to 20 nm. In the underwater domain, the Sea King-dipping sonar active-detection range of approximately 2,000 yards will be increased to approximately 20,000 yards with the Cyclone's Helicopter Long Range Active Sonar (HELRAS).[4] This works out to a 100-fold increase in area coverage for a single dip. The Sea King has not had the ability to link the tactical picture back to the supporting mother ship. Royal Navy experience has shown that the datalink on the Cyclone will become a force-multiplier as it obviates the problems associated with voice reporting and provides real-time situational awareness and targeting data.

Navy leadership sees the submarine as the primary threat to a Canadian task group and foresees a renewed interest in anti-submarine warfare in the years ahead. The Cyclone will be the primary weapon for both defending the task group against the underwater threat and providing the offensive punch with its MK 46 Torpedo. The Cyclone currently has no plan to incorporate an air-to-surface missile but as organic air is seen by the Navy as a natural extension of the ship itself, the capability to attack hostile surface targets at range from the mother ship is seen as highly desirable, if not essential, by 2025.[5]

The Cyclone will bring to the CF a significant intelligence, surveillance and reconnaissance (ISR) platform. While its relatively short range and endurance should prevent it from becoming the strategic asset that the Aurora became, there is still some concern within the Navy command that as the capabilities of this aircraft in the ISR role become more commonly known, it will become increasingly difficult for the Navy to remain the primary employer. The total number of 28 Cyclones purchased was predicated on the potential requirement to put a total of 15 aircraft to sea simultaneously; seven aircraft to each of two task groups, and an additional aircraft deployed with the NATO fleet. Should the Navy have difficulty providing enough flight decks due to manning problems or other issues affecting total fleet size, such that there is seen to be an "excess" of aircraft, it seems possible that some aircraft could be hived off to support the Army. The Cyclone radar has an overland capability and could support ground troops as an ISR platform or for medium lift, as the aircraft is equipped with a rear ramp and in the utility configuration there is seating for 20 passengers and the ability to sling a 10,000-pound load.

Long range patrol aircraft (LRPA) remain an essential complement to organic air power as Canadian naval doctrine still calls for layered defences with the LRPA operating at the outer edge. This is unlikely to change before 2025. Shore-based aircraft also offer a logistical advantage over organic air in that they are fuelled, maintained, and stored with sonobuoys and weapons from ashore. It is for that reason that an officer in tactical command (OTC) considers the LRPA as the primary weapon delivery platform. It is expected that in 2025 Canada will continue to fly the modernized CP140 Block III but we will be on the precipice of a new Canadian multi-mission aircraft (CMA). Sometime in the 1990s the CP140 nomenclature began its subtle shift from maritime patrol aircraft (MPA) to LRPA. This shift was precipitated by the Air Force itself as they sought to lay the groundwork for a shift from being solely a tactical naval platform to a strategic joint asset as the CP140 comes out of its modernization program with significant overland ISR capability. This has frustrated Navy leadership, as they have seen a reduction in the level of support from the CP140 community that they once enjoyed, and as a result, have seen an erosion in "team" anti-submarine warfare (ASW) skills that come with a ship,

helicopter and fixed-wing aircraft cooperating together to prosecute a submarine. Additionally, it makes it more difficult to force generate OROs and shipborne air controllers.

Maritime patrol aircraft will continue to act as the long range eyes and ears of the Navy and will be capable of conducting autonomous operations in detecting, classifying, and attacking surface and subsurface threats when required. Shore-based weapons-capable airborne platforms will augment the limited number of weapons available on ships.

- Draft Maritime Force Development Guidance

The CMA project has been seen to be completing this transition out of ASW, as initial project requirements did not call for the provision to carry and deploy a torpedo. It was left to the Navy to insist upon maintaining this capability. Further, the number of aircraft identified in the Canada First Defence Strategy to replace the CP140 is seen as insufficient to maintain a strong presence in the maritime domain, though this may be obviated once the Joint UAV Surveillance Target and Acquisition System (JUSTAS) comes into service.

Starting in 2020, 10-12 maritime patrol aircraft to replace the Aurora fleet. The new aircraft will become part of a surveillance "system of systems" that will also comprise sensors, unmanned aerial vehicles and satellites and keep Canada's maritime approaches safe and secure, including in the Arctic.

- Canada First Defence Strategy

By 2025 it is highly probable that UAVs will be operational from Canadian warships. It is more difficult to predict the roles that UAVs will play. In October 2009 the Canadian Forces Maritime Warfare Centre conducted a successful evaluation of the Scan Eagle UAV, launching and recovering from the Kingston Class minor warship HMCS GLACE BAY. The Scan Eagle is a tactical UAV with 3.1 metre (m) wing span, a maximum takeoff weight of 20 kilograms (kg) and a maximum payload of 6 kg. The Scan Eagle under test was configured with an EO payload on four occasions and an infrared payload on one occasion. There is also a synthetic aperture radar and automatic identification system (AIS) receiver payload available. This UAV was evaluated on its ability to detect, identify, track, and position large and small vessels and boats, and to detect personnel on decks, ashore, and in the water.[6] These capabilities lend themselves to the roles of search and rescue, tactical surveillance and reconnaissance, battle damage assessment, force protection to include support to a naval boarding party, chemical-biological detection, and ISR operations in a chemical, biological, radiological and nuclear (CBRN) environment.

It is likely that these will be the immediate roles for organic UAVs through to 2025. Additionally, by this time period we could also see operational organic rotary-wing UAVs conducting all of these roles with the addition of ship-to-ship cargo delivery. Less likely to be seen would be the commodore and their flag lieutenant being transferred ship-to-ship in a UAV by 2025. The Navy vision is that in the future all minor and major warships will deploy on operations with an organic tactical Scan Eagle-like UAV, though with a larger payload capability and more capable and sophisticated sensors. It is unlikely that UAVs will be used for weapons delivery by that time; though if there is a credible capability for submarines to launch surface-to-air missiles while remaining submerged, that would provide an added impetus to use UAVs for torpedo delivery.

The most significant change in air capability for the Future Navy will result from the Canadian Forces' introduction of unmanned aerial vehicles into maritime operations. The Future Navy will be required to work with shore-based wide

area surveillance UAVs as well as embark and operate its own organic tactical UAVs. The design of UAVs selected for operations with the Future Navy will necessarily dictate the amount and nature of support that must be designed into the host platform. The Future Navy must be capable of concurrent organic helicopter, fixed wing maritime patrol, and UAV operations.

- Draft Maritime Force Development Guidance

While the vision is there, as the environmental commanders are responsible to force generate and provide collective training for any Tier Three (Scan Eagle-size) UAV, it remains to be seen what priority they will be given when they compete for funding against more traditional naval expenditures.

As briefly alluded to earlier, the JUSTAS project aims to deliver a joint weapon system to support domestic and international operations. This project will proceed in two phases with the first phase providing a domestic and expeditionary overland capability and phase two seeing the implementation of a domestic maritime and Arctic UAV capability. JUSTAS will provide to naval leadership situational awareness in the maritime domain. The project's initial aims are to provide an aircraft on which future payloads can be integrated. In the maritime context this could include inverse synthetic aperture radar, electronic warfare support measures (ESM), AIS receivers, and EO systems. Both phases should be complete and the system declared fully operationally capable by 2020. The Army has a requirement that JUSTAS be weaponized with the capability to support ground troops in the close air support role.[7] The Navy has not articulated the requirement for an air-to-surface or air-to-air missile system for JUSTAS , but it is not too late for the Navy to advocate for this capability should they deem it necessary.

The Canada First Defence Strategy calls for the acquisition of six to eight Arctic offshore patrol ships (AOPS). These ships will be capable of operations in all of Canada's waters, including the Arctic throughout the navigable season. AOPS will primarily enable the CF to more effectively support other government departments and agencies, but will also position the Navy to monitor and control activity that may pose a threat to Canada. The Canadian Coast Guard has found the embarkation of a helicopter to be essential to operations in the Arctic for plotting a path for the ship through the ice and for supporting isolated coastal communities through transferring supplies and people between ship and shore. AOPS will therefore be equipped to operate a light organic helicopter to provide logistic and ice navigation support. The flight deck, hangar, and ship's spaces will, however, also be capable of accommodating the Cyclone with one crew and a limited maintenance detachment. The AOPS will not, however, be equipped with a helicopter recovery assist, secure and traverse (RAST) system and this will limit flight operations to free deck landing limits. This is not expected to be problematic in the Arctic, but will seriously limit the operations of any helicopter in the offshore role. The addition of a RAST system would add $2.5 to 5 million per ship. A more serious limitation to sustainability in the Arctic is that the ship will be limited to 60 cubic metres of aviation fuel with the ability to add an additional 60 cubic metres at the expense of ship's fuel. One hundred and twenty cubic metres provides just 140 Cyclone flight hours or approximately 300 Bell-212 flight hours.[8] Given the fuel constraints for the operation of large helicopters, the AOPS is most likely to employ a small tactical UAV for the ice reconnaissance and ISR roles complemented with a light utility helicopter like the Canadian Coast Guard's Bo 105.

Conclusion

Air vehicles have been a critical component of naval warfare from virtually the beginning of aviation itself and that will continue far into the future. Our opening vignette attempted to illustrate the future of warfare in the maritime domain as a system of systems. While we may

one day see the end of manned aircraft, as we look to the near future of 2025 we see a family of manned and unmanned, fixed-wing and rotary-wing, ship- and shore-based aircraft each complementing the other. Naval leadership recognizes the critical role that aviation plays in the completion of their task. They have provided critical support to the Cyclone implementation plan, altering the schedules for Halifax Class Modernization when necessary to accommodate and support Cyclone Operational Test and Evaluation, and have been a forceful advocate for the weaponization of CMA. Navy leadership has clearly stated a vision for a future Navy that includes organic helicopters, CMA and UAVs. ■

Major Neil Scott began his flying career with 415 Maritime Patrol Squadron in 1988, as a navigator/communicator and tactical navigator. In 1992 he brought his passive acoustic experience to the maritime helicopter community in anticipation of the soon to arrive EH101. Alas, it was not to be and Major Scott spent the next 17 years as a Sea King tactical coordinator, where he saw postings to 423 Squadron, 406 Squadron, Helicopter Operational Test and Evaluation Flight (HOTEF) and the Maritime Warfare Centre. He is currently the Aerospace Advisor to the Maritime Staff serving with the Directorate of Maritime Strategy.

List of Abbreviations

AIS	automatic identification system	JUSTAS	Joint Unmanned Surveillance Target Acquisition System
AOPS	Arctic offshore patrol ships	kg	kilogram
ASW	antisubmarine warfare	LRPA	long range patrol aircraft
CBRN	chemical, biological, radiological and nuclear	m	metre
CF	Canadian Forces	MPA	maritime patrol aircraft
CMA	Canadian Multi-Mission Aircraft	nm	nautical mile
EO	electro-optical	ORO	operations room officer
ESM	electronic support measures	OTC	officer in tactical command
HMCS	Her Majesty's Canadian Ship	RAST	Recovery Assist, Secure and Traverse
HMS	Her Majesty's Ship	SAR	synthetic aperture radar
ISAR	inverse synthetic aperture radar	TACCO	tactical coordinator
ISR	intelligence, surveillance and reconnaissance	UAV	uninhabited air vehicle

Notes

1. J. D. F. Kealy and E. C. Russel, *A History of Canadian Naval Aviation* (Ottawa: Queen's Printer and Controller of Stationery), 1.

2. Department of National Defence (DND), "Maritime Helicopter Programme (MHP) Statement of Operational Requirement (SOR)," Project File 23680-304, Article 2.4.1.1. Available online at http://shearwater.mil.ca/OPS/SO_MHP/Request%20for%20Proposal%20Volumes%200-13%20English/MHP_SOR_linked.doc (accessed April 30, 2010).

3. Assumptions used to calculate area coverage: Sea King radar 30 nm detection range and a cruise speed of 120 kts. Cyclone radar 100 nm detection range and a cruise speed of 150 kts.

4. DND, "Delivering Cyclone Operational Capability," 12 Wing Shearwater Staff Office MHP PowerPoint presentation. Available online at http://shearwater.mil.ca/Ops/SO_MHP/presentations/Delivering%20Cyclone%20Operational%20Capability.ppt (accessed April 30, 2010).

5. E. M. Gregory, (Commander, Director Maritime Strategy), interview with the author, April 26, 2010.

6. DND, "Report – ScanEagle Small Uninhabited Aerial Vehicle System Deval," Canadian Forces Maritime Warfare Centre Report, December 21, 2009.

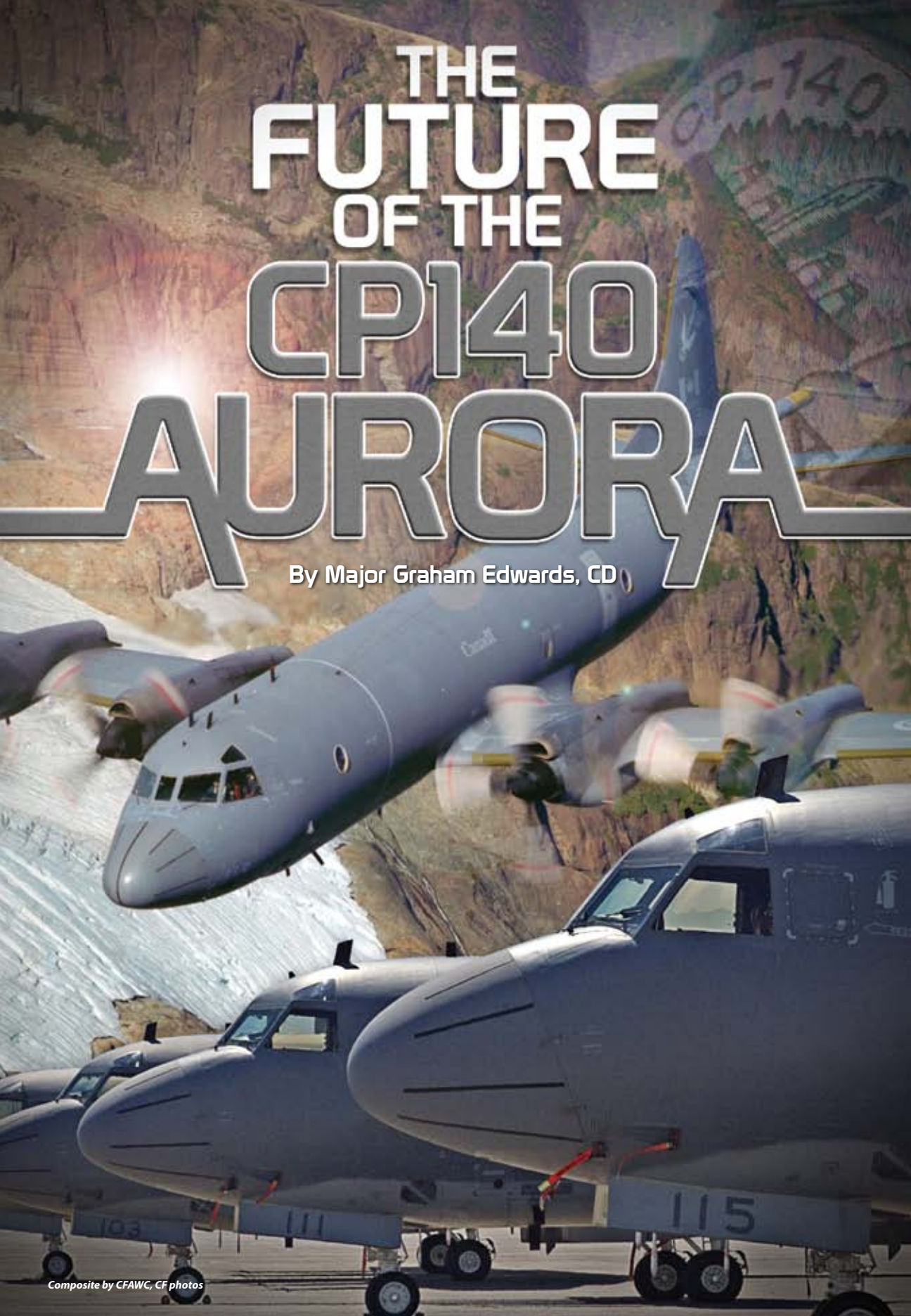
7. The contents of this paragraph were reviewed for accuracy by Major Mark Wuennenberg, DAR 8-2 (Unmanned Aerial Vehicles) on April 30, 2010.

8. DND, "Arctic Offshore Patrol Ship SOR," articles 1.3, 2.4.1, 3.2.6, 4.1.13, footnotes 37 and 38. Available online at http://otg-vcd-webs018.ottawa-hull.mil.ca/Cid/Data/Documents/1435/AOPS%20SOR%20Signed%20Ver%20131200%20May%202009.pdf (accessed April 28, 2010).

Photo composite by CFAWC

THE FUTURE OF THE CP140 AURORA

By Major Graham Edwards, CD



Composite by CFAWC, CF photos

When asked to write an article about the future of the CP140 Aurora, I was initially hesitant to accept. After all, I am a Staff Officer within the Chief of the Air Staff, and the influence I wield could potentially persuade political, industrial, and military leaders alike to invest in whatever resources I recommend... well, not quite. Unfortunately, I am not the Alan Greenspan of long-range patrol aircraft (LRPA), and believe me when I say that there is a well established (and quite lengthy) process through which the requirements and capabilities of the Canadian Forces (CF) are defined and acquired. As such, I figured my proverbial "six o'clock" was sufficiently covered, so I eagerly embraced the challenge of gazing into the long-range patrol crystal ball that every Staff Officer is issued upon their arrival to Ottawa, to reveal what the future has in store for the CP140 Aurora.

In an attempt to forecast the future of the CP140, I thought it prudent to review the origins of Canada's LRPA. In fact, as far back as 1939, the government at the time expressed concern over the protection of Canada's vast territories and maritime approaches. In response, the Department of National Defence (DND) established the home war establishment (HWE) to build the Air Force, much like the Canada First Defence Strategy (CFDS) is aimed at rejuvenating the Canadian Forces of today. As anticipated, the Second World War (WWII) ensued, and Canada's investment in the HWE paid off, ensuring that a viable anti-submarine warfare (ASW) and anti-surface warfare (ASUW) capability was delivered for both Canada and its Allies. Post-war cutbacks saw a lull in LRP activity, but with the advent of the cold war, Canada found itself back in the game of coastal and Arctic patrol. The arrival of the CP140 Aurora (a variant of the United States Navy P-3 Orion) in 1980 was a momentous occasion that placed Canada at the forefront of LRP capability amongst its Allies. However, years of military cutbacks and lack of funding for the Aurora's mid-life upgrade resulted in a serious deterioration in Canada's LRP capability. In the 1990s, the Aurora Incremental Modernization Program (AIMP) was created to rectify the erosion of LRP capability, but enduring fiscal constraints required the $1.67 billion upgrade to be spread over several years, thus delaying its delivery. During the modernization process, the discovery of severe corrosion across all P-3 fleets led to the Aurora Service Life Extension Program (ASLEP). Escalating costs associated with AIMP and ASLEP resulted in their temporary suspension and an initial review of Aurora replacement options.

In 2008, the CFDS was issued with very clear direction on the future of the Aurora. The CFDS identified the requirement to replace the Aurora starting in 2020 with 10–12 patrol aircraft as a part of a new surveillance system of systems. However, the efforts to find a suitable replacement and to establish a surveillance system of systems by 2020 present their own challenges. The post-AIMP Aurora will be a world class command and control, intelligence, surveillance and reconnaissance (C2ISR) platform. As such, there are notable advantages to producing more than the current 10 platforms, and maintaining the option to extend the fleet beyond 2020. This option, if properly supported, has the potential to become a mitigation strategy for the development and delivery of both the Aurora replacement and the CF's system of systems as a whole.

CANADA'S LONG-RANGE PATROL – THE ORIGINS

The birth of Canada's LRP capability could probably be marked by the establishment of the Eastern and Western Air Commands of the Royal Canadian Air Force (RCAF) in 1938 in response to the growing tensions between the United States and Japan on the Pacific Coast, and to the impending threat of war in Europe on the Atlantic Coast. These two commands, combined under the HWE, were part of the DND's air defence plan to protect Canadian territories from airborne, surface, and subsurface attacks. The resources required for the HWE read like a Christmas list calling for a total of 49 squadrons, consisting of 380 Hurricane fighters, 244 Mosquito bombers, 144 Conso flying boats, 40 Vultee Vengeance light

bombers, and transport aircraft for a total cost of $151 million. "This also meant adding 989 officers and 11,347 airmen, for an additional cost of $216 million."[1] It was an impressive defence strategy, similar in grandeur to the current CFDS, and equally challenged by unforeseen changes to requirements, personnel issues, and insufficient industrial capacity both at home and abroad. As a result, during the first months of WWII, the Canadian squadrons that conducted the vital ASW and surface surveillance roles, lagged in capacity and capability behind their British and United States (US) counterparts. Ultimately, the 49 squadrons would be formed, but not in direct support of the HWE. Most squadrons operated overseas in operations in Britain, Northwest Europe, North Africa, and Southeast Asia. By 1942, Canada had six squadrons equipped with Bristol Beaufighters, Blenheim and Hudson light bombers, Vickers Wellingtons and Consolidated Catalina flying boats serving under the British Coastal Command in support of the ASW and ASUW missions. By 1943, the RCAF received 148 American built B-24 Liberators also known as Very Long Range (VLR) aircraft because of the 12- to 15-hour missions they would conduct. The extended range and persistence capability enabled Coastal Command patrols to cover the mid-Atlantic gap, where U-boats previously operated without risk of being attacked by Allied aircraft.[2]

Following the end of the war, the RCAF was reduced to five squadrons and about 12,000 personnel. Peacetime LRP activities consisted of aerial photography, mapping and surveying, search and rescue, and mercy missions. Unfortunately, this lull in activity did not last long, and by the end of 1948, the Soviet Union ensured peacetime activities were no longer a priority for the Air Force. Canadian built Lancaster Mk X aircraft were pulled out of storage, overhauled, and placed into service as maritime reconnaissance aircraft to search for Soviet submarines or as Arctic reconnaissance aircraft tasked to conduct ice reconnaissance (recce), assert Canadian sovereignty, or inspect and photograph Soviet vessels and other items of interest in areas in and adjacent to Canadian territory. Other unmodified Lancasters served as photo reconnaissance aircraft. By 1955, the RCAF grew to a strength of 54,000 personnel and 41 squadrons of which the LRP sqns were equipped with a combination of Lancasters, Lockheed Martin Neptunes, and Canadair Argus aircraft. By 1968, the Lancaster and Neptune aircraft were retired, leaving only 32 Argus aircraft as the mainstay of Canada's LRP.

In February 1959, the US Navy awarded Lockheed Martin a contract to develop a replacement for their aging P-2 Neptune, and in July 1962, the first P-3 Orion entered into service. Canada would follow suit but 20 years later. In 1971, DND determined that a fleet of 20–30 modern aircraft would be required to replace the 32 Argus aircraft. This number was later refined to 24 aircraft, but fiscal constraints and what appeared to be a unilateral decision made by the Trudeau government further reduced the number to 18 without any apparent change to its missions. In May 1980, Canada took delivery of the first of 18 CP140 Auroras, the Canadian variant of the P-3C aircraft. The upside to our tardy replacement was that the CF took advantage of the opportunity to incorporate the advanced 1970's mission system of the Lockheed S-3A Viking, thus giving the Aurora an unprecedented level of systems integration along with the range and endurance of a P-3 Orion. At the heart of this mission system was a general purpose digital computer (GPDC) that processed acoustic, electronic warfare support measures (ESM), radar, and forward looking infra-red (FLIR) sensor data for display to crew members via their own multi-purpose displays (MPDs). This new level of integration gave the crew the capability to process the same data from multiple stations simultaneously, to manage workload by assigning tasks for a given sensor from one station to another, and to integrate data from each sensor to detect, identify, classify, and track subsurface, surface, and airborne targets. The Aurora's ASW and ASUW capability was unprecedented for its time and easily met the intelligence, surveillance and reconnaissance (ISR) needs of Canada.

The downside of the situation was that with only 18 aircraft and high operational demands, the yearly flying rate (YFR) was nearly double that of similar P-3C aircraft flown by other nations.[3]

THE CP140 AURORA – ON STATION

Even to this day, the CP140 constitutes Canada's only airborne strategic surface (sea and land) surveillance capability and remains a crucial element of Canada's maritime combat team. It is the only CF aircraft capable of conducting ISR and sovereignty patrols at the furthest extent of Canada's maritime approaches and within the Arctic. However, without its mid-life upgrade in the 1990s, the capability of the CP140's 1970 technology started to erode. Other operators of the P-3Cs benefited from regular update packages from the U.S. Navy; however, the distinctive configuration of the CP140 was a unique problem the CF had to solve on its own.[4] Budget cuts and force reductions exacerbated by a change in government in 1993 resulted in the cancellation of over $15 billion worth of planned capital projects and operating budgets. Chopped was the mid-life upgrade of the CP140 Aurora and 40 per cent of its YFR, reducing 1998 rates from 19,200 to 11,500 hours. In response, the AIMP was implemented, along with initiatives to ensure the airframe's viability to 2015, including the participation in the U.S. Navy's Service Life Assessment Program that provided the CF the data to evaluate the feasibility of extending the life of the fleet beyond 2015. The result of the latter was the initialization of the ASLEP.

Starting in 1998, the AIMP was implemented to launch the Aurora into the 21st century, providing Canada a maritime, Arctic, and overland surveillance capability second to none. This enhanced sensor, communication, and mission system capability will ensure the CF can respond to the traditional maritime roles, as well as the expanded new ISR roles demanded of the modern day LRP aircraft. In order to make the $1.67 billion price tag more palatable, the program was divided into four distinct blocks consisting of 23 individual projects, as summarized in Table 1. Initially, all 18 Aurora aircraft were to be modernized with a completion date of 2010. However, Block IV would never be funded, and managing the servicing schedule while continuing to conduct ongoing operations would prove to be more challenging than expected. The result was further slippage in the completion date until the 2012 time frame. To make matters even worse, in 2000, a fleet-wide corrosion problem was discovered, compromising the structural integrity of the Aurora's wings and horizontal stabilizer. Analysis determined that without addressing these concerns or significantly reducing the yearly flying rates, the CP140 would reach its end of life by the 2012–2015 timeframe.

BLOCK	EQUIPMENT
Block I Legacy Systems	• **replace high frequency radio** • **replace cockpit voice recorder** • **replace flight data recorders** • **update sonobuoy receiver antennae components** • **new iridium satellite communications (satcom)**
Block IIA Navigation Systems	• **new embedded GPS inertial (EGI) and control display unit (CDU)** • **replace flight director (FDI) and horizontal situation indicator (HSI)** • **replace autopilot** • **new radar altimeter** • **new airborne collision avoidance system (ACAS)**
Block IIB Communication Systems	• **new inter-crew communication system** • **new V/UHF radios (3), and satellite-communication radio (1)** • **new multi-band directional finder (MDF)** • **VHF modernization** • **new dedicated directional command activated sonobuoy system (DICASS) radio**

Block III Mission System	• **new acoustic processing system** • **new electro optic infra-red (EO/IR) systems** • **new electronic warfare support measures (ESM)** • **new imaging radar** • **new magnetic anomaly detector (MAD)** • **new data management system (DMS)** • **new operational mission simulator (OMS)**
Block IV Upgrades	• **new defensive electronic warfare system** • **new tactical data link 16** • **new air-to-surface weapon**

TABLE 1: Aurora Incremental Modernization Projects by Block

The ASLEP proposed incorporating the changes depicted in Figure 1, ultimately extending the average life of each Aurora aircraft by 11,000 hours. Updating all 18 aircraft would extend the Aurora until at least 2025; however, this would come at an estimated cost of $25 million per aircraft or $450 million for the fleet. As part of an initial options analysis, the feasibility of joining the U.S. Navy's P-8 Poseidon Multi-purpose Maritime Aircraft (MMA) program was conducted. However, this option was rejected in 2005 as it was determined that the P-8 would not be available until at least 2020, and that it would cost significantly more than continuing with AIMP/ASLEP.[5] In October 2007, faced with insurmountable costs of AIMP and ASLEP, the government suspended the ASLEP and Block III modernization until DND's fiscal commitments could be re-examined.

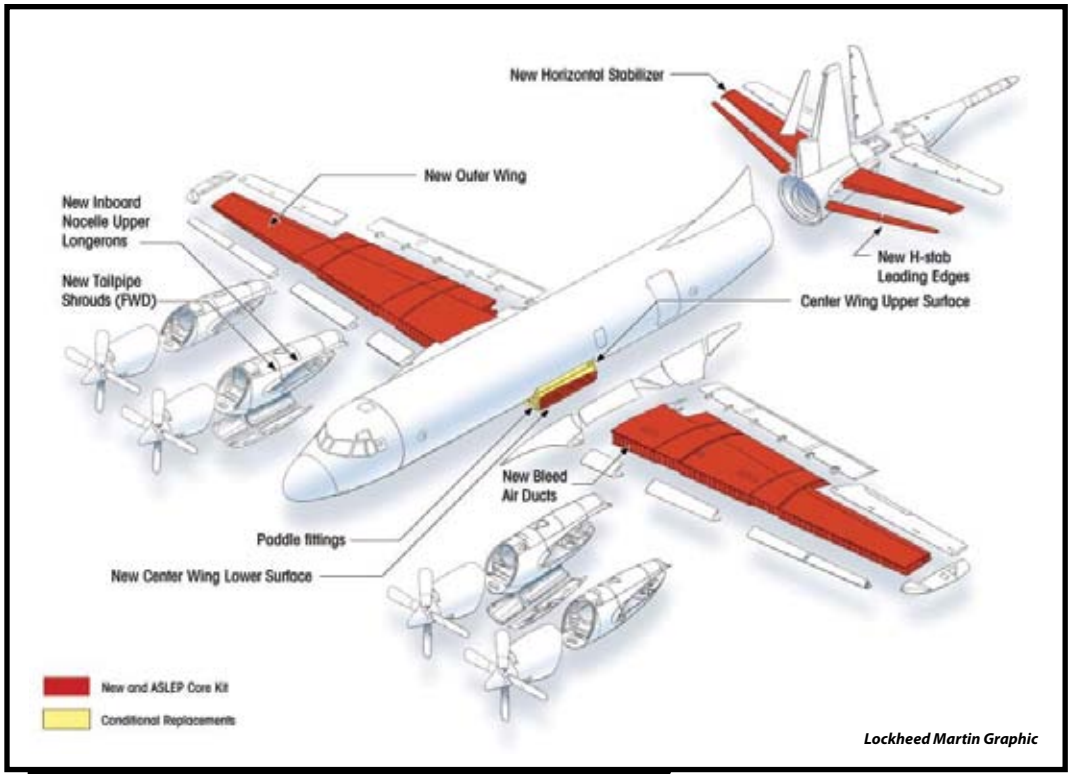


FIGURE 1: The CP140 Aurora Service Life Extension Program (ASLEP) Wing and Horizontal Stabilizer Replacement.

On 14 December 2008, the Minister of National Defence (MND) directed that 16 aircraft will receive the Block II upgrades; whereas, only 10 production aircraft will be modified to the Block III configuration and receive ASLEP. This decision means that there is the potential that Aurora will be operated in two configurations until approximately 2014 when the non-ASLEP aircraft will reach their end of life. The Block III ASLEP aircraft will continue to fly, but at reduced YFR not to exceed 6,500 hours and without third line maintenance and repair until reaching their end of life starting in 2020. In concert with this and commensurate with direction in the CFDS, a third project, the Canadian multi-mission aircraft (CMA) was identified to replace the Aurora fleet with 10–12 maritime patrol aircraft starting in 2020. "The new aircraft will become part of a surveillance 'system of systems' that will also comprise sensors, unmanned aerial vehicles and satellites and keep Canada's maritime approaches safe and secure, including the Arctic."[6]

It is generally accepted that AIMP will give the CP140 Aurora C2ISR capabilities second to no other LRP aircraft in the world. Furthermore, the ASLEP, along with investment into obsolescence replacement, additional spare parts, and ongoing third line maintenance and repair, will effectively reset the CP140's airframe life such that it could be flown to 2025 and possibly beyond. The latter is extremely dependent on the YFR and the fleet size. Ultimately, it would be prudent to determine if a fleet of 10 LRP aircraft can meet Canada's C2ISR needs before the system of systems is established.

CANADA FIRST DEFENCE STRATEGY – SITUATION REPORT

The CFDS, presented in May 2008, is different from previous white papers in that it not only delineates policy but also supports the long-term growth of the CF by ensuring real growth in the Defence budget, a 20-year capital reinvestment plan, and a newly adopted method of accrual accounting to assist in replacing or augmenting key capabilities. At the same time, the CFDS realigns the three main priorities of the CF "to deliver excellence at home, be a strong and reliable partner in the defence of North America, and project leadership abroad by making meaningful contributions to international security."[7] Like the shopping list of the HWE in 1939, the CFDS will meet these priorities with the acquisition of 17 fixed-wing search and rescue aircraft, 15 destroyers/frigates, 10–12 maritime patrol aircraft, 65 fighter aircraft, UAVs, various land force combat vehicles, the ongoing projects involving the C17 and C130J airlift procurements, Chinook helicopters, the Joint Support Ship, and the Maritime Helicopter Project, with capital investments totalling $45–50 billion. Although these capital procurements are necessary, the CF may be challenged by the specificity of quantities, cost, and prescribed timelines of the CFDS. Lieutenant-General George Macdonald (Retired) summarized it best in the executive summary of his paper *The Canada First Defence Strategy – One Year Later*:

> The existence of a small but steady increase in defence funding over the longer term is very positive for planning purposes, but the ability to meet the demand for capability with the supply of resources will remain a major challenge. Adjustments to the Strategy will certainly be required as circumstances and priorities evolve, suggesting the need for a mechanism to make modifications from time to time.[8]

As previously stated, the current plan is to operate 10 modernized ASLEP Aurora aircraft until at least 2020. It is generally accepted that the Block III Aurora will deliver a first class C2ISR capability equipped with state of the art sensors second to none. However, the question remains: will a fleet of 10 LRP aircraft have the required capacity to meet Canada's surveillance requirements?

To meet CFDS priorities and fulfill its six core missions, the Aurora must have the capacity to conduct the following three operations: domestic, contingency and deployed. Domestic operations are defined as the routine patrol of a minimum of two of Canada's three coasts at

least once per day, requiring two mission-ready aircraft. Contingency operations are defined as 24/7 operations at the furthest extent of Canada's area of responsibility for a duration of up to two weeks, requiring a minimum of four mission-ready aircraft. Deployed operations are defined as international operations consisting of two mission-ready aircraft for up to two months at a time.

CFDS SIX CORE MISSIONS

- **Conduct daily domestic and continental operations, including in the Arctic and through NORAD**
- **Support a major international event in Canada, such as the 2010 Olympics**
- **Respond to a major terrorist attack**
- **Support civilian authorities during a crisis in Canada such as a natural disaster**
- **Lead and/or conduct a major international operation for an extended period**
- **Deploy forces in response to crises elsewhere in the world for shorter periods**

Fleet size requirements can be calculated using the following equation:

$$\text{MISSION READY} = \left(\text{FLEET SIZE} - \text{AIRCRAFT IN PREVENTIVE MAINTENANCE}\right) \times \text{SERVICEABILITY RATE}$$

Rearranging the terms:

$$\text{FLEET SIZE} = \left(\text{MISSION READY} \,/\, \text{SERVICEABILITY RATE}\right) + \text{AIRCRAFT IN PREVENTIVE MAINTENANCE}$$

In determining the LRPA capacity to meet the CFDS requirement, it is difficult to project the daily demand upon the Aurora fleet based upon the frequently changing operational tempo. As such, one could evaluate the CFDS/LRPA fleet-size requirement using a goal post analogy by establishing the minimum and maximum requirements with the optimum number being somewhere in between. As a minimum, the Aurora must be able to conduct domestic operations, thus requiring two mission-ready aircraft. As a maximum, the CF may be required to respond to all three types of operations simultaneously, thus requiring a mission-ready fleet of eight aircraft. Understandably, variability exists in the frequency of preventive maintenance (periodic and third line maintenance and repair), and serviceability rate (~55%), but by using historical CP140 numbers, it can be determined that domestic operations would require a fleet size of 4.8 aircraft. To support all CFDS missions simultaneously would require a fleet size of 18.2 aircraft. Note that this calculation does not take into consideration force generation requirements. The resultant fleet size, preventative maintenance, and airframe hours remaining can be used to determine the YFR achievable. As expected, the larger the fleet size the more flexibility the CF will have to meet the CFDS missions and respond to variations in the operational tempo. Figure 2 summarizes the perceived risk of varying fleet size to meeting CFDS missions, along with the estimated YFR achievable.

The arrival of the CMA may seem some time off, but if historical procurement trends are any indication it is not too soon to begin work on its concept of operations within a surveillance system of systems. Given the variables associated with this new system of systems, the CP140 remains the only constant. The Block III Aurora's capabilities will be well known, will be operationally airworthy, and will provide the full gambit of the CF's maritime and Arctic ASW/C2ISR requirements. Extra capacity within the CP140 fleet, by way of more AIMP/ASLEP aircraft, would facilitate the option of extending the fleet, and risk mitigate for delays in either CMA or the surveillance system of systems. In addition, any extra capacity in the Aurora fleet would provide an ideal demonstration vehicle through which C2ISR systems for both CMA and UAVs could be developed and proven. As new technologies and tactics present themselves, the Aurora could be used to demonstrate and/or validate them. Furthermore, if larger issues preclude the implementation of satellite, UAV,

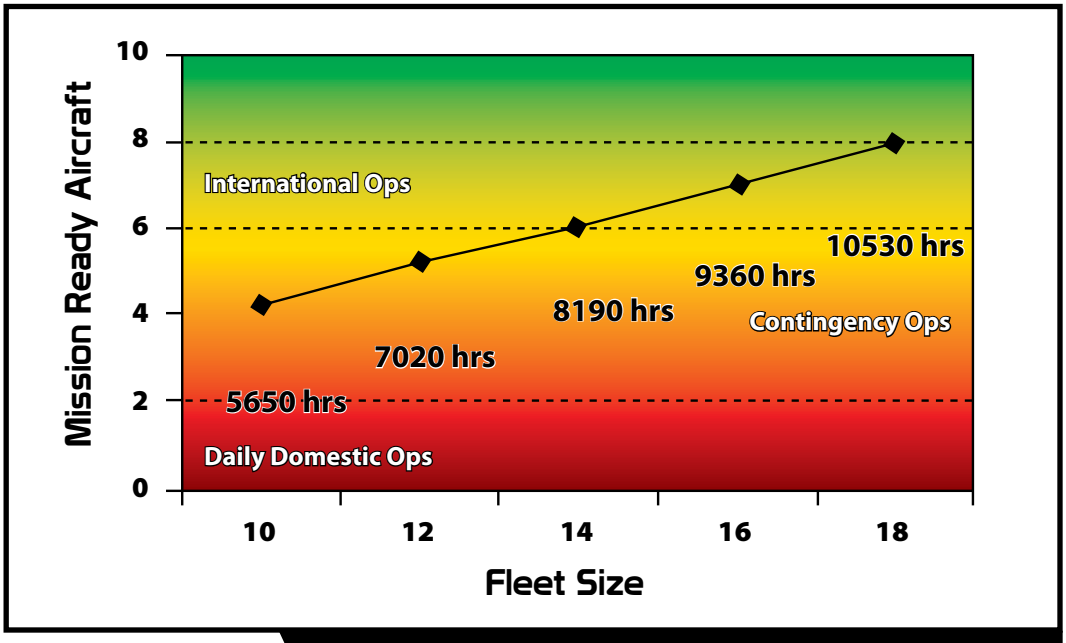


FIGURE 2: CP140 Aurora fleet size versus Canada First Defence Strategy mission requirements with overlay of achievable yearly flying rates.

or even the CMA aspects of the CF's system of systems, the option to extend the Aurora would serve to mitigate the risk of potentially widening Canada's ASW/C2ISR capability gap. The downside to all of this is that increasing the production of AIMP/ASLEP comes with the knowledge that the Aurora will need to be replaced at some point and that the CFDS budget, although significant, is not unlimited.

CP140 AURORA – OFF STATION

It is a central tenet of Air Force doctrine that "flexibility is the key to air power." For a country like Canada, that means that aircraft with multiple capabilities are essential. This tenet has rung true throughout the origins of Canada's LRPA capability in WWII to the peacetime activities of aerial photography, mapping and surveying, to today's requirement to respond to the traditional ASW and ASUW roles, to the new C2ISR roles expectant of the surveillance system of systems. AIMP brings the CP140 Aurora into the 21st century to give Canada a maritime, Arctic, and overland surveillance capability that is the best in the world. ASLEP provides the necessary improvements to make sure the Aurora can continue to deliver this capability for many years to come. The CFDS indicates that the Aurora will be replaced in 2020 with 10–12 aircraft within a surveillance system of systems. Specificity of quantities, cost, and timelines of the CFDS may present a challenge to the CF, and as such, it would be beneficial if there were a mechanism to make modifications to adjust the strategy as circumstances and priorities evolve. Ideally, the more Aurora that receive Block III and ASLEP, the more flexibility the CF will have to risk mitigate CMA and the surveillance system of systems. What is the future of the Aurora? I don't think I know just yet, but I believe there is a well established (and quite lengthy) process that does. ■

Major Graham Edwards joined the Canadian Forces in 1988, attending Collège militaire royal de Saint-Jean, then graduating from Royal Military College with a degree in Engineering and Management in 1993. After obtaining his air combat systems officer (ACSO) wings in 1994, he was posted to 407 Maritime Patrol Squadron to conduct a six-year tour on the CP140 Aurora. In 2000, he underwent an Aerospace Systems Course. Upon graduation, he was posted to 404 Marine Patrol and Training (MP&T) Squadron Advanced Training Section and then Maritime Proving and Evaluation unit (MP&EU) where he was Project Officer and Test Director for the CP140's EO/IR and Block II projects and the CU161 Sperwer tactical unmanned aerial vehicle (TUAV). In 2006, he conducted an exchange tour with 56(R) Air C2ISR Test and Evaluation Squadron, Royal Air Force Waddington, United Kingdom (UK), where he was a Trials Director on Air C2ISR systems, including the Zephyr high altitude, long endurance unmanned aerial vehicle (HALE UAV), UK airborne warning and control system and Nimrod aircraft. He was promoted to his current rank in 2007, and in 2009 posted to his current position within the Chief of Air Staff Directorate Air Requirements (CAS DAR) 3-5 in Ottawa.

List of Abbreviations		EO/IR	electro-optical infrared
AIMP	Aurora Incremental Modernization Program	ESM	electronic warfare support system
ASLEP	Aurora Service Life Extension Program	HWE	home war establishment
ASUW	anti-surface warfare	LRP	long-range patrol
ASW	anti-submarine warfare	LRPA	long-range patrol aircraft
C2ISR	command and control, intelligence, surveillance and reconnaissance	RCAF	Royal Canadian Air Force
CF	Canadian Forces	UAV	unmanned aerial vehicle
CFDS	Canada First Defence Strategy	US	United States
CMA	Canadian multi-mission aircraft	WW II	Second World War
DND	Department of National Defence	YFR	yearly flying rate

Notes

1. Juno Beach Centre, "Home Defence: The Creation of the Home War Establishment (HWE)." Available online at http://www.junobeach.org/e/4/can-tac-air-hwe-e.htm (accessed May 5, 2010).

2. Royal Canadian Air Force, "Consolidated B-24 Liberator's of the RCAF," *The Archives.* Available online at http://rcaf.com/Archives/archivesDetail.php?Consolidated-B-24-Liberator-s-of-the-RCAF-14 (accessed May 5, 2010).

3. Ernest Cable, "Aurora's Wing Clipped?" Available online at http://www.noac-national.ca/article/cable/aurora_bycolonelesccable.html (accessed May 5, 2010).

4. "Canadian Air Forces Aircraft-Lockheed Martin CP140 Aurora," *Canadian America Strategic Review.* Available online at http://www.casr.ca/101-af-cp140-aurora.htm (accessed May 5, 2010).

5. Cable.

6. DND, *Canada First Defence Strategy*, 17. Available online at http://www.forces.gc.ca/site/pri/first-premier/June18_0910_CFDS_english_low-res.pdf (accessed May 5, 2010).

7. Ibid., 3.

8. George Macdonald, "The Canada First Defence Strategy – One Year Later," *Canadian Defence & Foreign Affairs Institute*, October 2009. Available online at http://www.cdfai.org (accessed May 5, 2010).

Photo: Sgt Eileen Redding

THE CANADIAN NAVY AND ITS FUTURE ORGANIC AIR CAPABILITY

REPRINT FROM THE
CANADIAN NAVAL REVIEW
VOL. 5, NO. 4 (WINTER 2010)

BY **MAJOR SOL MARTINS, CD**

Photo: Cpl Shilo Adamson

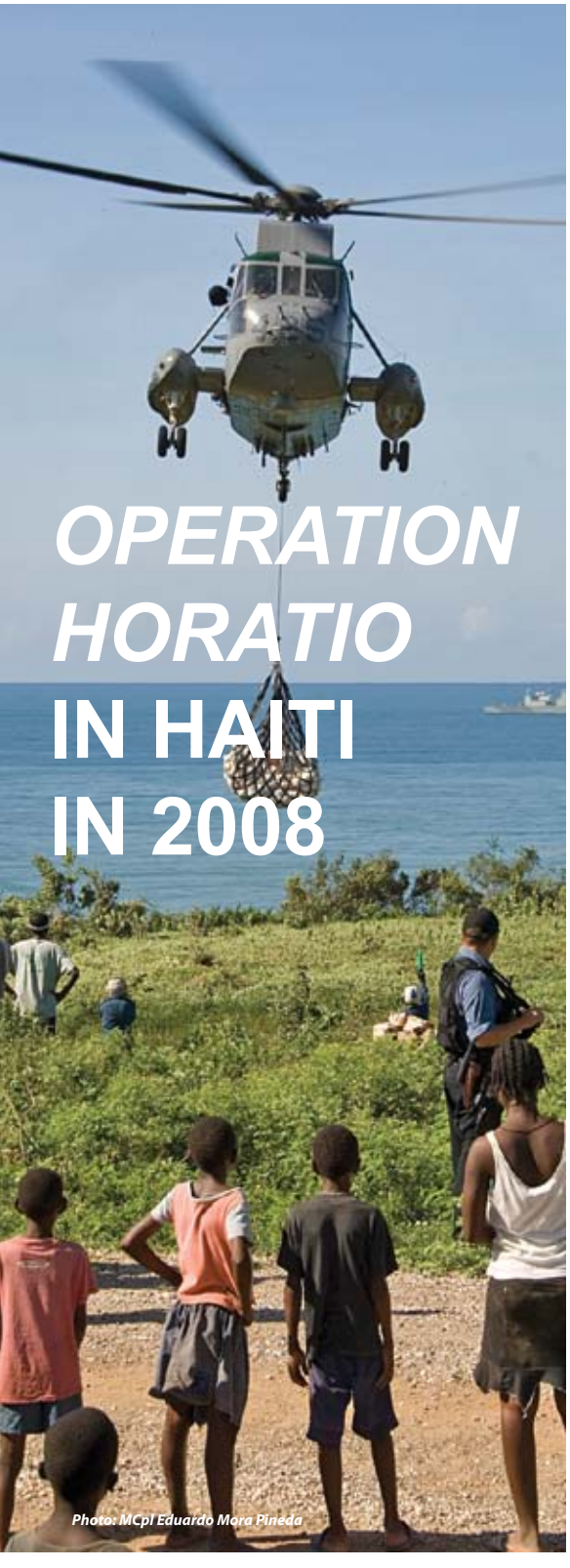
In modern naval warfare, the combat capability of one ship or an entire fleet is greatly dependent on its organic air assets. Organic air is the airborne component that is integral to ships and naval task groups. The most powerful navies derive much of their sea power through the use of aircraft carriers with embarked aircraft, primarily fighters and helicopters. Even the US Navy (USN), which has the largest naval air capability in the world, continues to expand its organic air capability. Take for example the new USN 3000-tonne Littoral Combat Ships (LCS). These relatively small warships were designed with an emphasis on coastal operations. Although smaller than a Canadian frigate, they will be designed to operate more than just one helicopter – they will be able to carry one Seahawk helicopter and three Fire Scout rotary wing unmanned aerial vehicles (UAVs) concurrently. The USN is integrating the capabilities of two different but highly capable airborne platforms on a relatively small ship. In future operations, this will significantly expand the options available to this class of warship. The UAV can remain on patrol for significant periods of time, and when it detects something of interest, the manned helicopter can be launched to initiate the appropriate response.

All of the major emerging economic powers – Brazil, Russia, India and China – possess aircraft carriers or are planning to build or buy them within the next decade. Many middle power countries have large ships with significant organic air capabilities. Thus, for example, Australia, a country with a military similar in size to Canada's, is acquiring two large multi-helicopter carrying amphibious vessels (LHDs). Obtaining as large an organic air capability as a country can afford is well understood and cannot be over-stated.

Since the early 1960s when Canada pioneered placing large Sea King helicopters on small warships, maritime helicopters (MHs) have been and continue to be the most effective method of providing an organic air capability to a non-carrier-equipped navy. The MH provides many essential capabilities to a fleet. The most obvious contribution is greatly extended situational awareness of the area around a ship. They provide the ability to see and react beyond the ship's very limited 10-20 nautical miles (nm) visual and surface radar horizon. All ships, from the most powerful warships to the smallest craft, have this same constraint. The ability to affect the battlespace beyond a ship's horizon requires eyes and weapons in the sky. Helicopters easily extend this horizon to well beyond 100-200 nm in any direction.

Increasing a ship's situational awareness of what is beyond its horizon can also lead to extending the range of ship sensors and more importantly permitting a warship to exploit fully its weapon systems. For example, our *Halifax*-class frigates carry Harpoon surface-to-surface missiles with a range of approximately 75 nm. This range cannot be exploited unless the ship knows what is beyond its 20 nm radar horizon. Without the ability to look over that horizon, the ship's effective Harpoon range is only as far as the ship can see.

Another unique capability MHs provide is the ability to conduct independent missions from their parent ships. For example, the ship may be focused on conducting an anti-submarine mission while the MH is concurrently maintaining an over-the-horizon plot of surface shipping. Also, helicopters, when equipped with appropriate sensors and air-to-surface/sub-surface weapons, can provide surface and sub-surface surveillance and control over areas many times larger than any ship can provide on its own. Helicopters conduct search and rescue (SAR) and combat SAR missions over land or at sea. They are the primary method of conducting personnel rescues – they can search large areas for a lost sailor at sea quicker and much more thoroughly than any ship and conduct the rescue. Of course, maritime helicopters can also conduct a multitude of other utility missions such as tactical transport, logistic resupply, environmental assessment such as ice reconnaissance or checking oceanographic conditions, and all of these missions can be conducted at distances beyond the ship's horizon.



When the MH and ship are considered together they are able to conduct missions that could not be conducted otherwise. This synergistic effect allows for the accomplishment of some unique tasks. A perfect example was *Operation Horatio* in Haiti in 2008. The frigate HMCS *St John's* was tasked to deliver humanitarian aid after Haiti had been struck by four hurricanes in a row. In 13 days, she delivered 450 tons of rice, bottled water and other relief supplies to an area of southern Haiti that had all its roads washed out and no usable harbours.[1] This was managed by slinging supplies from the warship to remote villages under its Sea King helicopter. A frigate could not have carried out this mission on its own but the combination of a maritime helicopter with its parent frigate permitted this mission to be conducted in a far timelier and less resource intensive manner than using an army unit for the same task.

With Canada's history and knowledge of deploying maritime helicopters on ships and the additional capabilities that organic air confers, one would assume that the navy would be trying to increase its capacity to carry organic air capability as much as possible. So is the navy increasing its flexibility and capacity to employ organic air assets?

The Canadian Navy seems to be going against conventional wisdom in this regard. Some people might disagree with this statement, since we are buying 28 new CH148 Cyclones, modern multi-role maritime helicopters specifically to increase this capability.[2] The Cyclone could provide a large increase in organic air capability but the navy does not seem to want to exploit this fully. Let us take a look at what is being planned in terms of the Canadian Navy's future organic air carrying capabilities. They are as follows:

- 12 *Halifax*-class ships will be converted to carry one Cyclone helicopter, the same as the current Sea King carrying capability;
- three *Iroquois*-class ships can carry two Sea King helicopters. They will not be converted to carry Cyclone helicopters. Thus, the two helicopter-carrying task group command flag ship will no longer have an organic air capability;

• 12-15 future Canadian Single Combatant (CSC) class ships, to replace the current destroyers and eventually the frigates, are planned to carry a single helicopter, thus replacing the equivalent of the *Halifax*-class but not the *Iroquois*-class two helicopter capability; and

• six to eight Arctic Offshore Patrol Vessels (AOPVs) are defined to operate a light observation helicopter, primarily to conduct ice reconnaissance in front of the ship. The AOPV as currently planned, cannot operate a Canadian MH effectively.

The current *Protecteur*-class supply ships (AORs) and the planned Joint Support Ship (JSS) will be able to operate up to three Cyclones but from a single spot flight deck. This is not effective for conducting multi-helicopter operations concurrently. Thus the operational benefit of carrying multiple helicopters is significantly reduced as only one can launch or land at a time.

If we compare the potential to carry organic air of the Canadian Navy from just five years ago to the navy of 2015 and 2025, we see that capacity will be significantly reduced.[3] In addition, the capacity in 2015 is optimistic as all of the frigates will not have completed the modernization and refit program by that time. Thus, in the medium term, there will be difficulty in force generating a maritime helicopter capability due to a shortage of ships to train on, and in the longer term the total capacity will be strained to maintain the 15 Helicopter Air Detachments (Helairdet) equivalents to be provided by the Maritime Helicopter Project.

Year	Fleet	MH Capacity Per Ship	MH Capacity Per Class	Max. MH Carrying Capability for a Canadian Task Group	Total MH Carrying Capacity (including ships in refits/ maintenance periods, etc.)
2005	2 *Protecteur*-class AORs 4 *Iroquois*-class 12 *Halifax*-class	3 2 1	6 8 12	8	26
2015	2 AORS [sic] or Joint Support Ships 3 *Iroquois*-class 12 *Halifax*-class	3 0 1	6 0 12	6	18
2025	3 Joint Support Ships 12-15 Canadian Surface Combatant-class	3 1	9 12-15	7	21-24

Table 1. Maritime Helicopter Carrying Capability

Is this a trend? Is the Canadian Navy reducing its overall organic air capability, despite its importance in the modern operational environment? Has the navy reduced its ability to project force over the horizon? Is this reversible?

There are certainly ways to ensure that the navy maintains and/or improves its organic air capability. This is especially so when ships are already designed to carry helicopters. In this case, the incremental cost to ensure the appropriate number being carried and/or optimized to exploit fully the capabilities that a modern MH such as the CH148 Cyclone will provide is relatively inconsequential. This applies to the JSS, CSC and AOPV classes in particular as these classes of ships have not yet been built and this is especially true if the incremental cost increase is compared to the cost of potentially losing ships in future operations. Suggestions to ensure the Canadian Navy's organic air capability does not wither include the following:

- Convert the *Iroquois*-class to operate the CH148 Cyclone (only beneficial for the short term, due to the short remaining lifespan of these ships);
- Amend the JSS Statement of Requirements to ensure that this new ship class is able to carry and operate four maritime helicopters and the ships are fitted with a dual landing spot flight deck to make best use of the larger helicopter detachment.
- Make one of the future CSC essential requirements the ability to embark and operate two helicopters, as with the current *Iroquois*-class destroyers.
- Amend the AOPV requirements to enable the ships to maintain and operate a helicopter in Sea States 5 or 6, as with other Canadian warships. Even greater flexibility could be built in by enabling AOPSs to operate two maritime helicopters.
- In the future, consider ships such as the Australians LHD mentioned earlier. Such large vessels provide great flexibility in naval missions and tasks, and could also operate much larger helicopters such as the CH147 Chinook helicopters that Canada has recently purchased to support army operations, and/or short take-off and vertical landing (STOVL) fixed-wing capability. A version of the Joint Strike Fighter with which Canada is considering replacing the CF18 then could be a possibility.

One of the few weaknesses of aircraft is their impermanence – they cannot stay in the combat area without regularly leaving to return to a base to refuel, re-arm, etc. Organic air is unique in this context, as its base is a ship and is therefore mobile and can deploy into or near the combat/operations zone. Also, organic air assets are the only air resources always available to a naval ship or task group. Helicopters provide ships greater situational awareness, greater operational flexibility and effectiveness, and enhance safety in maritime situations. However, the capacity to operate aircraft from our ships is being reduced just as we are about to increase the number of capable modern maritime helicopters available to deploy as organic air assets. It is essential to the future relevance and capability of the Canadian Navy that the greatest possible organic air capability and capacity is maintained. ■

Major Sol Martins is a member of the CF Maritime Warfare Centre's Education and War-Gaming Staff. His previous posting was as a member of the air requirements staff responsible for the Maritime Helicopter Project.

Notes

1. Department of National Defence, "HMCS *St. John's* Heading Home upon Completion of WFP Humanitarian Operation in Haiti," available at http://news.gc.ca/web/article-eng.do?m=/index&nid=420799.

2. The naval requirement is to provide 15 of the CH148 Cyclone helicopters on 11 ships concurrently. In a *Halifax*-class frigate, a Helairdet consists of 1 helicopter, 2 flight crews of 4 personnel each and a maintenance crew of 11 permitting operations of up to 12 hours a day. Having 15 *Halifax*-equivalent Helairdet units that can be transferred from ship to ship provides the most flexibility for the navy, in order to send them to any class of ship that will be operationally deployed.

3. According to previous research conducted by Ops Research, a naval task group of 4–5 ships in a combat situation requires a minimum of 7–8 helicopters to provide 2 helicopters airborne 24/7. In an anti-submarine warfare environment, for example, operating 2 helicopters is the minimum required to conduct effectively anti-submarine defence of the task group. In a littoral environment 2 additional helicopter roles are very important to a task group: (1) the main sea-shore connector for personnel is by helicopter, i.e., the ability to move over the land-sea interface while the task group stays at sea; and (2) the ability to conduct surveillance of additional land threats to the task group.

Photo: MCpl Robin Mugridge

TACTICAL GENERALS

LEADERS, TECHNOLOGY, AND THE PERILS OF BATTLEFIELD MICROMANAGEMENT*

Reprint from the *USAF Air and Space Power Journal*, Vol. XXIII, No. 2, Summer 2009

By **Dr. Peter W. Singer**

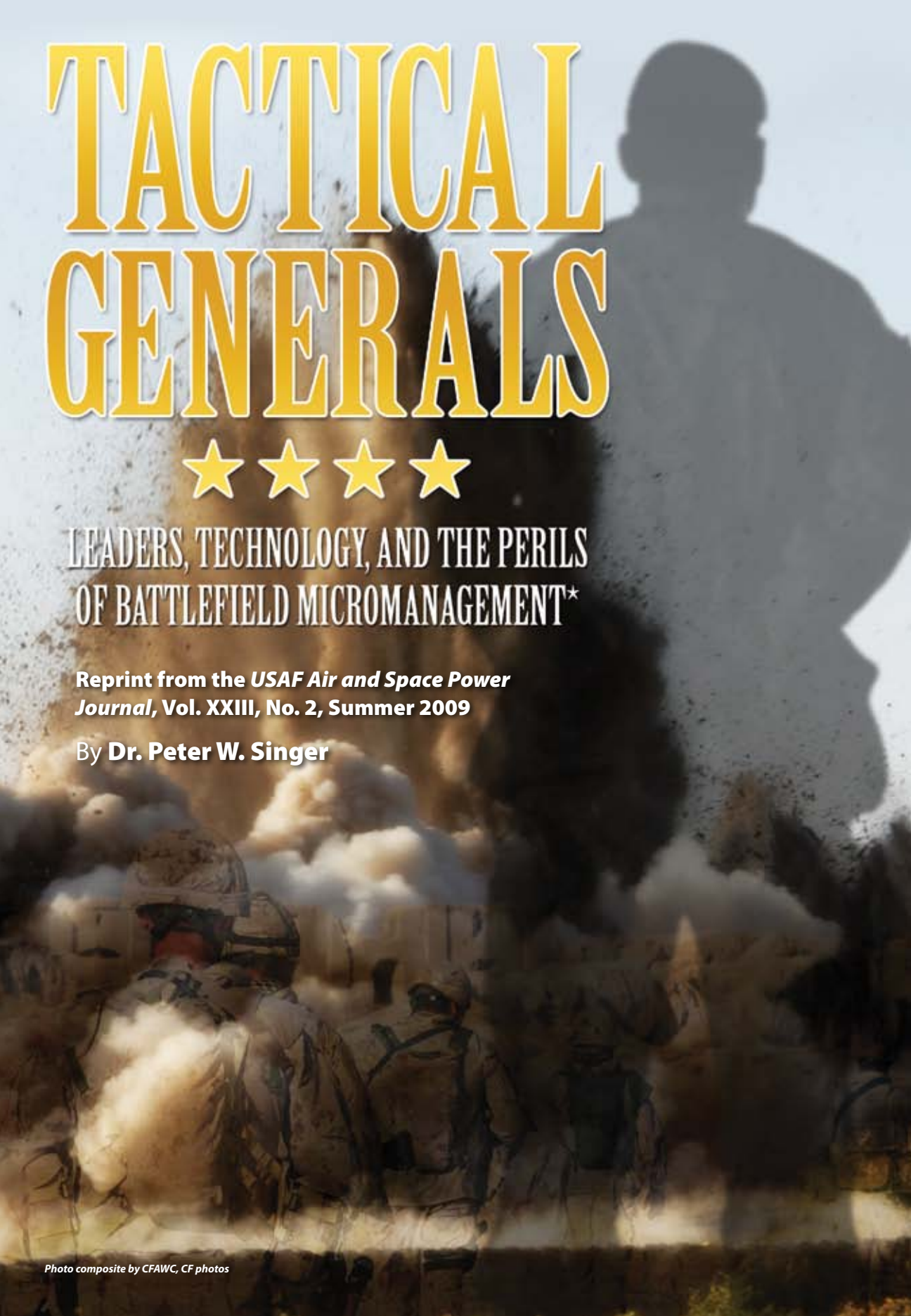


Photo composite by CFAWC, CF photos

Editor's note: In editing this article, the author's American spelling and idiomatic conventions have been maintained.

EDITORIAL ABSTRACT:

In 1999 Gen Charles Krulak coined the term "strategic corporal" (i.e., a junior member trained and empowered to make time-critical decisions in response to the dynamic ground fight). In this article, the author examines a similar phenomenon occurring among senior officers, observing that modern technology allows generals to personally engage on the tactical level from remote locations. How the military manages this phenomenon will become a core leadership question in the years ahead.

★★★★

The four-star general proudly recounts how he spent "two hours watching footage" beamed to his headquarters. Sitting behind a live video feed from a Predator unmanned aircraft system (UAS), he saw two insurgent leaders sneak into a compound of houses. He waited as other insurgents entered and exited the compound, openly carrying weapons. Now, he was certain. The compound was a legitimate target, and any civilians in the houses had to know that it was being used for war, what with all the armed men moving about. Having personally checked the situation, he gave the order to strike. But his role in the operation didn't end there; the general proudly tells how he even decided what size bomb his pilots should drop on the compound.[1]

THE RISE OF THE TACTICAL GENERAL

In *The Face of Battle*, his masterful history of men at war, John Keegan writes how "the personal bond between leader and follower lies at the root of all explanations of what does and does not happen in battle."[2] In Keegan's view, the exemplar of this relationship was Henry V, who inspired his "band of brothers" by fighting in their midst during the Battle of Agincourt.

With the rise of each new generation of communications technology, these connections between soldiers in the field and those who give them orders grew distanced. Generals no longer needed to be on the front lines with their men but operated from command posts that moved further to the rear with each new technological advance. Yet, the very same technologies also pushed a trend "towards centralization of command, and thus towards micromanagement."[3]

For instance, when telegraphs were introduced during the Crimean War (1853–56), generals sipping tea back in England quickly figured out that they could send daily plans to the front lines in Russia. So they did. With the radio, this went even further. Adolf Hitler was notorious for issuing highly detailed orders to individual units fighting on the Eastern Front, cutting out the German army's entire command staff from leading its troops in war. Even the US military has suffered from this problem. During the rescue attempt of the American cargo ship *Mayaguez* in 1975, the commander on the scene received so much advice and orders from leaders back in Washington that he eventually "just turned the radios off."[4]

These leaders of the past, though, never had access to systems like today's Global Command and Control System (GCCS). As one report describes, "GCCS—known as 'Geeks' to soldiers in the field—is the military's HAL 9000. It's an umbrella system that tracks every friendly tank, plane, ship, and soldier in the world in real time, plotting their positions as they move on a digital map. It can also show enemy locations gleaned from intelligence."[5]

This tracking system is reinforced by video feeds from various unmanned systems blanketing the battlefield. The growth in America's use of robotic systems has taken place so fast that many people seem not to realize how big it has gotten. US forces initially went into Iraq with only a handful of unmanned systems in the inventory; indeed, just one UAS supported all

of V Corps. By the end of 2008, however, there were 5,331 UASs in the total US inventory.[6] In Iraq, some 700 drones supported that same V Corps just a few years later, while the sum total of Army and Air Force UASs was logging almost 600,000 annual flight hours.[7]

Rapid growth in ground robotics has occurred as well. Zero unmanned ground vehicles took part in the 2003 invasion of Iraq; a year later, 150 were in use. By 2008 the inventory in Iraq had approached the 12,000 mark, with the first generation of armed ground robots arriving that same year.[8] And the technological development is moving so fast that all of these systems are outdated the very moment they hit the marketplace and battlespace. These are just the Model T Fords and Wright Flyers compared to what is already in the prototype stage.

'IT GIVES THEM AN UNPRECEDENTED ABILITY TO MEDDLE IN MISSION COMMANDERS' JOBS.'

With these trends in play, warfare is undergoing a shift that may well parallel that which occurred in World War I. Amazing new technologies, almost science-fiction-like in their capabilities, are being introduced. (Indeed, the number of unmanned ground systems now in Iraq roughly parallels the number of tanks used in 1918.) Yet, as in World War I and the ensuing interwar years, the new technologies are not "lifting the fog of war" or ending friction, as some of the acolytes of network-centric warfare would have it. Rather, in everything from doctrine to the laws of war, they are presenting more questions than we can answer.

Issues of command leadership offer just one example of the ripple effect now under way. The combination of networked connections and unmanned systems enables modern commanders as never before, linking them closer to the battlefield from greater distances and changing the separation of space. But the separation of time has changed as well. Commanders can transmit orders in real time to the lowest-level troops or systems in the field, and they have simultaneous real-time visibility into it. Previously, generals may have been distanced, but they could never "see" what soldiers saw in the crosshairs of their rifle sights—or do anything about it. With a robotic system such as a Predator UAS or Special Weapons Observation Reconnaissance Detection System (a ground robot, the size of a lawn mower, armed with a machine gun), commanders can see the same footage that the operator sees, at the same time, and even take over the decision to shoot or not.

Many people, especially the network-centric acolytes who surrounded former secretary of defense Donald Rumsfeld, thought this linking together of every soldier and system into a vast information-technology network would decentralize operations, enable greater initiative among the lower-level units in war, and allow frictionless operations that lifted the fog of war.[9] So far, actual experience with unmanned systems is proving to be the opposite. New technologies have certainly enabled a powerful revolution to occur in our capabilities, creating a strange new world where science fiction is fast becoming battlefield reality. But although commanders are empowered as never before, the new technologies have also enabled the old trends of command interference, even taking them to new extremes of micromanagement. Too frequently, generals at a distance use technology to insert themselves into matters formerly handled by those on the scene and at ranks several layers of command below them. "'It's like crack [cocaine] for generals,' says Chuck Kamps, a professor of joint warfare at the Air Command and Staff College. 'It gives them an unprecedented ability to meddle in mission commanders' jobs.'"[10]

Over the last few years, many analysts have discussed what Marine Corps general Charles Krulak described as the rise of the

"strategic corporal"—how technology has put far more destructive power (and thus influence over strategic outcomes) into the hands of younger, more junior troops. A 20-year-old corporal can now call in air strikes directed by a 40-year-old colonel in the past. But these new technologies have quietly produced its inverse, what I call the "tactical general." Technology may have helped move senior leaders off the actual battlefield, but now it allows them to become more involved in the real-time fighting of war. What to do about this phenomenon will pose a core leadership question in the years ahead.

TO INTERVENE OR NOT TO INTERVENE

The four-star general who told how he spent two hours watching Predator footage recounted the story proudly and unprompted. He did so while trying to make a point about how he intended to assume personal leadership of operations for which he was responsible.

That a general, who can now see what is unfolding on the ground, would want to shape it directly makes perfect sense. Who better knows "commander's intent" than the commander himself? All sorts of battles have been lost when subordinates in the field misinterpreted or wrongly implemented a general's commands. A general who stays on top of an ongoing situation can also rapidly adjust to any changes that happen in the midst of battle, rather than proceed with old plans that have been overcome by events.

Unfortunately, the line between timely supervision and micromanagement is a fine one and may be quickly fading with unmanned systems. More and more frequently, generals insert themselves into situations inappropriately, and their command leadership role becomes command interference.

Examples run rampant. One battalion commander in Iraq told how he had 12 stars' worth of generals (a four-star general, two three-star lieutenant generals, and a two-star major general) tell him where to position his units during a battle. A captain in special operations forces recounted how a brigadier general (four layers of command up) had radioed him while his team was hunting down an Iraqi insurgent who had escaped during a raid. Watching live Predator video back at the command center in Baghdad, the general had orders for the captain on where

Photo: MCpl Craig Wiggins

to deploy not only his unit but also his individual soldiers![11] Another interviewee described how officers hundreds of miles away would tell him which roads his vehicle should take during raids in Afghanistan.[12]

As retired Air Force lieutenant colonel Dan Kuehl points out, the fact that a general now can use a "5,000-mile-long screwdriver" doesn't mean he should.[13] Besides the frustrations that such micromanagement brings subordinates, there is also the question of the appropriate division of labor in command. To the general who described spending two hours watching Predator footage, this was time well spent. As the ultimate commander, he would be held accountable if the strike went awry and collateral damage ensued. So, if the technology allowed, he believed that he should make sure the operation went exactly the way he wanted.

But this comes at a cost. While this general was doing a job normally entrusted to junior officers, who was doing his job? New technologies allow him and other senior flags to make tactical decisions as never before. But the captains, majors, colonels, and so forth, whom they cut out of the chain, cannot, in turn, assume responsibility for the strategic and policy questions that the generals would have wrestled with instead.

Such generals seem more attracted to micromanagement in the kinetic realm. I liken it to the "Super Bowl" effect. That is, they have spent their entire professional lives preparing for battle and usually look back on their days at field level as the best part of their careers. So these generals don't want to miss out on "the big game" simply because they have advanced past it in their careers.

The challenge is that tactical generals often overestimate how much they really know about what happens on the ground. New technologies may give them an unprecedented view of the battlefield and the ability to reach into it as never before, but this view remains limited. For example, during Operation Anaconda in 2002, when the 10th Mountain Division took on Taliban and al-Qaeda fighters in the Shah-i-Khot valley in Afghanistan, generals back in the United States could watch a battle play out live, beamed back to them by a Predator UAS that flew above the fight. The danger, explains Maj Louis Bello, the fire-support coordinator for the division, is that the video tends to "seduce" commanders, leading them to focus on what the UAS beamed back, as if it told the whole story. "You get too focused on what you can see, and neglect what you can't see," Bello said. "And a lot of the time, what's happening elsewhere is more important."[14]

Jumping in and out of tactical issues, rather than working them day to day, senior officers also don't have the local context (nor are they usually trained for analysis). Moreover, they sometimes interpose their assumptions onto what they do see. During Anaconda, for example, American commanders viewed live video of al-Qaeda fighters moving across a mountain. Despite the footage staring them in the face, the commanders still thought they must be seeing Americans since they expected to see them there, based on their original plans.[15]

Older generations' lack of familiarity with cutting-edge technology can also heighten misunderstanding from afar. During the 2003 Iraq invasion, for example, overall commander Gen Tommy Franks reportedly became quite possessed with the "Blue Force Tracker" map, a massive electronic display that showed the exact locations and status of every US unit, as well as Iraqi units facing them. The appearance of so much information, however, proved deceiving. At one stage early in the fight, seeing that the tracking map showed no Iraqi units nearby, Franks concluded that several units in the Army's V Corps were idle, neither moving nor fighting. He reportedly flew off the handle and tracked down his land-forces commander, who then, in his words, was made to eat "a sh[--] sandwich."[16]

There was only one problem: the audience back at US Central Command saw the battles unfolding at the wrong scale. The blue icons, representing American units, may have looked alone on the large-scale map but were actually locked into one of the toughest battles of the

entire invasion, fighting against a swarm of Saddam Fedayeen teams. These small insurgent units had sufficient size to give the US invasion force fits but not enough to merit their own logos on the high-tech map viewed by generals far from the battle.

Most of all, officers in the field lament what they call the "Mother, may I?" syndrome that comes with the greater use of these technologies.[17] Rather than rely on the judgment of highly trained officers, generals increasingly want to inspect the situation for themselves. This is fine if the enemy plays along and gives the general several hours to watch the video and decide which bomb to use. But sometimes matters aren't decided on a general's schedule. An Air Force officer in the Middle East described his ultimate frustration, noting a time when even though he had information that could have saved lives, "it sat in someone's e-mail queue for six hours."[18]

GENERALS ON LAKE WOBEGONE

Ultimately, these problems combine to add another new problem. Or, rather, they create a new wrinkle on a venerable truism of war. As Napoléon once said, "One bad general is better than two good ones."[19]

A pyramid represents the traditional concept of a military operation, with the strategic commander on top, the operational commanders beneath, and the tactical commanders occupying the bottom layer. Aided by the new technologies, strategic and operational commanders who usurp authority from tactical commanders are erasing this structure from above. The pyramid also finds itself endangered from the sides. As one UAS squadron officer explains, the simultaneous location of reachback operations in multiple spaces presents a major challenge to their command and control.[20] Although UASs fly over Iraq, they launch out of a base in the Persian Gulf and are flown by operators sitting back in Nevada. At each of those locales, "each commander thinks he's in control of you."[21] Even worse, everyone clamors for these high-demand assets.

This situation results in "power struggles galore," tells the squadron commander. Because operations are located around the world, it is not always clear whose orders take priority. Instead, units get "pulled in many directions because you are in virtual space. Am I at Nellis, or am I at CENTAF [US Central Command Air Forces, the air command in the Middle East]?"[22]

Moreover, by giving everybody in the command structure access to the Internet, the ability to watch what goes on and weigh in on what units should do is not limited to a unit's physical location (Nevada) or virtual location (the Middle East). During the Shah-i-Khot battle, for instance, the Predators beamed video of the fighting to bases and offices all over the world. Army major general Franklin Hagenbeck, commander of US ground forces during the battle, recalls how "disruptive" this was since officers in places ranging from Tampa to the Pentagon now felt "they were in a position to get involved in the battle." While his team tried to fight the battle in Afghanistan, "people on other staffs at higher levels would call all the way down to my staff and get information and make suggestions." In the midst of battle, some officers back in the United States even called in asking for information that they could plug into their own generals' morning briefing, pestering soldiers in combat "for details that they presumed their bosses would want to know."[23]

Each of these tasking orders is tough to ignore. Not only do they originate from senior leaders, who can make or break careers, but also they tend to come in on a "priority basis." Generals around the world tend to use a logic that humorist Garrison Keillor cites in *Lake Wobegon Days*. Every single one of them considers his or her missions and orders "of above average" importance. But not everyone can be above average. This "flattening of the chain of command," summed up retired lieutenant general William Odom, causes "constipated communication channels" and "diarrhea of the email" that distracts troops from the mission at hand.[24]

At its worst, this pattern leads to the battlefield version of too many cooks spoiling the meal. A Marine officer recalls that during an operation in Afghanistan, he received wildly

diverging orders from three different senior commanders. One told him to seize a town 50 miles away. Another said to seize just the roadway outside the town. The third ordered him not to "do anything beyond patrol five miles around the base."[25]

In this case, the officer ultimately chose to seize the town. A veteran of the 1991 Gulf War, he felt confident enough to take the career risk of going with his gut on selecting the right order to follow. But the rise of virtual command from afar threatens to hollow out the experience of those who will move into these command roles in the future. Explains one former Predator squadron commander, "You may have some general officer sitting behind four Toshiba big screens [TVs] with greater knowledge of the battlefield from the distance. And maybe it works the first time when they intervene and save the day. But my worry is what happens with the next generation. What happens when that lieutenant, who learns thinking the guys in the back are smarter, becomes a colonel or a general. He'll be making the decisions, but not have any experience."[26]

Where this trend will end, no one is certain yet. Some worry that the ability to reach into the battlefield could even prove tempting to those outside the military. Retired marine Bing West expects that "in the near future . . . a president will say, 'Why do we need these 20 links in the chain of command?'" Enhanced connections could certainly help the commander in chief become better informed about the true situation on the ground but could prove catastrophic if civilian leaders are tempted to intervene, as West puts it, "trying to play soldier."[27] Referring to how President Lyndon B. Johnson (LBJ) often tried to influence air operations in Vietnam, former secretary of the Air Force Michael Wynne similarly warned that "it'll be like taking LBJ all the way down into the foxhole."[28]

DIGITALLY LEADING

So how must commanders—and even more, the training and development programs that create our cadre of leaders—respond to this new phenomenon that enables them in power and reach but also can enable their worst instincts? Clearly, twenty-first-century generals need to bring certain skills to increasingly unmanned wars in order to be successful. New technologies are creating an environment

Photo: MCpl Robert Bottrill

"where the strategic, operational, and tactical levels of war can at times be so compressed as to appear virtually as a single function."[29] The downside of this "compression" of the battlefield is that it tempts officers to micromanage (the "tactical general" problem). However, officers who have what Carl von Clausewitz called the "eye of command," who can find the right balance, will achieve what retired lieutenant general Richard A. Chilcoat once described as "simultaneous awareness."[30] This is the "sweet spot" of future generalship. It involves having a good sense of what is going on at all levels of war and making the appropriate decisions at the right levels.

Developing this skill will not be easy. All the information collected, all the real-time requests, and all the general "diarrhea of the email" threaten to flood officers with data. Much like their corporate counterparts (often thought of as drones in their office cubicles), twenty-first-century generals fighting with drones will also have to cultivate the ability to manage their in-boxes.

Our professional-development system must put more focus on cultivating an ethic of "enlightened control." Generals literally will have the entire battle at their fingertips. With the new networks and technologies, they can watch nearly every action and make every minute decision. But they still do not have an infinite amount of time. At some point, the leader has to turn matters over to subordinates. Generals who can figure out when to intervene, when to delegate, and when to empower junior troops to act with initiative will enjoy much more success than those who don't trust their force to do anything without them. Striking this balance will become the essence of strategic leadership.

Leaders must also focus on developing the mental flexibility needed to guide a "learning organization" that adapts to changing circumstances in something beyond just a top-down manner.[31] Senior leaders not only must have open minds themselves but also willingly empower subordinates to wrestle with new concepts and technologies that they don't even understand. As one colonel writes, "I speculate that the digital general some 35 years from now might not just communicate differently but will actually think differently from his or her predecessors, because conceptual behavior itself is evolving during the Information Age" (emphasis in original).[32]

Although a general may no longer have to be as fit a fighter as the troops, the way Henry V or Gustavus Adolphus was considered among the best warriors in his army, new technologies do impose certain physical requirements that commanders must cultivate in wartime. For one thing, generals should develop skills at using computers, e-mail, and other information technologies (beyond the ability to make a PowerPoint presentation)—something that once seemed an almost abhorrent concept to leaders. General Chilcoat once predicted, "To the strategic commander of the Information Age, the laptop computer, or its successor, will be a natural extension of his mind, as familiar as the telephone, map, and binoculars."[33] Events in Iraq have borne out his lessons.

Likewise, the fact that generals may not need the kind of physical fitness to wield a sword or match their troops in push-up contests does not signal the return of 300-pound-plus generals like nineteenth century commander Winfield Scott. Rather, stamina—not strength—now matters. Command has always been taxing, but it is now becoming a round-the-clock job, no matter the commander's physical location. Thus, generals now need the physical and psychological endurance of a young medical student on call in the emergency room.

Some of these changes might seem immense, but they will not supplant many of the qualities that made great generals in the past. For example, the idea of enlightened control (i.e., giving just enough guidance to officers closer to the scene, so that they can best decide what to do) is nothing new. The great Prussian generals of the nineteenth century called this *Führen durch Auftrag* (leading by task) as opposed to *Führen durch Befehl* (leading by orders). Their ideal was that the best general gave his officers the objective and then left it to

them to figure out how best to achieve it. The most famous instance occurred before the 1864 Prussian invasion of the Danish province of Schleswig. The commanding general so trusted his officers that, supposedly, he only ordered that he wanted to sleep in the enemy's capital within the week.

Although this may be a bit too succinct for modern war, the example set by World War II's General of the Army George C. Marshall remains an apt model for twenty-first-century leaders. New inventions like the radio and teletype may have given him the ability to instruct from afar, but Marshall chose to set the broad goals and agenda. He had smart staff officers write up details of the plan but ensured that everything remained simple enough that a lieutenant in the field could understand and implement everything.[34] Similarly, Marine general James Mattis's guidance to his troops before the 2003 invasion of Iraq was just as brief, understandable, and worthy as a guide: "Engage your brain before you engage your weapon."[35]

GENERAL 2.0

But the questions of leadership don't just stop at the issue of how much leash commanders give their subordinates. Every decision in a military operation, be it the corporal in the field deciding whether to pull the trigger or Gen Dwight Eisenhower deciding whether to give the "go" for the D-day invasion, can be broken down into four basic parts, known in the military as the observe, orient, decide, act (OODA) loop. One gathers information, figures out the situation, issues orders, and takes action. Then, the whole cycle begins again.

But technology has shrunk the time inside this decision cycle. Because massive amounts of data come in faster, decisions have to be made quicker. This, for example, led to our turning over the defense against mortars and rockets at major bases in Iraq to the Counter Rocket, Artillery, and Mortar (C-RAM) automated gun system. Humans just couldn't fit into the shorter OODA loop needed to shoot down incoming shells and rockets.

Shortening of time in the decision cycle is not just for the trigger-pullers. The shrinking OODA loop is working its way up the chain to the generals' level. Marine general James Cartwright, former commander of US Strategic Command, predicted that "the decision cycle of the future is not going to be minutes. . . . The decision cycle of the future is going to be microseconds."[36]

Thus, many people think that one last, fundamental change may occur in the role of commanders at war. If the first step of technology's effect on command and control is to force officers to learn how to lead troops fighting from afar, and if the second is to require generals to figure out when to intervene directly in the battle or not, then the final may be figuring out just what command roles to leave to humans, and which to hand over to machines.

The world is already awash with all sorts of computer systems that we use to sift through information and decide matters on our behalf. Artificial intelligence (AI) in e-mail programs filters out junk mail, and AI systems trade billions of dollars on the stock market, deciding when to buy and sell based only on algorithms.

The same sort of "expert systems" is gradually being introduced into the military. The Defense Advanced Research Projects Agency, for example, created Integrated Battle Command, a system that gives military officers what it calls "decision aids"—AI that allows a commander to visualize and evaluate plans, as well as predict the impact of a variety of effects.[37] The system can help a command team building an operational plan to assess the various interactions that will take place in it. The system sees how changing certain parameters might play out in direct and indirect ways so complex that a human would find them difficult to calculate. The next phase in the project involves building an AI that plans an entire military campaign.

Real-Time Adversarial Intelligence and Decision Making, the military-intelligence-officer version of this system, is an AI that scans a database of previous enemy actions within an area of operations to "provide the commander with an

estimate of his opponent's strategic objectives."[38] Similarly, "battle management" systems exist that not only provide advice to human commanders on actions an enemy might take, but also suggest potential countermoves, even drawing up the deployment and logistical plans for units to redeploy, as well as creating the orders an officer would have to issue.[39] The Israeli military is fielding a "virtual battle management" AI whose primary job entails supporting mission commanders but can also take over in extreme situations (e.g., when the number of incoming targets overwhelms the human).[40]

Developers behind such programs argue that the advantage of using computers instead of humans is not only their greater speed and processing power, but also the absence of human flaws—they lack our so-called "cognitive biases."[41] Because searching though reams of data and then processing it takes too much time, human commanders without such aids must filter which data they want to look at and which to ignore. This inevitably leads them to skip information they don't have time to cover. Humans also tend to give more weight in their decisions to the information that they see first, even if it is not representative of the whole. This produces something called a "satisficing" result—a satisfactory, though not the optimal, answer. One Air Force officer planning air strikes in the Middle East, for example, describes how each morning he received a "three-inch-deep" folder of printouts with that night's intelligence data, which he could only skim quickly before he had to start assigning missions. "A lot of data is falling on the floor."[42]

> "THE DECISION CYCLE OF THE FUTURE IS NOT GOING TO BE MINUTES. … THE DECISION CYCLE OF THE FUTURE IS GOING TO BE MICROSECONDS."

Emotions also can shape decisions, even the most major command decisions in war. Recent neurological findings indicate that emotions drive our thought processes, including leaders' political decisions, to a greater extent than previously recognized.[43] That is, our idealized concept of how decisions are made in war and politics—rationally weighing the evidence to decide how and when to act—does not tell the full story of how human leaders' brains actually work.

Studies have shown how two underrated factors frequently shape strategic choices in war.[44] The first—powerful emotional experiences that leaders had in the past—often steered their decisions, sometimes decades afterwards, including even decisions on whether to go to war. The second factor concerns how body chemistry affects one's state of mind. People with high levels of testosterone, for instance, are more likely to exhibit aggressive behavior and risk taking; Gen George Custer and Gen George Patton seem classic examples. By contrast, those with low levels of serotonin are more prone to depression and mood swings, typical of both Hitler and Pres. Abraham Lincoln.[45] As these examples show, emotions can shape a leader's decisions both for better or worse, so to pull emotions out of the equation could yield widely divergent results.

Setting aside the worry that such artificial decision systems are what enable robots' takeover of the world in sci-fi movies like The Terminator, machine intelligence may not be the perfect match for the realm of war for the very reason that it remains a human realm, even with machines fighting in it. "The history of human conflicts is littered with examples of how military forces achieved results that no algorithm would have predicted," according to an Air Force general.[46] And he is right. Command may seem just like a game of chess to some, but war doesn't have a finite set of possible actions and a quantifiable logic of zeros and ones. Instead, "in war, as in life, spontaneity still prevails over programming."[47]

Even so, the Pentagon's work on such programs continues. Few see robot generals

anytime soon, but many do think that the most likely result for future command and control in the decades ahead is a parallel to the Department of Defense's "war fighter's associate" concept, which is becoming a part of the Army's Future Combat Systems plans. The latter call for US units to have mixed teams of soldiers and robots fighting together in the field. We may soon have to wrestle with a situation in which their future commanders back at the base may have a staff that mixes advice from human officers and AI as well. Retired colonel James Lasswell of the Marine Corps Warfighting Lab thinks that the various technological decision aids will likely evolve into an AI "alter ego" for the commander. A sort of artificial aide-de camp to future generals, this technology would "automatically send and collate information for him to have at his beck and call."[48] As with the issue of tactical generals, even though this outcome may enable leaders, it also opens up a whole new array of questions that once seemed science fiction but may well lie in our not-too-distant future.

ROBOT CONCLUSIONS

When exploring the future role of machines in war, people often want to focus on the obvious issues of whether a robot should be armed or how much autonomy should be given to keep the "man in the loop." But it is a far more complex world that we are entering.

By providing generals insight into the front lines—something they have lacked since the age of gunpowder and telegraphs—new technologies like unmanned systems are lifting many of the burdens of command. But in giving newfound reach and visibility to the commander, they also add many new challenges. Most importantly, these technologies present a serious test for simultaneously managing an amazing array of possibilities and information while resisting the temptation to micromanage subordinates.

But the trend doesn't stop there. Human commanders and their staffs may even one day face a challenge to their own role as the pace and complexity of war continue to grow.

In short, where the ever-expanding role of machines in war will one day take us is a question that used to only be suitable for science-fiction conventions. Today's technologies, however, are bringing this question to our real-world battlefields. ■

*This article is derived from the author's latest book, *Wired for War: The Robotics Revolution and Conflict in the 21st Century* (New York: Penguin, 2009). For further information, see http://wiredforwar.pwsinger.com.

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Notes

1. General officer, interview by the author, Brookings Institution, Washington, DC, 17 December 2007. (All anonymous interviews were conducted in confidentiality, and the names of the interviewees are withheld by mutual agreement.)

2. John Keegan, *The Face of Battle* (New York: Viking Press, 1976), 114.

3. Chris Hables Gray, *Postmodern War: The New Politics of Conflict* (New York: Guilford Press, 1997), 274.

4. Ibid., 63.

5. Joshua Davis, "If We Run Out of Batteries, This War Is Screwed," *Wired Magazine*, issue 11.06 (June 2003), http://www.wired.com/wired/archive/11.06/battlefield .html. HAL 9000 was the computer in Arthur C. Clarke's book *2001: A Space Odyssey*.

6. Tom Vanden Brook, "Report: Insurgents Benefit from Drone Shortage," *USA Today*, 25 March 2008, http://www.usatoday.com/news/world/iraq/2008-03-24-UAV_N.htm.

7. Lolita C. Baldor, "Military Use of Unmanned Aircraft Soars," *USA Today*, 1 January 2008, http://www.usatoday.com/news/military/2008-01-01-unmanned-killers_N.htm.

8. Robert S. Boyd, "They're Very Expensive, but They Save Lives: U.S. Enlisting Smart Robots for War's Dirty, Deadly Jobs," *Philadelphia Inquirer*, 20 February 2006, E02.

9. Secretary of Defense Donald Rumsfeld, interview by Richard Dixon, WAPI-AM Radio, Birmingham, AL, 28 September 2004; Stephen J. Cimbala, "Transformation in Concept and Policy," *Joint Force Quarterly*, no. 38 (2005): 28–33, http://www.dtic.mil/doctrine/jel/jfq_pubs/0838.pdf; *Network Centric Warfare: Department of Defense Report to Congress* (Washington, DC: Department of Defense, Command and Control Research Program, 27 July 2001), http://www.dodccrp.org/files/ncw_report/report/ncw _cover.html; and Arthur K. Cebrowski and John J. Garstka, "Network-Centric Warfare: Its Origin and Future," *United States Naval Institute Proceedings* 124, no. 1 (1998): 28.

10. Quoted in Noah Shachtman, "Attack of the Drones," *Wired Magazine*, issue 13.06 (June 2005), http://www.wired.com/wired/archive/13.06/drones.html.

11. Andrew Exum, interview by the author, Washington, DC, 28 April 2008.

12. United States Marine Corps officer, interview by the author, Washington, DC, 16 January 2007.

13. Quoted in Barry Rosenberg, "Technology and Leadership," *Armed Forces Journal*, July 2007, 18, http://www.armedforcesjournal.com/2007/07/2786772.

14. Quoted in Thomas E. Ricks, "Beaming the Battlefield Home: Live Video of Afghan Fighting Had Questionable Effect," *Washington Post, 22* March 2002, 1.

15. Stephen D. Biddle, *Military Power: Explaining Victory and Defeat in Modern Battle* (Princeton, NJ: Princeton University Press, 2004), 65.

16. Michael R. Gordon and Bernard E. Trainor, *Cobra II: The Inside Story of the Invasion and Occupation of Iraq*, 1st ed. (New York: Pantheon Books, 2006), 314.

17. Four different interviewees used this expression.

18. Interview by the author, US military facility in US Central Command region, 19 February 2008.

19. Nicholas Wade, "Bytes Make Might," *New York Times Magazine*, 12 March 1995, 28.

20. *Reachback* is "the process of obtaining products, services, and applications, or forces, or equipment, or material from organizations that are not forward deployed." Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms*, 12 April 2001 (as amended through 17 October 2008), 454, http://www.dtic.mil/doctrine/jel/new_pubs/jp1_02.pdf.

21. Air Force colonel, interview by the author, Arlington, VA, 18 April 2006.

22. Ibid.

23. Quoted in Ricks, 1.

24. Quoted in Rosenberg, 17.

25. United States Marine Corps general, interview by the author, Washington, DC, 16 January 2007.

26. Air Force colonel, interview by the author, Arlington, VA, 28 August 2006. See also LCDR John J. Klein, "The Problematic Nexus: Where Unmanned Combat Air Vehicles and the Law of Armed Conflict Meet," Air and Space Power Journal - Chronicles Online Journal, 22 July 2003, http://www.airpower.maxwell.af.mil/airchronicles/cc/klein.html.

27. Bing West, telephone interview by the author, 23 August 2006.

28. Michael Wynne, interview by the author, Washington, DC, 25 January 2008.

29. Richard A. Chilcoat, "The 'Fourth' Army War College: Preparing Strategic Leaders for the Next Century," *Parameters* 25, no. 4 (Winter 1995–96), http://www.carlisle.army.mil/usawc/parameters/1995/chilcoat.htm.

30. Ibid.

31. See Janine Davidson, "Learning to Lift the Fog of Peace: The United States Military in Stability and Reconstruction Operations" (PhD diss., University of South Carolina, 2005).

32. Paul T. Harig, "The Digital General: Reflections on Leadership in the Post-Information Age," *Parameters* 26, no. 3 (Autumn 1996): 134.

33. Chilcoat.

34. Credit for this point goes to Harlan Ullman.

35. James Mattis (presentation, Brookings Institution, Washington, DC, 16 January 2007).

36. Quoted in John T. Bennett, "DoD Struggles to Craft Offensive Cyberspace Plan," *Defense News* 22, issue 9 (26 February 2007): 1.

37. Tony Skinner, "DARPA Develops Strategic Decision Support Tools," *Jane's Defence Weekly*, 4 January 2007, 7.

38. Donald McFarlane, "Dr. Alexander Kott," *Jane's International Defence Review* 41 (March 2008): 66.

39. Gray, 58.

40. Barbara Opall-Rome, "Israeli Defense to Use Artificial Intelligence, [sic] *Defense News* 23, issue 3 (21 January 2008): 1.

41. McFarlane, 66.

42. Interview by the author, US military facility in US Central Command region, 19 February 2008.

43. Drew Westen, *The Political Brain: The Role of Emotion in Deciding the Fate of the Nation* (New York: Public Affairs, 2007), ix, 69–88, 417–20.

44. Stephen Peter Rosen, *War and Human Nature* (Princeton, NJ: Princeton University Press, 2005), 28.

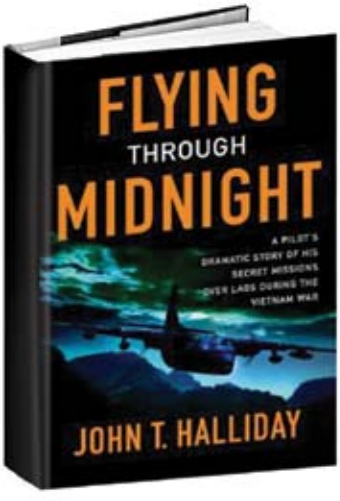
45. Ibid., 87.

46. Charles J. Dunlap Jr., *Technology and the 21st Century Battlefield: Recomplicating Moral Life for the Statesman and the Soldier* (Carlisle Barracks, PA: Strategic Studies Institute, US Army War College, 1999), 12, http://www.strategicstudiesinstitute.army.mil/pdffiles/00222.pdf.

47. Christopher Coker, *The Future of War: The Re-Enchantment of War in the Twenty-first Century*, Blackwell Manifestos (Malden, MA: Blackwell Publishing, 2004), 73.

48. James Lasswell, interview by the author, Washington, DC, 7 November 2006.

BOOK REVIEWS



FLYING THROUGH MIDNIGHT:

A PILOT'S DRAMATIC STORY OF HIS SECRET MISSIONS OVER LAOS DURING THE VIETNAM WAR.

BY **JOHN T. HALLIDAY**

NEW YORK:
ST MARTIN'S PRESS, 2007
480 PAGES
ISBN-10: 0312942036 OR ISBM-13: 9780312942038

Review by
Captain Greg S. Zweng, CD

At first glance, *Flying Through Midnight* is another tale of one airman's year-long tour of duty during the Vietnam War. This story is not just another tale; it will leave you unable to put the book down as it describes daring wartime aviation that rivals any told. On the surface it is a tale of a C-123 pilot flying Top Secret Special Operations missions from Thailand over Laos and the Ho Chi Minh Trail, and there is no doubt that while the book is extremely captivating, its implications and applications today make it much more than an entertaining read.

The story, told in the first person, recounts how John Halliday arrived in Southeast Asia in 1970 as a young, naive United States Air Force (USAF) pilot assigned to the 606th Special Operations Squadron, Thailand. The book has many interesting, rarely told stories of missions over Laos: night illumination missions, night airborne forward air control (FAC) missions, and even missions involving intentionally drawing enemy anti-aircraft artillery fire, and many more fascinating true life tales. These stories in themselves are thrilling and worth a read. In his first mission alone he is targeted by thousands of anti-aircraft shells, leaving a 24-year-old, naive Halliday wondering what the next year would bring.

Flying Through Midnight does much more than tell one man's story or educate us about a little known part of the air war over Southeast Asia. Once the reader goes beyond this tale of Halliday's missions over Vietnam, it becomes a reflective look at how professional airmen and airwomen have evolved to what they are today.

The story opens with Halliday's arrival at the 606th Special Operations Squadron, where he is quickly taken under the wing of one of the veteran squadron pilots. This veteran pilot has decided to show Halliday an alternate view on how not only to survive, but also to thrive in their assigned missions, a view that differs from what has been taught up until this point in his flying career. During his indoctrination, Halliday questions every aspect of how the veterans operate, questioning not only why they do things, but also the competency of some of his squadron mates and leaders to operate in a war zone. On his first combat mission, Halliday lists numerous violations in USAF flying rules that the veteran crew knowingly break. Eventually, though, he begins to understand that these veterans are not reckless but true professionals, applying skill, knowledge, and independent thought to their trade. As an example, he is encouraged to fly with dice, often rolling them in flight when choosing how to maneuver his aircraft in order to keep his tactical choices as random as possible. This forces him to keep in mind that unpredictable flying is less vulnerable to enemy fire, a technique obviously not reinforced in his formal training.

Later in his year-long tour, Halliday is introduced to The Ledgers, an informal lessons learned catalogue captured on a pad of paper. These words of wisdom are shared only with those trusted with the information, and date back to the squadron's inception in Southeast Asia. The Ledgers are a wealth of information, which Halliday uses to trace the roots of his unit's Standard Operating Procedures (SOPs), often discovering the procedures were written as they were because the writer had neither the time nor the experience and knowledge to incorporate other methods of operating. Halliday finds that published procedures are often wrong, and since the staff find implementing changes too difficult, inaccuracies remain, putting people at risk. Additionally, when changes are made, they are often overruled by stateside USAF bureaucrats.

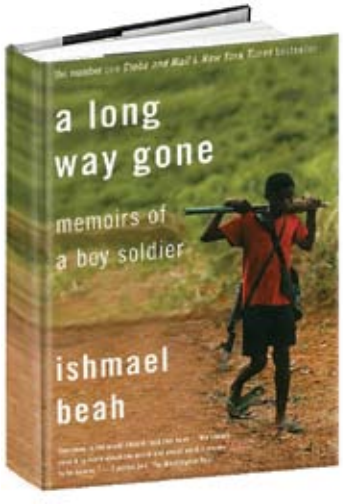
Halliday, through the story of his tour in Southeast Asia, challenges the conventional and contemporary thinking that what is written in the rule books and manuals is the gospel. He forces the reader to consider what thinking outside the box really is.

This book is an important reflection on what "the system" is and where it is leading us. ■

Captain Greg Zweng is a pilot at 427 Special Operations Aviation Squadron flying the CH146 Griffon. He has served with Canadian Special Operations Forces Command (CANSOFCOM) since January 2003 in various positions, including an overseas tour. He earned his pilot wings in 2000 as a reserve pilot and served with 440 Transport Squadron and as commercial pilot in Yellowknife prior to moving to CANSOFCOM.

List of Abbreviations

USAF United States Air Force



A LONG WAY GONE – MEMOIRS OF A BOY SOLDIER

BY **ISHMAEL BEAH**

VANCOUVER, BC:
DOUGLAS & MCINTYRE LTD., 2007
229 PAGES
ISBN: 978-1-55365-398-1

Review by **Major François Dufault, CD**

This book should never have been written. Don't get me wrong, not because of its content, far from it, but because no child should ever, ever have to endure what Ishmael Beah and so many others like him had to endure during the atrocities of the civil war in Sierra Leone in the early 1990s.

Ishmael Beah was born in 1980 in the small town of Mattru Jong, in southern Sierra Leone. His father worked for an American mining company, thus earning sufficient income to keep his kids fed, happy, and in school. Ishmael lived the first 13 years of his life as a normal child within a normal family. His first contact

with war came in 1993 when war refugees would walk across his hometown. At this young age, he could not understand why they would continue on beyond his town; after all, it was safe there. He would soon find out.

The first half of the book relates how Ishmael avoided being "recruited" by the rebels, along with his older brothers and some friends. They walked from village to village, most of them abandoned, in hope of finding a safe place. Throughout this journey, he escaped the grips of the rebels many times, but in the process, he lost all his relatives and friends. What marked him most during this time were the changes that war could cause to ordinary people who were otherwise welcoming and generous. He describes how his group, made of five or six teenagers, would be chased from villages by screaming, grown-up men with sticks and machetes trying to defend their families. Everybody became suspicious and distrusted strangers, even young boys.

His group escaped the rebels only to be forcibly enrolled into the government army as soldiers, some of them only six or seven years old. Like most boy soldiers, they were fed a dangerous combination of hard drugs, including "brown brown," a combination of cocaine and gun powder, which would make them insensitive to the atrocities they were witnessing and perpetrating. But hard drugs can't completely numb the soul, and these boys were permanently scarred from these abuses. The one thing that makes reading this book bearable is Ishmael's smiling face on the back cover, inspiring hope, at least for him.

In the 2008 *Journal of the Defence Ethics Programme*, Virginia Wolfe describes the *jus in bello* or justice in war principles guiding the conduct of war, focusing on non-state conflicts.[1] When conflicts emerge between parties that include the state or government, and these parties ignore these principles and systematically enroll children as soldiers, and use them to destroy civilian villages, to recruit, to steal food, drugs, and ammunition, this is when the international community needs to get concerned and implicated.

With the recent talks in the media about Canada's foreign policy and the Canadian Forces' potential future international deployment post-Afghanistan, this book offers a glimpse of what we might have to deal with. It shows the complexities of African conflicts and what foreign forces are faced with. Although Ishmael's story is in Sierra Leone, similar horrible stories have come out of many African countries, but also the Middle East and Asia, including Afghanistan.

As long as kids and teenagers, boys and girls, are forcibly enrolled in conflicts they could not possibly understand, the United Nations, the international community, and Canada should be involved, whether or not we have national interests in the region. ■

Major François Dufault is a Griffon pilot who currently works in the Directorate of Aerospace Requirements 9 – Tactical Aviation – within the Air Staff in Ottawa. He holds a Bachelor's degree in civil engineering from the Royal Military College of Canada and is currently pursuing a Master's of Engineering Management from the University of Ottawa as a part-time student.

Notes

1. Wolfe, V.L., "Is the Just War Theory Still Relevant?" *Journal of the Defence Ethics Programme*, 2008, Vol. 1, No. 1, 20-27. Available online at http://www.dep-ped.forces.gc.ca (accessed April 13, 2010).

NAVY CELEBRATES 100 YEARS OF PROUD SERVICE

By **Lieutenant (Navy) Wendy Goulet**

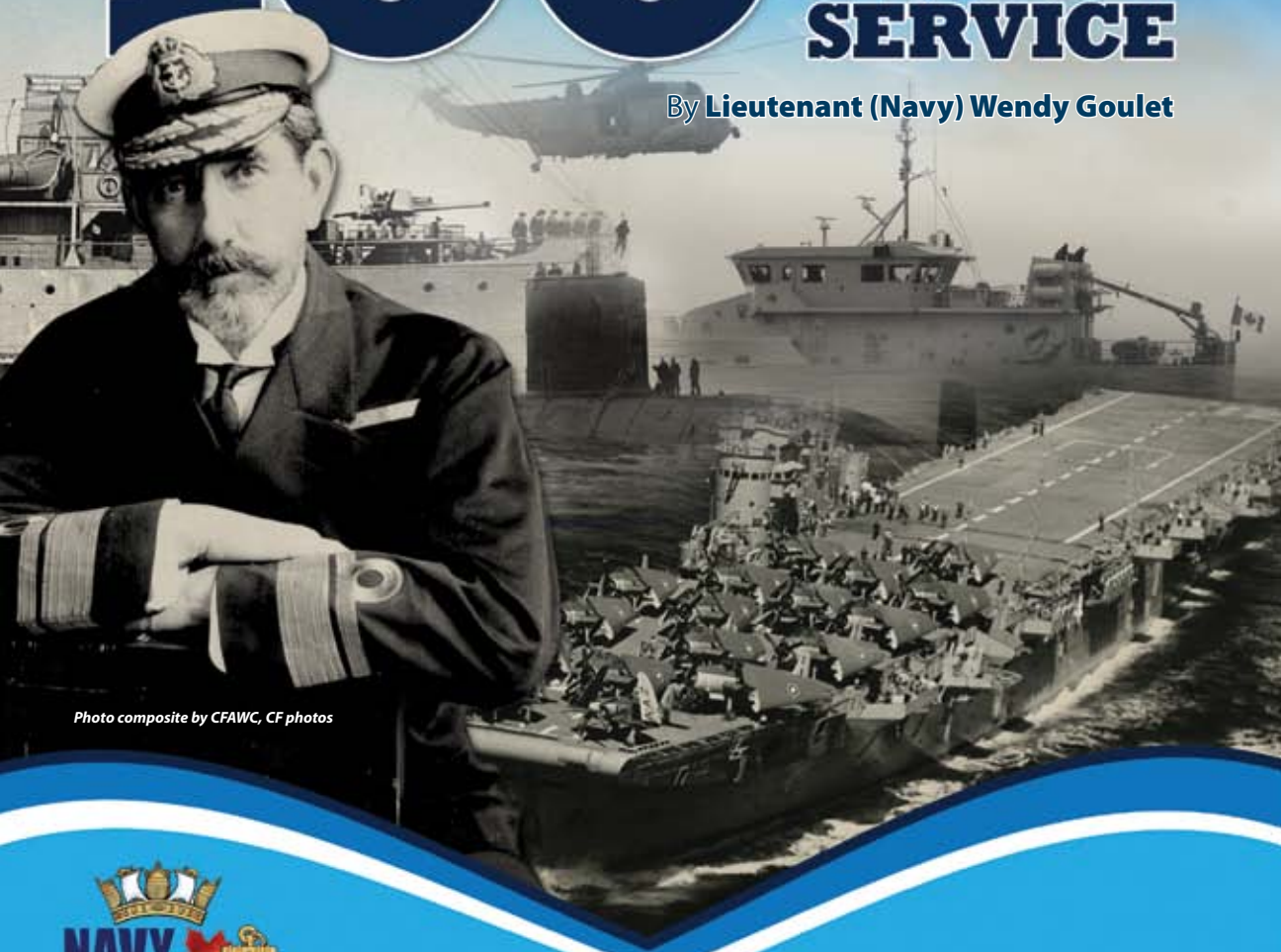


Photo composite by CFAWC, CF photos

NAVY MARINE 100 1910 • 2010

With the passage of the Naval Service Act in 1910, Canada's navy was born. On May 4, 2010, it reached a century of service.

To mark this significant occasion, Canadian Naval Centennial (CNC) teams in Halifax, Ottawa, Esquimalt, BC, 24 Naval Reserve Divisions across the country and friends of the navy have created an exciting program of national, regional and local events with the goal of bringing the navy to Canadians.

Leading into the centennial year several events occurred that helped achieve this goal, including the consecration of the Queen's Colour in Halifax and the celebration of the 250th anniversary of HMC Dockyard in Halifax against the backdrop of the Tall Ships Nova Scotia Festival in July.

Fall of 2009 saw the launch of the centennial commemorative coffee table book, and the commissioning of six original paintings which outline significant periods throughout the Canadian Navy's history.

The centennial slogan is "Commemorate, Celebrate, Commit," reflecting on 100 years of proud history, the role of the navy in a maritime nation, and its commitment to the next 100 years.

As 2010 began, celebrations got under way with the raising of the CNC flag on ships and in shore establishments.

"The flag stands as a symbol of respect that reflects the desire to honour the past, celebrate Canadian Navy achievements, and recognize the Navy's obligation to Canada," says Captain (Navy) John Pickford (Retired), CNC Special Advisor.

Also in January, The Royal Canadian Mint introduced a Proof Silver Dollar to honour the centennial.

In Ottawa, centennial celebrations included the Gala Ball, Battle of Atlantic parade and unveiling of Canada Post's CNC stamps. May 4 was the groundbreaking for the national naval monument and a presentation of a ship's bell to the people of Canada through Parliament.

"It has always been a challenge to overcome maritime blindness in Canada, but the extraordinary work of our sailors is helping to demonstrate the amazing capability of our service and the important role the navy plays in Canada," says Captain (N) Colin Plows, Maritime Chief of Staff.

Nationally, hundreds of events are taking place in communities across the country. Three major projects include:

NAMESAKE COMMUNITY PRESENTATIONS: In the past 100 years, more than 300 ships were named after Canadian communities. Framed prints of the ships' histories will be presented throughout the centennial year to connect communities with their namesake ships.

TRAVELLING MUSICAL ROAD SHOW: The Stadacona Band of Maritime Forces Atlantic and Naden Band of Maritime Forces Pacific will tour to more than 50 locations beginning in April, with a road show entitled "Sailors and Songs: A Musical Tribute to 100 Years of Naval Service to Canada."

INTERNATIONAL FLEET REVIEWS: Sailors will visit Victoria June 9–14 and Halifax June 28–July 2 for the International Fleet Reviews, with more than 35 ships from around the globe participating.

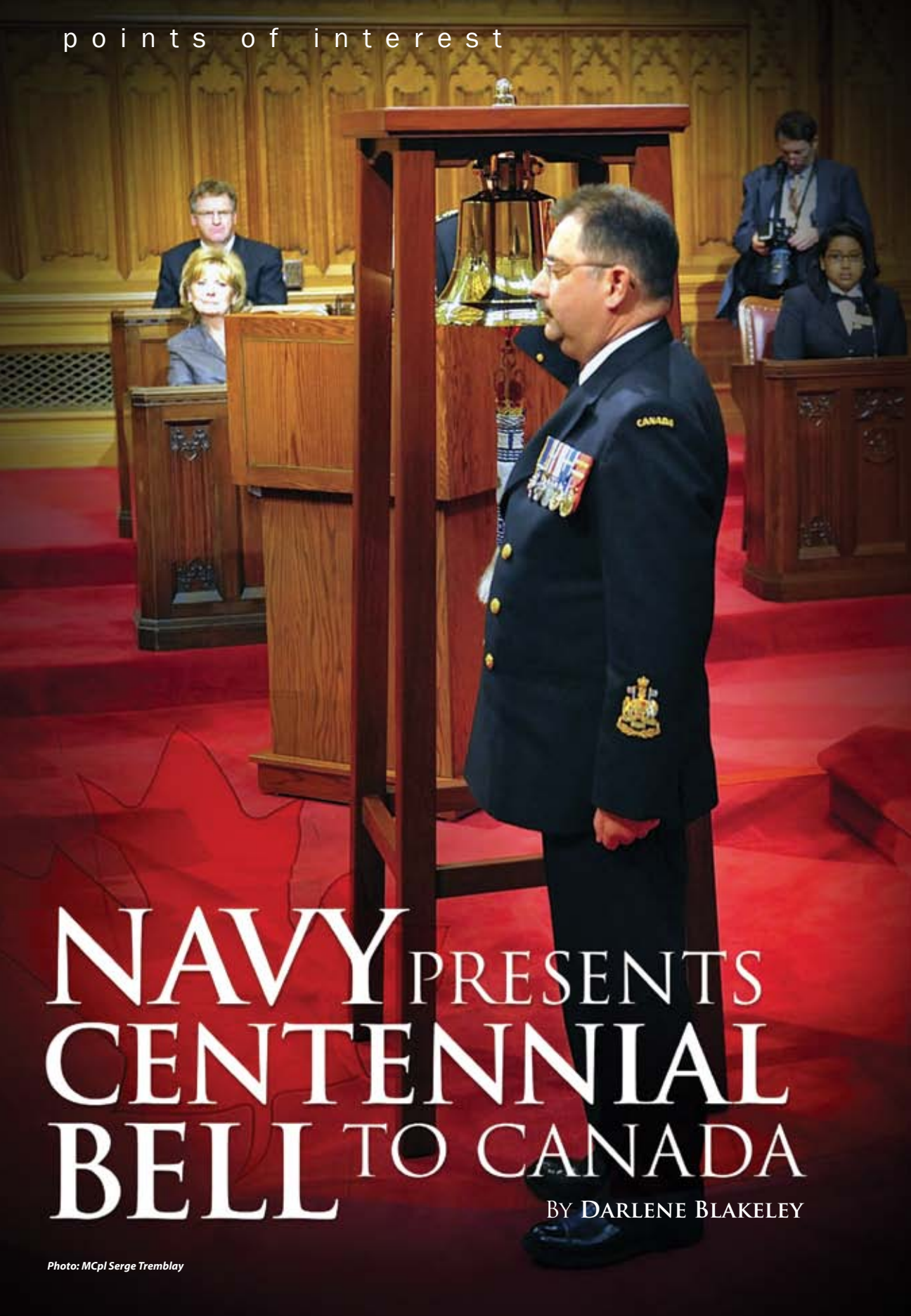
Help commemorate the past, celebrate the present, and make a commitment to the future by participating in navy centennial activities taking place near you. ■

To view a full list of centennial events, visit http://www.navy.forces.gc.ca/centennial/ (accessed May 10, 2010).

Lieutenant (Navy) Wendy Goulet is the public affairs officer for the Canadian Naval Centennial.

LIST OF ABBREVIATIONS

CNC	Canadian Naval Centennial
Capt(N)	Captain (Navy)



NAVY PRESENTS CENTENNIAL BELL TO CANADA

By Darlene Blakeley

Photo: MCpl Serge Tremblay

OTTAWA – In the hallowed hall of the Senate of Canada, the Canadian Navy, 100 years to the day that it was created (4 May 1910), presented a ship's bell to the people of Canada, rededicating itself to another century of service.

"[The Centennial Bell] stands as a symbol that honours the past, celebrates the Royal Canadian Navy's achievements and recognizes the Navy's safeguarding of Canadian values of freedom, democracy, respect for human rights and the rule of law," said Minister of National Defence Peter MacKay.

During the ceremony, Prime Minister Stephen Harper announced that the Government of Canada is designating May 4, 2010, as Canadian Navy Centennial Day to mark the Navy's 100th anniversary of service.

Photo: MCpl Serge Tremblay

"In one relatively brief century, our sailors have established a mighty tradition of service and heroism, one that is second to none in the world among navies that are often far older, and in some cases, far larger," said Prime Minister Harper. "And Canadians have come to understand that our way of life, our trade, our security, our capacity to influence events elsewhere depends in significant part upon the men and women of the Canadian Navy and the ships in which they sail. It has for 100 years, and in the future that is mine to see, I expect it will continue to be so."

The Centennial Bell, presented by Chief of the Maritime Staff Vice-Admiral Dean McFadden, was christened with the waters of Canada's three oceans—Atlantic, Pacific and Arctic—and the Gulf of St. Lawrence and the Great Lakes, as well as the Indian Ocean to represent the Navy's international theatre of operations. These waters were collected throughout 2009 by naval ships and submarines. The bell, with its original rope made by Chief Petty Officer 2nd Class David Lowther, and a book highlighting the history of the bell and displaying the variety of artefacts from which it was made, are to be kept as a permanent reminder that Canada is a maritime nation dependent upon the oceans for its national prosperity.

"For many mariners, the ship's bell came to symbolize life at sea itself," said Vice-Admiral McFadden. "That is why even to this day, the bell is a warship's most important artefact, and why it continues to play an important role in naval routine and ceremony, even in a technically sophisticated force where operations are coordinated to the second."

In a tragic turn of events, attendees at the ceremony also mourned the loss of Petty Officer 2nd Class (PO 2) Craig Blake, the first Canadian sailor to die in Afghanistan. A member of Fleet Diving Unit (Atlantic), PO 2 Blake was killed May 3 after an improvised explosive device detonated during a dismounted operation, about 25 kilometres southwest of Kandahar City in the Panjwayi District.

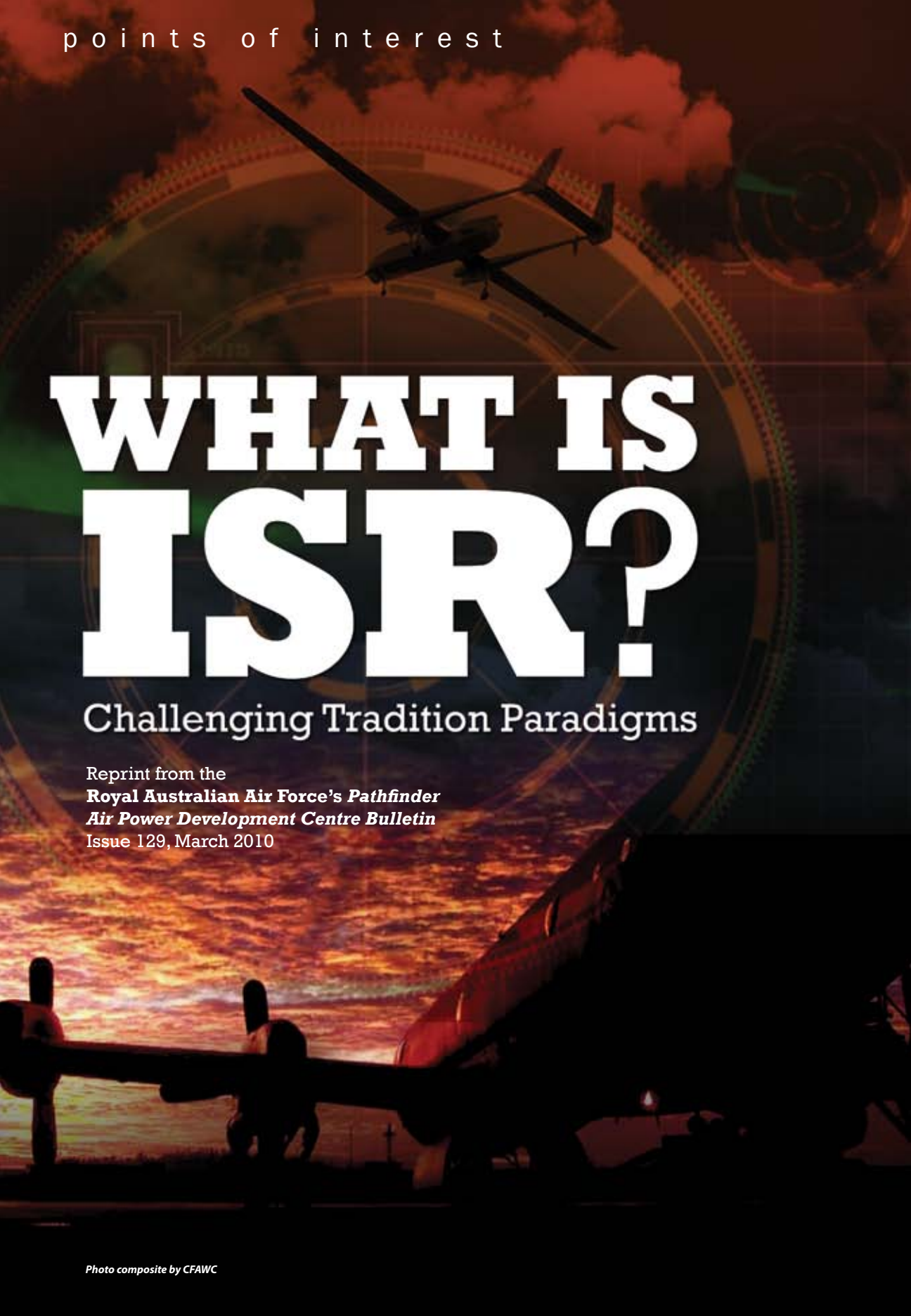
"The presentation of this bell to the people of Canada allows us— the men and women of today's navy who are but custodians of this great national institution—to do more than commemorate and reflect on the past," Vice-Admiral McFadden said. "It allows us to acknowledge our covenant with the nation and dedicate ourselves anew to the watch, that ceaseless vigil that keeps Canada safe from the perils of the world. It is a vigil that still demands effort to the last measure, and sacrifice, even far from the sea—in the dusty plains of Afghanistan where we lost one of our own yesterday, PO 2 Craig Blake." ■

Darlene Blakeley is the senior editor and writer with Chief of the Maritime Staff in Ottawa.

List of Abbreviations

PO 2 **Petty Officer 2nd Class**

points of interest



WHAT IS ISR?

Challenging Tradition Paradigms

Reprint from the
Royal Australian Air Force's *Pathfinder*
Air Power Development Centre Bulletin
Issue 129, March 2010

Photo composite by CFAWC

Editor's note: *In editing this article, the Australian spelling and idiomatic conventions have been maintained.*

Surveillance and reconnaissance have been important air power missions ever since the beginning of military aviation. In recent years, the traditional understanding of surveillance and reconnaissance has been challenged by the emergence of the concept of *Intelligence, Surveillance and Reconnaissance—or ISR*—as a single integrated activity and the resultant convergence of tactical and strategic missions. Recent operational experience indicates that ISR is now a critical air power role that incorporates both the traditional and singular aspects of surveillance and reconnaissance. The modern requirement is to not maintain separate tactical or strategic, or surveillance or reconnaissance, capabilities but instead to have a singular and holistic ISR capability that operates across the spectrum of conflict and levels of war.

AAP 1000-D—*The Air Power Manual* defines surveillance as the *'systematic observation of air, space, surface or sub-surface areas, places, persons, or things, by visual, aural, electronic, photographic or other means.'* It also states that *'reconnaissance is undertaken to obtain information about the activities and resources of a designated enemy, or to secure data concerning the meteorological, hydrographic or geographic characteristics of a particular area.'*

Therefore, surveillance is systematic observation while reconnaissance is observation of a specific place at a specific time. The two air power missions have in the past been complimentary, but now as ISR they allow the *Kill Chain* to be synergistically completed by Finding, Fixing and Tracking targets so they can be Targeted, Engaged and Assessed (F2T2EA). Together, surveillance and reconnaissance provide information that is transformed into intelligence by processing, exploitation and dissemination (PED) capabilities. The characteristics of air power such as perspective, reach, penetration, responsiveness, versatility and flexibility make ISR very effective when conducted in the air environment and as such, there is a particularly strong relationship between air power and ISR.

This relationship is clearly reflected by the fact that observation, or surveillance, was the first air power mission developed in air power thinking. It was first used in the Napoleonic Wars where the French established balloon contingents to observe the enemy. Reconnaissance developed into a key air power role during World War I where it was critical in both the ground and maritime environments for identifying and assessing the enemy. While airborne surveillance and reconnaissance developed further during World War II, it was in the Cold War environment where surveillance and reconnaissance became critical at the strategic level where they developed into sensitive national intelligence collection activities. Accordingly, there emerged a strong demarcation between strategic reconnaissance (missions undertaken to obtain information for strategic planning and targeting purposes such as infrastructure, industry, nuclear forces, etc) and tactical reconnaissance (missions undertaken to secure information for use on the battlefield such as orders of battle, force disposition, etc).

Recent operations have reinforced the importance of airborne ISR particularly in providing time-critical intelligence for targeting and force protection related situational awareness. While traditionally the RF-111C provided the Royal Australian Air Force (RAAF) its reconnaissance capability (see *Pathfinder 128*) and the AP-3C its maritime surveillance capability, recent RAAF AP-3C and Heron unmanned air vehicles (UAV) missions have become synonymous with ISR. Whilst the term 'Overland ISR' (OISR) has come into common use since the RAAF starter to use the AP-3C away from its traditional maritime surveillance activities against land based targets in the Middle East, it is not a useful delineation as all AP-3C activities to find, fix and track targets—regardless of whether they are on or below the ocean's surface, or on land—are ISR.

Indeed, RAAF operations in the Middle East have seen the AP-3C aircraft become the ADF's primary airborne ISR platform. RAAF AP-3C aircraft have become important ISR platforms where their flexibility and responsiveness enables [sic] the aircraft to perform a range of ISR tasks against a range of targets. In 2006 an Australian AP-3C was tasked to conduct a mission in support of a counter- Improvised Explosive Device (IED) mission by surface forces. An hour prior to take-off the aircraft was urgently re-tasked to provide support over a city where coalition troops had been killed by a Rocket Propelled Grenade (RPG), the local population had rioted and a curfew had been established. Towards the end of the on-task period the

The Heron UAV, recently deployed into Afghanistan, is the RAAF's latest ISR capability.

CF photo

AP-3C was requested to provide route clearance for coalition forces exiting the area by road. On completing the route clearance, the crew were further tasked to provide route clearance for a coalition command element exiting the area over water. The AP-3C crew provided the necessary surveillance and clearance and also advised the command element of suspicious activity both on the water and on the land in the vicinity of their watercraft. After ensuring that the command element had safely reached their destination, the aircraft was again tasked to provide support to coalition surface forces that were under fire in a city about 50 miles away. On their transit back to base the crew imaged a static maritime rig to ensure that there were no vessels threatening the maritime task force. During this single mission the AP-3C undertook several 'Overland ISR' activities and maritime surveillance activities—both sequentially and simultaneously. Indeed, the AP-3C undertook a single ISR mission from takeoff to landing—against different targets and for different requirements. Such mission flexibility will become the new norm, is already evident in RAAF Heron UAV operations over Afghanistan, and will become more evident when the Wedgetail AEW&C enters service. The Jindalee Operational Radar Network (JORN) also operates in a similar manner now.

The individual terms of 'surveillance' and 'reconnaissance' are no longer that relevant and are best captured by the term ISR.

The traditional labelling of strategic or tactical missions subject to where the platform is operating and what information it is collecting is equally outdated. Surveillance and reconnaissance are now effectively ISR and are not inherently strategic, operational or tactical. ISR is used to satisfy the information requirements of commanders at all levels irrespective of whether the platform/sensor is thought of as a tactical or strategic asset. What has become particularly important, however, is the requirement to clearly synchronise and deconflict the command and control of the asset and its ISR mission with other activities across the battlespace. Recent operations have highlighted the potential for platforms under the control of disparate elements to unnecessarily duplicate collection efforts thus wasting precious collection capability as well as very limited exploitation and dissemination capacity.

Within Air Force the tenet of *centralised control and decentralised execution* as applied to all air operations by an air component commander within an Air and Space Operations Centre (AOC) allows a theatre wide perspective to be applied thus maximising the airborne ISR capabilities of the joint force. Indeed, in the modern battlespace, there is no such thing as 'Air Force' targets—just 'joint' targets—whether they are kinetic, non-kinetic or ISR. Optimisation of the employment of the ADF's limited airborne ISR capabilities can only be achieved when they are coordinated, synchronised and planned at AOC level.

In the past surveillance and reconnaissance have been key air power missions. However, in recent years their character has evolved to a point where traditional definitions are not longer relevant. Doctrinally, surveillance and reconnaissance now have diminishing relevance as discrete terms and there is greater value in collectively referring to them simply as ISR, which better reflects the capacity of air power to conduct intelligence focused multi-role missions. Likewise, ISR missions are neither strategic nor tactical—they are simply ISR missions with different commander's requirements. While ISR challenges many traditional air power paradigms, the inherent characteristics and joint focus of air power make it particularly well suited to conducting airborne ISR—a synchronised and integrated air power role.

- **The individual terms of 'surveillance' and 'reconnaissance' are no longer that relevant and are best captured by the term ISR.**
- **ISR is not inherently strategic, operational or tactical—its output may be used at all levels depending on the commander's requirements.**
- **The AOC has a unique and valuable capacity to plan, synchronise and coordinate theatre-wide airborne ISR activities in support of the joint commander.**

"Our photo reconnaissance pilots were instructed to fly on the theory that fighter planes win battles while camera planes win wars."

General Henry H. 'Hap' Arnold,
US Army Air Forces

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