

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

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SUBMISSION REQUIREMENTS

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

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| ITEM | WORD LIMIT* | DETAILS |
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| LETTERS TO THE EDITOR | 50-250 | Commentary on any portion of a previous RCAFJ. |
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EDITOR'S MESSAGE

It seems like it was just yesterday when I was informed that I had "volunteered" to be the senior editor of the *Canadian Air Force Journal*. It was the summer of 2008, and the previous senior editor, Lieutenant-Colonel Bill Lewis (now Colonel Lewis [Retired]), was moving on to greener pastures. Nine years and 30 issues later, it is time for me to hand over the reins of the, now, *Royal Canadian Air Force Journal (RCAFJ)*. It has been one heck of a ride.

When the concept of establishing an air force journal was first floated within the halls of the Canadian Forces Aerospace Warfare Centre (CFAWC) in 2007, I was a staunch supporter. I had read old volumes of the Royal Canadian Air Force (RCAF) *Roundel*, grown up with the Canadian Forces' *Canadian Defence Quarterly*, been a regular contributor to Air Command's Roundel newspaper in the 1990s and am an avid reader of the *Canadian Military Journal*. However, the journal proposed by CFAWC would be something different. With a focus on air power, it would encourage and support the broader professional development of the national aerospace community from a Canadian perspective. In many ways, the *Journal* would be a throwback to the original *Roundel*, albeit with more academic and intellectual rigour. It was an exciting opportunity to be in on the ground floor of creating such a journal, and I doff my metaphorical "hat" to the senior air force officers who had the vision to create and sustain such a publication.

As in all the endeavours I have been a part of in my career, success is dependent upon the people I worked with. So my heartfelt appreciation for the efforts of the "crackerjack" CFAWC production team, both past and present, of Ernie Alkenbrack, Adri Boodoosingh, Cara Hunter, Denis Langlois, Luc Leroy, Lisa Moulton, Anne Pennington and Françoise Romard. You taught me a lot while graciously allowing me to think I was in charge. And a big thank you as well to Hope Smith and Chris Rodych for letting me bother you with questions about the mysteries of audiovisual technology and the World Wide Web (especially the intranet!!!).

During my tenure, I served five editors-in-chief: Colonel Jim Cottingham (Retired), Brigadier-General Mike Dabros (Retired), Major-General Derek Joyce, Colonel Martin Cournoyer (Retired) and Colonel Kelvin Truss. I appreciated your guidance and the confidence you placed in me to get the *Journal* out on your behalf. That I managed to do it for so long without getting any of you into trouble is no doubt as big a surprise to you as it was to me.

My last goodbye is to you, the readers. For when all is said and done, whether a publication like the *RCAFJ* thrives or withers on the vine is fundamentally due to its readership and their contributions. I have had the pleasure of reading every article, book review and letter that you have sent my way. With this in mind, given the quality, not to mention the quantity, of material that has crossed my desk, I am confident the *Journal* will continue to serve the RCAF for many years to come. And now for the last time on my watch . . .

Enjoy the read.

W.L. J

Sic Itur Ad Astra

Major William March, CD, MA

(Ex) Senior Editor

ABBREVIATIONS

CFAWC Canadian Forces Aerospace Warfare Centre

RCAF Royal Canadian Air Force

RCAFJ Royal Canadian Air Force Journal

LETTERS TO THE EDITOR

Editor's note: While not strictly letters to the editor, the comments below reflect a thoughtful reading of "Professional Airpower Mastery and the Royal Canadian Air Force: Rethinking Airpower Education and Professional Development," included in this issue of the *Journal*. I do hope that these will be the first of many such comments and observations on this subject.

Y OVERALL IMPRESSION OF THE PAPER IS VERY GOOD. A FEW THOUGHTS? WHAT IS THE INTENDED AUDIENCE? THE ABSTRACT IS THE ONE AREA I WOULD SUGGEST YOU READ TO ENSURE IT DELIVERS THE MESSAGE YOU WANT BECAUSE IT SETS THE TONE.

Paragraph 2. I find the initial sentence to be too focused on the operators. In my opinion, when we discuss the importance of Royal Canadian Air Force (RCAF) intellectual capital, people reading the paper must understand that this is important in all aspects of what the RCAF does (communications, logistics, maintenance, etc.) and not only the pointy end. The paragraph also discusses how issues are nuanced, that problems are different at the strategic level and that different skills are needed. I would argue that different skills and experiences are needed and that the paper must define these skills and experiences. Most importantly, the institution will have to adjust to ensure that developing these skills is valued and rewarded by the institution. This will be the greatest challenge in my opinion. There is also discussion on how the RCAF struggles to justify new capabilities and associated resources. I think the integrated theme of your AIRPower (Agile, Integrated, Reach, Power) must be included here and expanded on in paragraph 3.

Paragraph 3. The paragraph focuses on comprehension of how the RCAF functions and operates. Once again, I think it is important to understand this also as it relates to other elements and domains. My point is that airmen and airwomen must understand not only how the RCAF functions and operates but also how the Army, Navy, Special Operations Forces operate; airmen and airwomen must also understand the space and cyber domains in order to ensure that the concepts we develop make the RCAF relevant and shine within the entire Canadian Armed Forces. I get the point of focusing on RCAF doctrine and air mindedness, but I think we must plant the seed on the importance of understanding all the people we have to integrate with on various operations. This will be an investment for when our leaders get to the more strategic levels.

Paragraph 4. In line with my previous observations, I would add at the end of the paragraph a comment on exchanges, either with other elements or other nations, as there is strength through diversity of education, experience and perspective. We must define the skill sets required but not be too prescriptive on how to get these skills. We need to leave space for innovation.

Paragraph 6 c. Same comment on integration as above.

Paragraph 11. I think the four priorities highlighted by Air Commodore Wait are still very relevant today and reflective of an officer who had the right vision for what was good for the RCAF. His third point highlights the importance of understanding the Armed Forces as a whole, its operations and how the RCAF can best contribute.

Paragraph 15. Excellent. I believe in the importance of building a strong foundation and mastering the basics of our craft. I think this starts with recruiting, then I think RCAF Development Period (DP) 2 is absolutely critical.

Paragraph 16. It makes the point on self-serving education versus command driven/rewarded. I wonder if this has changed. It seems that there is an effort to do this now which is exciting. We need to ensure that the skills sought by the RCAF leaders are the ones rewarded. This is easier said than done but is absolutely critical. This will determine the leaders of tomorrow, thus the culture of the institution and when the right leaders are in place; this will lead to a virtuous circle where the culture will attract and produce the type of people we are looking for. This comes back to my paragraph 15 comment, where there needs to be emphasis on recruiting the right type of people and ensuring that after DP 2 we have set in place the right foundation at the captain level to build on.

Paragraph 17. I don't like the first sentence on leadership and management. I think there is a huge difference between leadership and management. When I talk about the type of people we should recruit and what we want to produce and identify at DP 2, I think we must focus on leaders and not so much on managers. This is how the RCAF will produce future commanders and the culture I think I understand that you wish for.

Paragraphs 18/19/20. Unfortunately still true today. I wholeheartedly agree that the focus of education within the RCAF needs to be command driven. I think we are all working hard, but we need to work smarter. Paragraph 20 is great. My old hockey coach used to say that speed kills if you don't know where you are going.

Paragraph 23. Great paragraph.

Paragraph 24 b. Once again, this is a bit too generic, as it talks about understanding our business and the system we are working within. This could be more precise so that the reader understands what you mean.

Paragraph 25. Last sentence is very good.

Paragraph 40. I don't like the part on competition with the Army, Navy and other departments for resources. I understand the intent but feel this goes directly against your message of flying in formation. I think we must think in terms of lead and not lag measures, thus focusing on being the best we can be as RCAF officers and then trusting that this will lead us to attain our objectives.

Parting thoughts:

- Excellent paper.
- It seems to me that defining the skill sets sought is critical. Then we must ensure these are rewarded. This will determine what kind of people we want to recruit, how we want to set the foundation at the captain level at DP2, and then how to build on this foundation during their entire career. It should be command driven.
- Building this kind of culture requires leaders/commanders, not managers.

Lieutenant-Colonel Jeannot Boucher, MSM, CD

ABBREVIATIONS

6

DP development period

RCAF Royal Canadian Air Force

FIND IT FUTILE TO JUSTIFY CRITICAL/ANALYTICAL THINKING BY INVOKING THE CONTINUED NEED FOR "AIRPOWER MASTERY." IN A WORLD WHERE EVERYONE AGREES THAT "IF YOU ARE NOT DOING CRITICAL/ANALYTICAL THINKING YOU'RE PRETTY MUCH DEAD," SHOULD WE NOT FOCUS OUR PRECIOUS TIME AND ENERGY ON THE HOW RATHER THAN THE WHY?

Critical and analytical thinking is the great separator of followers and leaders. If we want to be leaders (even before thinking about "airpower mastery"), we should rely on critical thinking as a foundational element.

Critical thinking, for me, is the first line of defence against illogicality, status quo, silo mentality and unsupported arguments. Critical thinking is to be in control and not follow others like sheep. To have critical thinking means you've collected information without bias and know how to make decisions based on facts and not based on "we've always done it like this" mentality.

"Professional Airpower Mastery and the Royal Canadian Air Force: Rethinking Airpower Education and Professional Development" (included in this issue of the *Journal*) is right about one thing: We urgently need critical thinking in the Royal Canadian Air Force. What are the symptoms? Dangerous and repetitive errors, bad decisions, failed projects, inaction when action is warranted, erroneous assumptions, obsolete training programmes, taking four years to produce aircraft captains, rank-based culture, high attrition rates and mismanagement of financial resources. This list should be enough to provoke thought, but most importantly, we should never forget that a lack of critical/analytical thinking leads to the ultimate consequence: loss of life in a high-risk business.

My critical thinking tells me that it's unproductive to allocate resources to elaborate an elegant linkage between the decline of airpower mastery and the need for critical thinking. It's a given! The real questions are: What can we do about it? How will we reform our culture to retain high performers fleeing toward greener intellectual pastures? How will we stay relevant in the information age when decision power is removed from leaders and firmly crystallized in processes and procedures that discharge anyone of accountability and calculated risk taking?

If we are to regain airpower mastery through the use of critical thinking: We need to start with modern and capable machines on the line. We need competent aviators who fly every day. We need a culture and supervisors that recognize competencies and encourage excellence. We need exercises and exchanges with allies to maximize knowledge transfer and hands-on knowledge. We need an organizational culture where continual improvement and challenging the status quo are encouraged. We need a modern and lean way of thinking instead of a culture of fear and an exception-based rule for every single outcome. We need leaders who aren't afraid to get into an argument and demand answers from the government. We need leaders who are confident in their team and let them do their job—even when there's a risk involved.

My hopes are to provoke thoughts, illicit a sense of urgency and suggest we focus on tangible actions that have an immediate impact.

Captain Jean Le Bouthillier, MSc

Liaison Officer, Canadian Special Operations Forces Command



A PAPER SPONSORED BY THE COMMANDER, ROYAL CANADIAN AIR FORCE

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Editor's note: The following article was produced as a service paper with numbered paragraphs. Although not our usual practice, for ease of reference with respect to feedback from the readership, we have retained the numbered paragraphs.

As the Commander of the Royal Canadian Air Force, I am blessed with a workforce that possesses significant intellectual capital, and I see it as my role to harness this potential in order to further the development of the conceptual component of airpower. I am, therefore, committed to exploring ways to expand our body of professional knowledge, to encourage self-development, and to provide opportunities for experiential learning. There is also a requirement to continually review the training and education we give to all ranks to ensure that it is configured to deliver what we need within the contemporary environment. To this end, I recently commissioned a paper by the Canadian Forces Aerospace Warfare Centre to look at airpower education and professional development as one of a series of academic pieces that will underpin a professional airpower mastery programme. Such a programme will ensure expert comprehension of airpower and the ability to apply that understanding effectively wherever and whenever needed. This consequent paper does not hold all the answers, but it is an excellent point of departure for future work. I commend it to you and encourage you to join the ongoing professional airpower mastery debate.

Lieutenant-General Michael J. Hood, CD Commander Royal Canadian Air Force

ABSTRACT

Directly related to the moral and physical components, the aim of the conceptual component is to provide the intellectual basis for armed forces, theoretically justifying the provision and employment of armed forces as well as to preserve and take forward corporate memory, experience, and knowledge. The conceptual component is relevant from the tactical through to strategic levels.

Today's operating environment is as challenging as it has ever been. At the strategic level, the foreseeable future will involve the Royal Canadian Air Force (RCAF) competing for capital investment, operating funds, and human resources; those Air Force personnel involved in supporting related decisions will need to be masters of their business. On operations, continued focus on joint and multinational actions will require Air Force leaders to have a deep understanding of airpower in general as well as Canadian air power's particular strengths and limitations.

Through natural evolution rather than design, the RCAF is an air force that predominantly generates and employs tactical-level air power. This has long been the case and is the reason why the RCAF invariably delivers high-calibre tactical output. Such mission-execution focus, however, may have led to disinvestment in the development of knowledge, skills, and competencies required at the operational and strategic levels.

Earlier in the RCAF's history, the need to nurture the conceptual component was deliberately addressed. Following World War II, the RCAF developed a programme of professional development and military education that concentrated on core airpower requirements. However, these programnes were not to endure. In the years following the unification of Canada's separate military services in 1968, the overall control that the RCAF had exercised over the professional development of its personnel underwent considerable change. In the pursuit of a more joint approach, the Canadian Armed Forces (CAF) adopted a broad military-education model at the expense of specialist airpower expertise.

To redress the educational deficit, action is required to promote a deeper understanding of airpower within joint, multinational, and corporate contexts and to develop the individual skills needed to capitalize on such understanding.

This study reviews the historical context, current situation, and possible options for action to make significant strides in the professional development of the RCAF primarily with respect to education. The basic tenet upon which the paper is built is: in order to succeed in the future, the RCAF must do more to leverage the intellectual capital of its people, invest in the conceptual component, and strive for mastery of its domain.

INTRODUCTION

- 1. Almost a century old, the air forces of Canada have evolved into the modern, capable, and battle-tested RCAF. After decades of experience gained through participating in operations that varied from domestic security and emergency assistance to Canadians, United Nations' peacekeeping missions, to higher-intensity combat operations in the Persian Gulf, the Balkans, Afghanistan, Libya, and Iraq, the RCAF has developed an effective way of operating, defined by tactical professionalism and mission success, sound operating procedures, and effective leadership.
- 2. By being metaphorically constrained to the cockpit, though, the RCAF may have unintentionally restricted its institutional and intellectual development to the tactical level. The net effect has been the development of an officer corps which is able to think and act, to problem solve and

analyse, and to communicate in a way that is effective for the non-complex, often linear challenges that present themselves at the squadron level. At the operational level, through some targeted exposure and on-the-job training, we perform adequately. At the strategic level, however, where issues are more nuanced and wicked problems are the norm, different skills are needed which must be inculcated over time. In this area, the RCAF appears to be doing less well. At the departmental level, especially, the Air Force struggles to explain new doctrinal constructs or new air operating concepts, to justify new capability requirements, or to argue convincingly for resources based on clear logic.

- 3. It may be argued that staff officers from all environments face the same demands in order to be effective and that the RCAF's situation is not unique. Airpower issues, though, must be informed by airpower expertise. Related decisions must be knowledge based, and it behooves the Air Force to ensure its personnel can give the best professional advice possible. Consequently, the RCAF must enhance its own comprehension of how it functions and operates in order to explain its relevance to national government policy and grand strategy. Through development of a culture that values learning, encourages knowledge development, and embraces and fosters critical analysis as well as constructive debate, the RCAF will be more effective at the strategic level, for its own institutional-credibility's sake and, more importantly, for defence.
- 4. There are a number of avenues through which such a cultural change might be achieved. A blended solution of training, education, learning incentives, access to information sources, and creation of airpower forums will likely be required. The CAF professional-development framework acknowledges the role experiential learning has to play, and this key developmental pillar, with its attendant requirement for careful talent management, must not be overlooked. The focus of this paper, however, is formal, structured airpower education.
- 5. Before solutions can be devised, we need to consider the genesis of today's apparent problem. It is important to understand the roots of the challenge as well as to appreciate from where the RCAF as an institution has come and where it is now, in order to have the context to determine where it needs to go.

DEFINING KEY TERMS

- 6. As a first step, it is necessary to identify some key terms and concepts that will not only be central to the debate but also should become core components of the RCAF's daily operations and lexicon. The following definitions of key terms are not meant to be definitive at this point; instead, they are offered as the initial seeds to grow a shared mental model of what the RCAF needs to achieve:
 - a. **Air power and airpower.** Air power can be thought of as the delivery of an air force's output (essentially, the bones, muscle, and organs of the RCAF; the physical manifestation of our activity). Airpower is a more comprehensive notion that includes the physical aspects (the physical component), conceptual and intellectual elements (the conceptual component), and the moral compass (the moral component) that guides and develops the delivery of air power.
 - b. **Professional airpower mastery.** The aspirational level of airpower, professional airpower mastery (PAM), can be applied to an individual or the entire institution. For the RCAF it represents the institutional requirement to maintain expert levels of comprehension of airpower; ability to contemplate and debate airpower in future development terms; an understanding of organizational theory and institutional functions; a professional awareness of the joint, combined, and interagency environments; and the ability to apply operational, strategic, and governmental decision-making constructs. All this in order to fully understand the science of airpower but also to be able to effectively apply the necessary art to be considered airpower and war fighting experts.

c. Airpower mindedness. With a focus on the individual, airpower mindedness refers to an attitude or mindset. Based on an in-depth, comprehensive understanding of airpower's large body of knowledge achieved through training, education, analysis, and debate, airpower mindedness allows the individual to automatically see problems and opportunities through an airpower lens. Key to airpower mindedness is not merely the understanding of the underpinning theoretical concepts of airpower but also the requisite depth of comprehension of systems (planning, execution as well as platforms and training, techniques, and procedures) in order to practically deliver air power.

RCAF PROFESSIONAL AIRPOWER MASTERY PRIOR TO UNIFICATION

- 7. The RCAF came into existence gradually in the post–World War I period (1918–1923), building upon a non-permanent foundation that, although rich in combat experience, focused primarily on the nation's civil-aviation requirements. As a result, the RCAF during the interwar period thought, acted, and developed as a tactical air force, with little room for airpower considerations in a culture that venerated the individualistic "bush pilot in uniform" ideal. As an institution, the RCAF sought well-educated individuals, at least in technical terms, as recruits, but service training and experience at the squadron level and below became the benchmarks of professional development instead of broader staff training and education.
- 8. In many ways, the RCAF was the brainchild of John Armistead Wilson, a seasoned public servant with an intuitive appreciation of the country's air power requirements and what would be acceptable to the government. Recognizing the symbiotic relationship between military and civil aviation, he spent his career supporting the former and fostering the latter. A frequent contributor of airpower articles to the *Canadian Defence Quarterly*, Wilson used the term "airmindedness" in a 1928 article that highlighted government assistance in setting up flying clubs throughout the country to "promote the knowledge and use of Aviation [sic] among the rising generation, and to encourage the provision of flying fields by municipalities." These flying clubs would provide numerous pilots for the RCAF and formed the backbone of the British Commonwealth Air Training Plan during World War II.
- 9. From 1924 to 1939, the RCAF focused on civil-government air operations (forestry patrols, support for other government departments, etc.), training, and aerial-defence responsibilities. High-level staff training and airpower education were provided to the one or two individuals per year selected to attend the Royal Air Force Staff College in the United Kingdom. During World War II, a massively expanded RCAF (over 250,000 personnel by 1944) functioned at the tactical level through the provision of aircraft, personnel, and squadrons in all of the overseas theatres of war.
- 10. Notwithstanding this overall tactical focus, charged with the aerial defence of Canada during World War II, Western Air Command and Eastern Air Command saw the RCAF engaged at the operational level of air-warfare planning, coordinating and implementing air campaigns in conjunction with the other services and allied military forces.³ Faced with a shortage of trained and educated staff officers who had mastered their profession at the operational level, an RCAF War Staff College was established, offering 10-week-long courses that emphasized staff training with a smattering of other educational elements.
- 11. The RCAF War Staff College ran seven courses prior to the end of the war, which was deemed a success, so the RCAF, despite shrinking to an immediate post-war strength of less than 12,000, not only kept the institution open, albeit with the removal of "War" from its title, but also lengthened the course to six months. Both staff training as well as subjects of a broader educational nature



were expanded. The Commandant, Air Commodore F. G. Wait, articulated four goals of the RCAF Staff College: (1) To teach individuals to think clearly, express their opinions briefly, and develop critical analysis skills; (2) to train individuals in higher staff skills and methods; (3) provide a background knowledge of armed forces organization and operations; and (4) impart an understanding of the correct application of air power and how best to integrate it with land and sea power. These goals remained relatively unchanged until unification.

12. Although a small number of personnel attended allied air colleges, most of the training and education was provided through this institutionally developed approach to professional airpower mastery. The RCAF Staff College continued to follow the goals set out in 1945 and encouraged airpower discussion with the promulgation of the *R.C.A.F. Staff College Journal*, beginning in 1956. It also recognized a need to provide air-staff training and airpower education at lower levels, establishing separate RCAF Staff and Extension schools. The RCAF Extension School also provided access to university courses through an agreement with the University of Toronto. In 1962, a reorganization of the RCAF educational system led to the establishment of the RCAF Air Force College, consisting of the Staff College, Staff School, and Extension School. Total directing staff for all three components of the Air Force College was approximately 59 military and civilian personnel.⁵ In hindsight, this institutional investment in the intellectual capital of the RCAF, with a particular focus on airpower, is seen as quite exceptional in comparison to today's approach.

- 13. Beyond the wing commander (lieutenant-colonel) rank, there were no provisions within the RCAF for advanced airpower training and education except what could be gleaned from national institutions such as the National Defence College (1948–1994) and attendance at similar foreign institutions. For flag-level officers, it was very much a learn-as-you-go approach, with a premium placed on experience.
- 14. Since it was raised in 1924, the Canadian Air Force has maintained an institutional emphasis on controlling tactical training. In contrast, it controlled higher-level air-staff training and airpower education up to the lieutenant-colonel level only for a brief period. The period between 1945 and 1966 (where the Air Force had control of the development of its intellectual capital, the officers, through a maturing professional development programme) could well be viewed as a potential watershed paradigm shift for the RCAF. The loss of control of the intellectual-capital development of the RCAF and the potential to enhance institutional professional airpower mastery at unification is now a matter of fact.

RCAF PROFESSIONAL AIRPOWER MASTERY FROM UNIFICATION UNTIL TODAY

The appropriate level at which a joint, or purple, organization can be allowed to work on the attitudes, values and beliefs of service personnel and officials is problematic.⁶

- Air Commodore Peter W. Gray and Jonathan Harvey

- 15. With unification, the RCAF lost its control of higher air-staff training and airpower education, as the newly-minted CAF adopted the RCAF educational model. The RCAF Staff College became the Canadian Armed Forces Command and Staff College; the RCAF Staff School became the Canadian Armed Forces Staff School; and the RCAF Extension School gradually morphed into the Officer Professional Development Programme (the "Opie-Dopies"). Henceforth, how much "airpower" was taught would be determined by joint as opposed to air requirements, the level determined by college staff, with little or no direct input by the Air Force. There is no doubting the importance of the joint educational and training demands in light of the complexity of contemporary military operations, but surely the aim should always be that an Air Force officer is an airpower expert prior to the joint step. That is, of course, the focus of training up to Developmental Period 2. Whether the desired level of expertise is being achieved is the point in question.
- 16. Specialized airpower education became even more problematic, as it was only available through occasional courses at civilian universities and the Royal Military College of Canada (RMC), but with its access controlled via a yearly selection process at National Defence Headquarters (NDHQ) and its fields of study heavily populated by technical or specialist degrees. Often—given a prevalent belief at that time that education was self-serving and no substitute for tactical experience—bolstered by a lack of strong recognition by evaluation boards as well as a lack of long-term personnel planning to permit the selection of optimal candidates, suitable post-graduate billets that might have been useful from an airpower perspective were handed out to individuals at the bottom of the merit list as an afterthought or as a consolation prize. Although Minister of National Defence Douglas Young decreed in 1997 that all CAF officers required undergraduate degrees, the subject of the degree was never specified, nor did the new educational directive translate in a meaningful way to the post-graduate realm.
- 17. With the business-oriented approach to leadership and management that thrived in the 1990s and early 2000s, a master's in business or public administration became the new "ticket" to punch. Increased educational opportunities with more of a military focus were created at various civilian universities using government funds to support the establishment of centres for defence studies. At RMC, the Department of War Studies was created to offer a multi-disciplinary approach to the study of the profession of arms.

- 18. Underpinning these initiatives was a reinvigorated Individual Learning Programme that allowed serving members to pursue continuing education on their own time. Again, while the Air Force permitted its personnel to take advantage of these opportunities, there was no concerted effort to capitalize on them. The Air Force seemed content to leave responsibility for developing and administering post-graduate education with either NDHQ or the newly created Canadian Defence Academy, while only providing minimal input of its own. Post-graduate opportunities languished or were taken up by support services, such as the technical and personnel branches, that had some semblance of long-term educational plans.¹⁰
- 19. In the same period, the Air Force developed a vision that included the creation of a warfare centre, responsible to some extent for the three main pillars of the conceptual component: doctrine, conceptual innovation, and expounding the principles of war as they relate to air operations. The Canadian Forces School of Aerospace Studies (CFSAS), which had been established in 1987, had and still has a mandate to meet the RCAF's professional-development needs, thus providing another medium through which one might expect professional airpower mastery would be achieved. Despite creating units such as CFSAS and the Canadian Forces Aerospace Warfare Centre (CFAWC), however, there appears to have been no overarching policy to guide such units' activities in order to meet the institution's overall needs, and inadequate mechanisms were put in place through which their products and services could be institutionalized throughout the Air Force. Where plans were put in place, a lack of consistent institutional leadership meant that they were often not carried out. Plans to make CFSAS a subordinate unit to CFAWC, for example, which would have encouraged a more coordinated, coherent approach to professional development, were not seen through. Even as CAF acknowledged that all of its members "must master the art of war in their own medium if they are to become true professionals in the joint, combined and inter-agency context," the Air Force seemed content not only at the tactical level of thought and action but also with a fragmented or disjointed approach with regard to nurturing the conceptual component.¹¹
- 20. Although the Canadian Forces continued to develop educational opportunities for advanced education from 2000 (including the professional Master of Defence Studies programme at Staff College as well as opportunities through centres for defence studies at civilian universities, and the War Studies programme at RMC), the opportunities afforded by these programmes are not being leveraged by the RCAF institutionally to enhance professional airpower mastery or individual airpower mindedness in a deliberate manner, with command-led oversight.
- 21. In any case, the opportunities available in Canada are not exhaustive and would not satisfy all the institutional needs. There is no equivalent, for example, of the United States Air Force School of Advanced Air and Space Studies doctoral-level course in air strategy available domestically. While it is fair to state that the RCAF may have developed in recent years a more educated Air Force in academic and perhaps technical terms, this has not equated effectively to institutionally enhanced professional airpower mastery. To be frank, with the RCAF's natural and cultural bent to the tactical in light of an increasing operational tempo since 2000 and a quite intense recent focus on force development, the internal concern to strive for enhanced professional airpower mastery (in the broadest sense of the definition) has not really been the focus over the last 10–15 years.
- 22. It is interesting to note that if one includes the most recent "Canadian Armed Forces Professional Development System Study Final Report", there have been no less than eight detailed examinations of officer professional development in the Canadian military since unification, but not one that looks at it specifically from an RCAF or airpower perspective. To paraphrase the words of General Jean Victor Allard (Chief of the Defence Staff, 1966–1969), "it matters little whether the [RCAF has its] present manpower strength and financial budget, or half of them, or double them;

TO UNDERSTAND THE PAST AND ⁻ JUDGE THE PRESENT **FORESEE** THE FUTURE.

without a properly educated, effectively trained professional officer corps the [RCAF] would, in the future, be doomed at best to mediocrity; and at worst, to disaster." ¹²

THE RCAF AND THE FUTURE OF AIRPOWER MASTERY

- 23. There exists a growing internal RCAF perception that the institution is not meeting the demand in aspiring to enhance professional airpower mastery. Major-General Coates, Deputy Commander (Continental), Canadian Joint Operations Command, in an article entitled "Airmindedness: An Essential Element of Air Power," argued that more has to be done to "prepare the RCAF and others to apply air power to achieve desired effects."13 More importantly, he argues that in the joint arena it is not enough to cultivate airmindedness solely amongst aviators, an outlook echoed by our current Chief of the Defence Staff General Jon Vance, "airmindedness in other planners is critical, as effective planning can't be the air force guy saying after the fact 'hey, don't forget about air... ."14 These views must be taken into consideration as we seek to address RCAF shortcomings with respect to professional development so that it is inclusive rather than exclusive.
- 24. Any assessment of the current level of professional airpower mastery in the RCAF, necessarily subjective, needs to be based on institutional needs. What then is the extent of

the need for professional airpower mastery for the RCAF going forward? It was noted above that the RCAF can be relied on to deliver high-calibre mission results and, therefore, we are already clearly doing some things right. It should be remembered, however, that the RCAF has wider responsibilities than just delivering today's air power (the sustain agenda). We must also develop the RCAF of tomorrow (the change agenda) while meeting corporate departmental responsibilities. All three key roles demand intellectual agility, sound judgment, critical analysis, and deep professional knowledge. To reiterate just some of the issues at play:

- a. There is insufficient capital funding available to meet the current air, maritime, land, and special-forces acquisition requirements. "Gentlemen, we have run out of money. Now we have to think." The same pressure exists for force structure, manning levels, and operating budgets. The RCAF must be able to articulate valid requirements convincingly.
- b. Air power has been at the heart of three most recent operations, yet RCAF representation within Canadian Joint Operations Command, Strategic Joint Staff, and Vice Chief of the Defence Staff remains, for obvious reasons, significantly less than that of the Canadian Army.

It is imperative, therefore, that Air Force personnel understand their business and the system they are working within and can provide the necessary airpower advocacy and advice in a way that can be heard and understood by all.

- 25. Examples of the kinds of questions that have recently challenged RCAF staff relate to command and control of expeditionary air operations, optimum peacetime force structures, air-capability readiness, and the relationship of flying hours to force posture. These are not hard questions for an Air Force with established professional airpower mastery, yet anecdotally at least, the RCAF has not been able to explain its position well. This cannot be good enough. If a future defence review or alternative to the *Canada First* Defence Strategy raised more existential questions (such as "Why does the Army not control tactical aviation?" or "Why does Canada need an expeditionary attack capability?"), there is a risk that an inability to provide cogent, strategic advice could do irreversible damage to the institution and to the nation's security. The capability to develop war fighting experts centred on the airpower comprehension platform with the skilled application of air power—requiring individual airpower mindedness and an enhanced institutional professional airpower mastery—must be developed.
- 26. If institutional professional airpower mastery is built around the individual airpower mindedness of its officers and non-commissioned members at all rank levels, and that individual airpower mindedness is the sum of each person's knowledge and understanding of the theory and practice of air power and its effect in war and peace, plus their knowledge and understanding of institutional processes and advanced staff skills, then the initial steps for enhancing both qualities in the RCAF seem readily apparent. Charting a relevant course forward would involve changes to the RCAF professional-development system to ensure the required level of airpower competence is achieved through training and education, which complements the practical air power experience gained over a career.
- 27. In this process, the role of senior leadership is critical in transforming individual airpower mindedness into institutional professional airpower mastery. This will be done by continually defining the enduring vision for the RCAF as an institution and adjusting it to ensure its relevance to grand strategic goals as well as providing the guidance necessary to shape the force towards those ends while enabling effective operations.
- 28. The objective of the RCAF education and professional-development programmes needs to be raised in order to harness the clear intellectual capital base that the RCAF maintains. In so doing, the development model (of which a key component is education) adopted should be separated from "the foundational training necessary in military forces" and instead "must have a visible continuum from the lower levels all the way to the senior ranks." In other words, changes should not be targeting only the very senior leadership of the RCAF. The development of individual airpower mindedness is something that must begin early in a member's career and continue throughout their time in uniform.
- 29. The kind of critical thinking and analytical skills called for are not easy to acquire, nor is a comprehensive understanding of airpower theory and practice, and these skills are perishable without continual challenge, employment, and ongoing education. Thus, an acknowledgement of the value of the study and critical analysis of airpower—both the history and theory of its practice and the underlying reasons for its successes and failures—must be forthcoming from RCAF leadership at all levels in order to ensure the success of changes to the RCAF professional-development system.
- 30. Some recent scholarship has pointed to a need for small air forces to have their personnel possess a higher level of professional mastery, which equates to both individual airpower mindedness

and institutional professional airpower mastery, because "they function at the critical mass most of the time, especially when they are engaged in actual operations." This requires a higher level of command ability and institutional understanding, developed in part through individual airpower mindedness, to ensure the force is being optimally employed; to prevent operational fatigue; and to continue to raise, train, and sustain the force while conducting operations.

- 31. There is, though, a dichotomy between the demands placed on an air force with a high operational tempo and the development of both individual airpower mindedness and institutional professional airpower mastery. Professional development is one of the principal factors that ensures the competence and relevance of small air forces, and yet, because of the demands on their personnel, these programmes are often the first casualties. Only through emphasizing professional development and becoming true "learning organizations" are small air forces able to shape the security environment rather than being reactive to emerging challenges. Thus, it is critical to the future success of the RCAF as an institution that it continues to deliver appropriate air power effects at the tactical level, improve its ability to articulate the central role of military airpower at the strategic level, and advance the institutional output. Doing so will require a professional-development system that supports a comprehensive understanding of airpower and nurtures the critical thinking skills that result from that study.
- 32. The focused study of airpower history and theory (such as studying the literature on the long-term trends in warfighting over the past century or thoroughly examining the lessons from recent military operations) as a central feature of a revised RCAF professional military-education programme provides more utility and ultimately better guidance in preparing RCAF personnel to engage more effectively across the continuum from force employment to force generation and force development. In particular, the study of the history of air power can help one understand change or, conversely, continuity in military trends by providing a theoretical or mental framework for looking at change over a time, and it also can serve as an effective method for investigating lessons from specific operational experiences.
- 33. In terms of understanding change, how one addresses future uncertainty can very much depend upon on how one thinks about the past and how it has shaped the present. History can serve to educate both military professionals and analysts of the factors associated with past victories and defeats as well as the enduring principles and evolving character of air and joint warfare, all of which should shape their discussions and inform their judgments about ways to meet future air requirements. Such study across a career develops and shapes critical-thinking skills while providing the essential contextual understanding needed to confront current airpower and warfighting problems.
- 34. Moreover, the contextual understanding provided by a study of the history and evolving airpower theory normally instils an appropriate sense of humility regarding new concepts purporting to solve all military problems. Thus, any evolution to the RCAF professional-development system should feature the study of air power history as a central feature. As British Army armoured warfare theorist Major-General J. F. C. "Boney" Fuller aptly said, to "understand the past and to judge the present is to foresee the future." It is only through the continual study and thoughtful reflection on the history and modern application of air power that the required expertise can be developed to confront and address current and future airpower problems and in so doing, to improve the RCAF institutional output. Again, the development of a base of airpower knowledge, and the career-long education of RCAF personnel in its theory and practice, provides far more utility in confronting the very real problems facing the development and employment of Canadian military air power.

- 35. Over time, the emphasis on this kind of focused study of airpower theory and practice will pay dividends, and as the analytical skills across the RCAF improve, it will be well placed to address present concerns. Collectively, these efforts will harness the vast intellectual capital resident within the RCAF—a resource with which to develop what 19th century Prussian military theorist Carl von Clausewitz called a "sensitive and discriminating judgment ...; a skilled intelligence to scent out the truth," and to pierce the fog of uncertainty that clouds both operations and strategic military planning.¹⁹
- 36. Although this paper is not a plan proposal, it is important to note at this stage that many of the pieces likely to figure in any solution are already in place. For example, CFSAS, RMC, and the Canadian Forces College Joint Command and Staff Programme provide military history and airpower courses that could be strengthened and aligned with command intent. Moreover, many of CFAWC's publications—in particular the reports from Operational Research and Analysis, RCAF doctrine, lessons-learned reports, and the *Royal Canadian Air Force Journal*—along with RCAF history and heritage studies are valuable resources not fully exploited.
- 37. With appropriate oversight and likely minimal investment, these resources could be strengthened through the addition of academically sound literature and thinking, supplemented with regular airpower symposia discussing the future of military airpower, and all aligned with command intent to ensure a comprehensive approach. While a thorough analysis of the existing professional-development system might identify educational gaps that should be addressed through additional airpower history and airpower theory courses of varying sophistication, the additional resources needed to address these gaps would be modest since the expertise already exists within the RCAF.²⁰ Into whatever final form the professional-development system transforms, the careerlong learning model, beginning with basic airpower-history theory courses through to an advanced study or fellowship programme for high performers, should be the ultimate aim in order to develop true masters of airpower—the future senior leadership of the RCAF.

CONCLUSION

- 38. For an Air Force that has shown great professionalism and success in its varied tactical roles, as witnessed over decades of air operations, the RCAF is now poised to begin the journey of rising to its full potential by harnessing the intellectual potential found in its most valuable asset—its people. By focusing on career-long professional development, including preparing high performers with advanced study that features a detailed appreciation of its vast and proud heritage, the RCAF can attain airpower mastery as an institution and, through this understanding, assume a more prominent and effective role in the defence discussions on the central role of the RCAF in current and future military operations in support of Government of Canada policy goals.
- 39. While identifying the problem of a lack of airpower mastery is an important first step, there is an urgency to develop and institutionalize this intellectual evolution within the RCAF. This is because the problems associated with a lack of airpower culture will only expand and grow more complicated as time passes, air power embraces advanced technology, and the demands of the battlespace begin to change rapidly. A coherent and dedicated approach to improvement is needed; one that insists that the status quo is no longer acceptable. There is an opportunity for the RCAF to further the national-power responsibility, effectively provide air power sovereignty protection, and play a greater role in the joint operating environment.
- 40. If the RCAF cannot embrace an immediate programme of transformational and intellectual change, then it will remain a force that merely excels at the tactical delivery of air effects instead of truly mastering airpower itself. The importance of this point cannot be overstated. By virtue of

being a small air force, the RCAF must find ways to ensure its officers and members can use airpower mindedness and professional airpower mastery to the RCAF's and the nation's benefit. There will always be times when the RCAF will need to compete with the Army, Navy, and other federal departments for limited government resources—particularly in times of economic austerity—and those times require agile and flexible minds with a professional mastery of airpower to press for the continued evolution of Canadian military airpower. Moreover, the speed with which the security environment is changing and, more importantly, the speed with which the United States and other key allies are adopting advanced technologies and novel operating concepts with which to deal with real threats make this all the more imperative.

41. Unless the RCAF has members (especially senior officers) who understand or, better yet, possess the intellectual prowess to link the value of Canadian airpower to national policy objectives, it undoubtedly will find itself in a position where its relevancy and, perhaps, its very survival are drawn into question.

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ABBREVIATIONS

CAF Canadian Armed Forces

CFAWC Canadian Forces Aerospace Warfare Centre
CFSAS Canadian Forces School of Aerospace Studies

DND Department of National Defence **NDHQ** National Defence Headquarters

RCAF Royal Canadian Air Force

RMC Royal Military College of Canada

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NOTES

- 1. Hugh Halliday, "Fathering Civil Aviation: Air Force, Part 8," *Legion Magazine*, 1 March 2005, accessed January 11, 2016, https://legionmagazine.com/en/2005/03/fathering-civil-aviation/.
- 2. J. A. Wilson, "Civil Aviation in Canada, 1928," *Canadian Defence Quarterly* 6, no. 3 (April 1929): 307.
- 3. Both of these RCAF commands provided operational-level command and control: Western Air Command in the Aleutian Campaign and more broadly, the Eastern Air Command in the Battle for the Atlantic.
- 4. William R. Shields, "Canadian Forces Command and Staff College, a History: 1797–1946," 4–27. This is an unpublished draft document prepared at Canadian Forces College, Toronto, 1987. A copy is held by the Directorate, RCAF History and Heritage, 8 Wing Trenton.
- 5. Canada, Royal Canadian Air Force, *R.C.A.F. Staff College Journal* (Armour Heights, Ontario: RCAF Staff College, 1964), 90. The commandant of the Air Force College was an air commodore (brigadier-general) with a headquarters staff of 12, including one civilian with a PhD. The director of the RCAF Staff College was a group captain (colonel) with a staff of 15 (no civilians). The director of the RCAF Extension School was a wing commander (lieutenant-colonel) with a staff of six including a civilian with a master of arts. The director of the RCAF Staff School was a group captain with a staff of 22 (no civilians).
- 6. Air Commodore [Royal Air Force] Peter W. Gray and Jonathan Harvey, "Strategic Leadership Education," in Colonel Bernd Horn and Lieutenant-Colonel Allister MacIntyre, eds., *In Pursuit of Excellence: International Perspectives of Military Leadership* (Kingston: Canadian Defence Academy Press, 2006), 81.
- 7. Allan English and Colonel John Westrop (Retired), *Canadian Air Force Leadership and Command: The Human Dimension of Expeditionary Air Force Operations* (Trenton: Canadian Forces Aerospace Warfare Centre, 2007), 49.
- 8. Colonel Bernd Horn, "Education The Key Component to the Development of the Next Generation of Military Leaders," in Major Julie Bélanger and Lieutenant-Colonel Psalm Lew, eds., *Developing the Next Generation of Military Leaders: Challenges, Imperatives and Strategies* (Kingston: Canadian Defence Academy Press, 2011), 26–27.

- 9. Ronald G. Haycock, "The Labours of Athena and the Muses: Historical and Contemporary Aspects of Canadian Military Education," *Canadian Military Journal* 2, no. 2 (Summer 2001): 11.
 - 10. Ibid., 12.
- 11. Canada, DND, *Duty with Honour: The Profession of Arms in Canada* (Kingston: Canadian Defence Academy, 2003), 74.
- 12. Canada, DND, *The Report of the Officer Development Board* (Ottawa: March 1969) 1: iv. The committee that produced the report was chaired by Major-General Roger Rowley and is commonly referred to as the "Rowley Report."
- 13. Then Brigadier-General Christopher J. Coates, "Airmindedness: An Essential Element of Air Power," *Royal Canadian Air Force Journal* 3, no. 1, (Winter 2014): 70.
- 14. Ibid. 76. Quote taken from an interview between Coates and then Major-General Jonathan Vance, 28 January 2013.
- 15. Attributed to Winston S. Churchill or, in an alternative form ("We've got no money so we've got to think.") to Ernest Rutherford.
- 16. Sanu Kainikara, *At the Critical Juncture: The Predicament of Small Air Forces* (Canberra: Air Power Development Centre, 2011), 146.
- 17. Ibid., 147. In Dr. Kainikara's analysis, air forces are either large or small. This term is used deliberately and in no way assumes that a small air force is incapable of strategic effect.
- 18. Michael Evans, *The Continental School of Strategy: The Past, Present and Future of Land Power* (Duntroon, Australian Capital Territory: Land Warfare Studies Centre, 2004), 1.
- 19. Carl von Clausewitz, *On War*, edited and translated by Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1976), 101.
- 20. In the "think globally and act locally" tradition, there is value in following the pattern begun by Dr. Brad Gladman and Lieutenant-Colonel Pux Barnes at CFAWC. With the support of the Commanding Officer at CFAWC, a "Barker Society" was established in 2014, which brings officers, non-commissioned members, and civilians together to discuss assigned readings on airpower. This approach has been trialed at wings across Canada and has been well received. It is entirely voluntary, but allows for a peer discussion of airpower theory and/or history to broaden the understanding of airpower of RCAF personnel—civilian and military.



A TACTICAL SILVER LINING IN A HORRIFYING STORM: CANADIAN AIRLIFT IN RWANDA, 1994

BY MAJOR JAMES PIEROTTI, CD



INTRODUCTION

In 1994, a small Canadian tactical-airlift mission provided a glimmer of hope throughout the tragedy in Rwanda. The horrific Rwandan genocide started on 7 April and lasted over 100 days, with most of the world sitting idly by as 800,000 to 1,000,000 people in the country were raped, unspeakably mutilated and slaughtered.¹ In the midst of the genocide, the United Nations Assistance Mission in Rwanda (UNAMIR) stoically remained in place with a small force numbering roughly 460 personnel under the command of Canadian Major-General (MGen) Romeo Dallaire. UNAMIR watched as nations arrived with aircraft in early April, only to load their own civilian and military personnel and immediately depart.² The logistical support UNAMIR required to remain in Rwanda, and throughout the genocide until 18 July, came solely from a small Canadian air-transport detachment in Nairobi, Kenya.³ The UNAMIR mission has been relatively well documented, but there has been little to nothing written about the successful airlift that kept the UNAMIR mission supplied. An examination of the airlift in Rwanda is a useful case study for the suitability of Canadian tactical airlift as a response to international crises.

Contemporary airlift missions are nearly always conducted by a coalition of willing nations where the dangers are assessed through comprehensive intelligence and the risks are shared among participating military forces. What makes the Rwanda mission unique is that the other military airlift partners departed within two weeks of the start of the air evacuation on 9 April. An analysis of the Canadian airlift to Rwanda, called Operation (Op) SCOTCH, provides some important lessons on what a tactically trained and properly equipped transport capability can achieve despite dangerous conditions.

After 7 April 1994, the United Nations (UN) requirement for logistical support in Rwanda was critical. UNAMIR became a strategic enabler for the international community to ultimately get involved with the genocide's resulting refugee crisis. During the genocide, UNAMIR helped save thousands of lives, and after the genocide, it was the initial coordinating agency to feed and support millions of displaced refugees. The Canadian Air Lift Command Element (ALCE) detachment from 8 Wing Trenton, Ontario, provided the tactical airlift, working with UNAMIR to manage aircraft risk and keep the UN presence in Kigali, the capital city of Rwanda.

THE INITIAL RESPONSE TO THE DEVELOPING GENOCIDE

In order to understand the mission, it is necessary to understand a bit about the underlying reasons for the tragedy in Rwanda. The ethnic hatred displayed by the 85 per cent Hutu majority towards the 15 per cent Tutsi population existed since the late 1800s and was exacerbated by Belgian colonial power, which had insisted that the Tutsi population was "approaching, however gradually, the exalted level of white people in contrast with the declared brutishness and innate inferiority of the Bantu (Hutu) majority." The Tutsis benefited from Belgian preferential treatment until the Europeans withdrew from Rwanda in 1962 and the subsequent election—resulting from a violent reaction to wide-spread discrimination—of a Hutu-dominated government. As the government became increasingly hostile towards the Tutsi minority (a situation that was complicated by the same ethnic tensions in surrounding countries), the Tutsis formed the Rwandan Patriotic Front (RPF) in 1988 under the direction of MGen Paul Kagame. The RPF initiated a civil war against the Hutu Rwandan Government Forces (RGF) in 1990.

UNAMIR was established in October 1993 to enable a brokered ceasefire between the two sides of the civil war and to assist in implementing the Arusha Accord, a peace-process agreement developed in August 1993.⁸ However, the implementation of the accord did not gain acceptance on either side, and in March of 1994, MGen Dallaire reported that the situation was deteriorating.⁹ Western nations did not understand at the time that the ethnic tensions had achieved genocidal levels of anger and that the Interahamwe militia, passively supported by the RGF, planned to eliminate the Tutsi minority.¹⁰

On 6 April, the matter came to a head when the Rwandan Hutu President, Juvenal Habyarimana, was killed when his aircraft was shot down on approach to Kigali airport. The RGF and the government-controlled radio station claimed that the RPF and the Belgians were responsible for the assassination, a claim since proven to be a lie, and Radio Rwanda urged the Hutu population to rise up against the Tutsis. On 7 April, murderous groups of Hutu militia—urged forward by "hate radio" —started killing Tutsis by the thousands. The initial round of killings included 10 Belgian peacekeepers, who were tortured and slaughtered while protecting the Rwandan Prime Minister, a Tutsi. These events caused Western governments to immediately fear for the safety of their personnel within Rwanda and neighbouring Burundi. Both Canada and Belgium started plans for an air evacuation, with Belgium evacuating both civilians and military peacekeepers.

The destruction of the aircraft with the president onboard was a source of considerable concern for any airlift evacuation. Handheld and highly portable surface-to-air missiles (SAMs) were now in use in the vicinity of Kigali airport, but no one knew for certain by whom. However, Canada had recently equipped several CC130 Hercules with a countermeasures system (CMS) that warned the aircrew if missiles were fired at the aircraft and provided additional active-defensive measures. ¹⁵ This capability was used in early April 1994 at Ancona, Italy, during relief missions into Sarajevo—in the Former Republic of Yugoslavia—and allowed procedures and tactics to be developed and refined.

The most obvious changes to the aircraft were: armour plating in the cockpit and on the paratroop doors to protect crewmembers from projectiles, sensors to monitor radar and infrared threats, and a CMS that was capable of deceiving missiles aimed at the aircraft. The crews were trained to operate at high speed and low altitudes, evade threats and minimize time on the ground to reduce the ability of enemy forces to target the aircraft. Due to the equipment and training, the CMS-equipped CC130 Hercules was the only Canadian cargo aircraft suitable for the environment, so it was selected to aid in the evacuation of Canadian and Belgian personnel at the beginning of the crisis in Rwanda.

In Canada, a warning order was issued to Air Transport Group (ATG) on 8 April to prepare to provide a CMS-equipped Hercules aircraft to evacuate personnel.¹⁷ The next day, formal direction was provided from the Minister, Department of Foreign Affairs and International Trade (DFAIT), through the Department of National Defence (DND), to evacuate Canadians and Belgians from Kigali.¹⁸ The only CMS-equipped Hercules resource operating outside of Canada in April 1994 was at Ancona.¹⁹ The Canadian Detachment at Ancona was composed of an ALCE, two CMS-qualified aircrew and support personnel to load and maintain the aircraft.²⁰ All 28 personnel departed immediately for Nairobi. On 10 April, they attempted the first evacuation flight out of Bujumbura, Burundi, but unfortunately, the personnel they were to evacuate were delayed in Rwanda.²¹ This small deployment, centred on one aircraft, evacuated 211 UN personnel by 11 April long before a Hercules could have arrived all the way from Canada.²² The re-allocation of the aircraft already overseas allowed for the use of assets where the need was greatest.



Concurrently, ATG decided that it was too risky to conduct the evacuation with a single aircraft, as serviceability issues or damage from small-arms fire could ground the aircraft.²³ As well, the Hercules required four hours for each round trip, and it was unsafe to land in Kigali at night, so one aircraft meant a maximum of two flights per day.²⁴ The Canadian Forces (CF) augmented the small detachment with one additional Hercules and crew, plus command and support personnel. The two CMS Hercules and three CMS-qualified aircrews with all necessary support personnel were in place in Nairobi on 13 April.²⁵ French troops secured the Kigali airport on 9 April, permitting the operation of Belgian and Canadian airlift assets in a reduced-threat environment. Once a truce was agreed to, the civilians were quickly evacuated on 12 April.²⁶ The Belgian government then pulled out its contingent, reducing UNAMIR from 2,539 military personnel on 22 March to 1,705 by 19 April.²⁷ The evacuation of personnel meant that relief supplies could only be brought in to UNAMIR on a "non-interference basis" with the primary evacuation mission.²⁸ UNAMIR would become a priority immediately after the evacuation, as the mission had as little as 12 days' worth of food and water supplies at minimum rations.²⁹

Over the course of the genocide, UNAMIR was essential for the eventual de-escalation of the crisis. Dallaire and his staff did everything in their power to inform the media and the international community of the events in Rwanda.³⁰ UNAMIR blocked convoys—when they could—to allow refugees time to escape from advancing militia and RGF troops, which in Dallaire's estimation, saved upwards of 10,000 people.³¹ UNAMIR provided necessary security at the airport for medical evacuations³² and was the initial supporting force to direct aid to the millions of refugees displaced by the massacres. Most importantly, it provided a UN presence and acted as an intermediary between the warring factions by maintaining lines of communications. These activities provided a limited international response that was crucial when an expanded mission was authorized in June. The role of UNAMIR as witness, informer and refugee coordinator required airlift support in order to remain in theatre.

As the violence continued unabated, the UN Security Council decided on 21 April to reduce UNAMIR to approximately 270 personnel, and the ALCE was tasked to support the withdrawal of approximately 1,300 peacekeepers.³³ As the ALCE was due to depart when the reduction of UNAMIR was complete, MGen Dallaire made a request to Vice-Admiral Lawrence Murray, the Canadian Deputy Chief of the Defence Staff, to keep the Canadian airlift in Nairobi, as no other nation was assisting UNAMIR and insurance for UN-chartered aircraft was in danger of being withdrawn.³⁴ The Prime Minister of Canada, Jean Chretien, approved the continued support of the Canadian airlift, and the continuation of the mission was communicated to the ALCE on 22 April.³⁵ It appears that the presence of a Canadian commander on the ground in Rwanda translated into action by the Canadian government to support UNAMIR as a way to prove Canada could lead UN missions. This was very welcome news for UNAMIR, as the UN-chartered flights were mostly cancelled after 24 May due to the continuing insurance problems as a direct result of violence near the airport. The Canadian Hercules was a reliable form of support that would continue to promote Canadian and UN objectives.

On 22 April, the evacuation of troops escalated. The Canadian ALCE flew five missions and evacuated 374 passengers followed by another four missions and 353 passengers the next day. This amounted to half of the evacuation of peacekeepers, as approximately 1,300 military personnel left Rwanda after the Security Council decision. At least one of the flights exceeded the seat count of a Hercules, but the Bangladeshi soldiers were told to sit back-to-back, and cargo straps were used around rows of soldiers to keep them as safe as possible during take-off and landing. This procedure was authorized at the outset of the evacuation and remains an important capability of the Hercules, which can carry cargo loads one way and passengers the other, by varying the internal configuration of the aircraft as needed. The flexibility of the cargo area meant that Canadian evacuation objectives and UN support objectives could be carried out on the same round trip.

The ALCE used both Hercules to maximum effect prior to reducing the detachment back down to one aircraft, as per the direction from ATG.³⁹ Two factors were at work. First, the airlift in Ancona was without a serviceable aircraft and there was pressure to restart the airlift into Sarajevo, so an aircraft from Nairobi needed to return to that theatre.⁴⁰ Second, UNAMIR had been reduced to such a small size that two aircraft would not be fully employed.⁴¹ Therefore, on 1 May, the second Hercules departed Nairobi for Ancona and left a detachment of 41 Canadian personnel to support UNAMIR.⁴² The smaller ALCE remained sufficient for the basic needs of UNAMIR.

The situation in Kigali worsened. On 3 May, UNAMIR reported that two Ghanian peacekeepers were injured and required medical evacuation. During the evacuation the next day, a mortar round landed 800 metres from the aircraft, and UNAMIR Headquarters took small-arms fire. The aircrew reported being fired upon but was able to take on a third injured soldier and depart safely. Dallaire closed the airport due to the incident, and that ended any further discussion on insurance for UN-chartered aircraft, as the risks were deemed too high for civilian operations. The airport would not reopen to civilian aircraft until well after the genocide and civil war were concluded on 18 July.

The Canadian ALCE had practically become the sole lifeline for UNAMIR on 24 April, but as of 5 May, the deteriorating situation at the airfield meant that the Canadians had to go it alone. The initial evacuation of civilians and military had demonstrated an important aspect of airlift, but it was an aspect that was conducted by both military and civilian transport aircraft. The increasing fighting around the airport made the use of civilian aircraft too dangerous, and the UN knew that it had to rely on military transport aircraft after 5 May. The inability of civilian aircraft to land in Rwanda demonstrated that there are some missions that can be supported only by tactical military transport aircraft.

THE CANADIAN ALCE HAD PRACTICALLY BECOME THE SOLE LIFELINE FOR UNAMIR ON 24 APRIL, BUT AS OF 5 MAY, THE DETERIORATING SITUATION AT THE AIRFIELD MEANT THAT THE CANADIANS HAD TO GO IT ALONE.

A SMALL TACTICAL AIRLIFT IN A DANGEROUS AREA

Transport aircraft, military or not, assist an operation with the delivery of supplies, personnel transfers and medical evacuations. The military tactical airlift was able to provide support despite the risks both in the air and on the ground. The risks involved were managed by both the ALCE and UNAMIR, which had effective procedures to allow the Hercules to land and depart relatively safely, despite the fact that the airport was in the middle of the battle area. These procedures were necessary to allow for continued airlift, as the UNAMIR mission was essential to ongoing communications between the UN and the warring factions. The airlift was a critical component of the continued ability of UNAMIR to operate in Rwanda, and multiple sources make it clear that without the airlift, UNAMIR would have had to withdraw in May or June. 46

The primary requirement of UNAMIR from the ALCE was the transport of food, water and supplies. As there were 400–500 personnel to support at any given time, it might appear that one aircraft was insufficient. However, the aircraft was rarely used to its full capacity. Problems were encountered with the UN logistics resupply efforts shortly after the airlift commenced; cargo capacity exceeded the supplies provided, and logistics problems continued until July. Compounding these



difficulties was customs in Nairobi, which required days to clear loads from outside the country for distribution to Kigali.⁴⁸ The problem of acquiring loads for UNAMIR became a regular entry in ALCE situation reports (SITREPs) and was not resolved while Canada was the only airlift detachment supporting the UN operation. This meant that the ALCE of one aircraft and two crews was sufficient for the task assigned, even though UNAMIR required more supplies than were available to airlift. Had the UN been more efficient, the requirement for a second aircraft could have been revisited.

The ALCE planned to fly two missions into Kigali every day. However, many of these were cancelled due to heavy fighting around the airport. Each flight could carry 25,000 pounds (lbs) or 11,340 kilograms (kg) of freight and up to 12 passengers, both in and then out of Kigali, which was a total capability of 50,000 lbs [22,680 kg] and 24 passengers. ⁴⁹ In the month of May, 26 flights were flown with an average of 19,260 lbs [8,736 kg] and 15 passengers, which includes all the freight and passengers returning to Nairobi. The aircraft was not used as often as it could have been flown. The limitation, however, was not the airlift; it was the airport availability in Kigali and the loads available from the UN for distribution to Kigali. However, the basic needs of UNAMIR were met by the available airlift.

Dallaire reopened the Kigali airport on 7 May, and the aircraft operated under heightened risk, as the people around the city continued to be ravaged by the massacres. Roving death squads made it difficult for UNAMIR troops to move from the stadium to the airport to provide convoy security. Aircrews reported hundreds if not thousands of bodies floating down the Nyabarongo River during flights to Kigali. As the airport was heavily mined, movement was restricted to paved areas. The importance of this restriction was demonstrated when a dog running in the open area between a runway and taxiway was killed by a mine on 31 July. ⁵⁰ At the end of July, when Canadian military

personnel reopened the air traffic control tower, they found chunks of flesh all over the walls and puddles of dried blood from one of the battles in May.⁵¹ Through May and into June, Dallaire and the Secretary-General of the UN knew the scope of the tragedy, but there was a strategic failure in obtaining sufficient action from the Security Council.⁵²

In early May, MGen Kagame's RPF had taken the high ground around Kigali and systemically shelled RGF positions throughout the city, avoiding a direct fight against a numerically superior foe. Kagame's plan was to tie up as many RGF troops as he could in Kigali while his troops slowly won and methodically took control of the country.⁵³ While the massacres continued in the interim, he was willing to take the time necessary for a complete victory. He believed that the only way to lasting peace was for total victory over the RGF troops and a new government, despite the cost he knew his fellow Tutsis would suffer.⁵⁴ The result of the shelling from the RPF and the military reprisals from the RGF meant that approval had to be received from both sides for Canadian aircraft to land, otherwise the risk to the crew and aircraft was too high.

Flight approval from both factions did not eliminate the threat to the aircraft while arriving or departing the area. The aircrew used a combination of tactics to minimize the risk. One tactic was to approach the airport at high level and conduct a steep approach to the runway, but this technique left the crew open to the dangerous potential threat of SAMs, as the CMS was not effective at slow speeds. Another tactic was to approach at low level and high speed. The advantage of this tactic was that it minimized the threat from the handheld missiles, but it did put the crew in range of small-arms fire. The high speed and very low altitude—sometimes lower than 200 feet (61 metres) above the ground—made it very difficult to target the aircraft. Whichever tactic was taken, it was combined with varying routes in and out for reduced predictability.

The tactics worked. Handheld missiles were not used after the 6 April incident, which suggested that the warring factions were not willing to alienate the international community by destroying a UN-employed transport aircraft. Small arms were used against the airlift, but how frequently remains unknown. So Only one bullet hit a Hercules during the airlift. That bullet was discovered on 24 May. It had hit a spar on the wing, but testing indicated that the structure was sound. Flying resumed with crews confident that random bullets would not cripple the aircraft, and the crews had classified tactics they could use against sustained small-arms fire. Despite the threat posed by violent and angry personnel on the ground, the tactics that had been developed by ATG were used successfully and avoided injuries and accidents.

Safety in flight is important, but transport aircraft are most vulnerable on the ground when loading and unloading takes place. In Rwanda, only one aircraft was on the ramp at Kigali airport at any given time during the genocide, and this benefit was exploited by the Canadian crews. Crews used a combat offloading technique to quickly deposit pallets of cargo on the ground without the use of forklifts or any outside equipment or assistance.⁶¹ The aircraft would stop briefly, release the locks holding in one pallet, and then release the brakes and accelerate, which would launch the pallet off the ramp of the Hercules so that it could land upright on the tarmac. There were up to four pallets on board, but each pallet could be dispatched in seconds. Once the aircraft was empty, UNAMIR could board personnel, and a forklift could load the outgoing cargo pallets. From the moment the aircraft touched down until the time it took off, only eight minutes would elapse on a typical mission using this technique.⁶² The engines would remain running, and the aircraft was nearly always in motion. The fast turnaround times allowed the warring factions little time to target and damage the aircraft.

Eight minutes, however, was still a long time on the ground when an aircraft was at its most vulnerable. On 5 June, despite clearance from both sides for the aircraft to land, elements of the RGF fired a mortar at the Hercules as it was offloading. The aircraft aborted the offloading sequence and taxied for an immediate departure. As the Hercules was on its take-off roll, a second round landed exactly where the aircraft had stopped. Dallaire witnessed the event and knew that the aircraft had been the target, so he shut down the airport to further flights.⁶³ The closure of the airport created a dangerous phase for UNAMIR, as the airport would remain unsafe for a month and another route for supplies needed to be found.

As the RPF continued its advance throughout the rest of Rwanda, desperation was becoming evident in the actions of the RGF. Furthermore, the airport would remain closed until after the RPF captured the airport and city on 4 July. The ALCE had previously devised a plan to use Entebbe, Uganda, in the event the airport in Kigali proved too dangerous. Supplies for UNAMIR were always desperately short, so the ALCE flights commenced into Entebbe the day after the mortar incident. UNAMIR had no alternative but to organize a convoy of trucks to pick up the supplies and drive them into Kigali. The first supplies arrived at the UNAMIR compound on 8 June, and the new convoy route was established, although this increased the reaction time from logistical requirement to delivery.

ONCE THE FIGHTING WAS OVER, THE WORLD RESPONDED TO THE MASSIVE REFUGEE CRISIS AS STARVATION AND DISEASE BECAME RAMPANT, BUT EVEN THEN THE ACTUAL ARRIVAL OF TROOPS TOOK TIME.

The Kigali airport did not reopen to Canadian crews until 6 July after the RPF had consolidated control of the airport and surrounding area and provided approval. ⁶⁷ However, an exception was made in the interim for medical evacuations, and one such mission took place into Kigali on 17 June. ⁶⁸ A rocket-propelled grenade had been deliberately fired by RGF troops at UNAMIR troops, and two peacekeepers had been injured. One died before the Hercules arrived, but the other survived. It was incidents such as this that were of massive significance to the troops under Dallaire's command. It was one thing to put one's life on the line for the mission, but quite another if there was no way to get one to qualified medical care. This type of mission was a critical component of the ALCE's overall offering to UNAMIR, and there was always a flight crew on standby to support medical evacuations. ⁶⁹

Apart from supplies, the airlift brought in replacement personnel and facilitated contingent rotations of troops, which were necessary to the long-term commitment of UNAMIR. As the aircraft were flying back and forth regardless, UNAMIR was able to take advantage and send overworked staff to Nairobi to give personnel a much-needed three-day rest. The supply flights also allowed for dignitaries and high-ranking individuals to go to Kigali to see the horrors themselves. Vice-Admiral Murray and the Deputy Minister of National Defence, Robert Fowler, were two such visitors who determined "Kigali [was] in dire need of food and medical supplies." Their visit was critical to decisions, such as the amount of Canadian airlift required for the planned June expansion of UNAMIR. The communication provided by transport aircraft missions was a critical component throughout the crisis.

Some missions were special to all involved. UNAMIR and the ALCE coordinated with international organizations, and they made arrangements for 31 children to be evacuated to Paris. The children were successfully evacuated on 4 June, but they had to wait six hours on the aircraft in Nairobi because customs would not allow them on Kenyan soil and the French had timed their flight to arrive in Paris at noon to maximize media exposure. Nations other than Canada were not yet cognizant of the massive scope of the unfolding disaster, and France appeared to be looking for ways to highlight a good deed with limited involvement. Still, at least an international focus on Rwanda had started.

On 17 May, the UN Security Council authorized a massive increase of up to 5,500 peacekeepers for Rwanda, but the resolution was gutted by an American demand that observers be sent first and a ceasefire brokered, which the RPF would not endorse.⁷³ Over the following weeks, it appeared as if those American requirements would disappear due to increased international pressure, so the Canadian government sent a second Hercules and a third crew on 17 June to assist with the build-up.⁷⁴ However, France decided to launch its own peace-enforcement mission into one corner of the country, and that delayed the expansion of UNAMIR, as the UN waited to see if that mission would be sufficient to resolve the violence.⁷⁵

The build-up was again delayed, so the Canadian second Hercules was sent home on 2 July.⁷⁶ The French mission secured the southwest corner of Rwanda but was at odds with UNAMIR due to past French support of the RGF, which infuriated the RPF.⁷⁷ This complicated the situation until the RPF secured Kigali on 4 July, when UN discussions began in earnest to assist with the expanding humanitarian emergency.⁷⁸ MGen Kagame and the RPF secured total victory of Rwanda on 18 July, but the cost of the victory was extraordinary. The Secretary-General of the UN summarized the situation in early August:

The protracted violence in Rwanda has created an almost unprecedented humanitarian crisis. Of a total population of approximately 7 million, as many as 500,000 people have been killed [later upgraded to a minimum of 800,000], 3 million displaced internally and more than 2 million have fled to neighbouring countries. Although the flight of people seems to have slowed, the situation remains volatile and extremely fluid. Of particular concern is the possibility of another massive outflow from the humanitarian protected zone in south-west Rwanda when the French forces withdraw.⁷⁹

Once the fighting was over, the world responded to the massive refugee crisis as starvation and disease became rampant, but even then the actual arrival of troops took time. It was not until 31 July that the expansion of UNAMIR finally started en masse, and on 1 August, the Kigali airport was opened to civilian flights. Nearly four months after the beginning of the crisis, the world had arrived. UNAMIR expanded to 5,500 troops with the new name UNAMIR II and was tasked with taking the lead on the humanitarian response, assisting refugees until October when the mission was deemed to be no longer required. The ALCE continued right until the end of September and completed the mission with a total of 312 flights, 5,871,200 lbs [2,663,131.5 kg] of cargo delivered and 6,340 passengers carried. Despite the importance of the initial evacuation and the assistance to the refugee crisis, the most important contribution of the Canadian effort was the airlift during the genocide.

THE CANADIAN AIRLIFT IN CONTEXT

The Canadian airlift was the sole lifeline of UNAMIR from 24 April until 31 July. During that time, the ALCE flew 137 flights and transported 2,357,500 lbs [1,069,344 kg] of cargo and 2,409 passengers.⁸² For most of the period, there was only one aircraft assigned to the detachment.

Without this support, one can conclude that UNAMIR would not have been able to remain in Rwanda. The factors involved in national decisions on Rwanda bear scrutiny to gather insight on the lack of support initially provided by most first-world nations. Given the likelihood of a similar situation arising in the future, the employment of a small ALCE along the lines of the one employed in Rwanda or an enhanced capability using current resources should be examined.

Given all that the Canadian airlift in Rwanda accomplished, it would be easy to exaggerate Canada's role. The mission was initiated to evacuate Canadians and Belgians from Rwanda, and it was only when it was realized that no one else was staying to support UNAMIR, coupled with a direct request from MGen Dallaire, that Canada authorized the ALCE to remain. Even then the extensions were provided only one or two weeks at a time, allowing Cabinet and DND time to review other options.⁸³ The reality is that there were other concerns at the time, including Canadian military peacekeepers taken hostage by Serbian armed forces in the former Yugoslavia. In the opening weeks of the conflict, the hostage situation occupied more time in the House of Commons than did debate on Rwanda.⁸⁴

In addition, the government was deeply concerned about the defence budget, as it was in the process of reducing military expenses by \$2.3 billion. This concern over cost is evident in the initial faxes between DND and DFAIT, the latter making it clear that the cost of the initial deployment of the second Hercules would have to be absorbed by DND. However, the government increased aid by \$4 million on 26 April, and by that date, costs were no longer a factor in airlift decision making. In light of the ever-expanding humanitarian crisis developing in Rwanda and just outside its borders, Canada announced another \$10 million in aid to the victims on 21 July. Regardless of these factors, the number of Canadian aircraft in theatre appears to have always matched UNAMIR's basic needs, mostly due to the inability of the UN to increase the quantity of supplies available for airlift.

Outside of Africa, airlift was important to another major UN operation. So Coalition operations into the former Yugoslavia had been ongoing since 1992, and "by the end of 1993, over 345,000 Bosnians depended on air-dropped supplies for their survival. On 5 February 1994, the world was shocked to learn of the market massacre when 68 people were killed in a deliberate strike against civilians. Canada had a large contingent of troops in Bosnia, and CMS airlift resources were required in that operation as well. Due to manning concerns, as the tactical crews were heavily tasked, the compromise solution was to provide detachments to both UNAMIR and the operation in the former Yugoslavia. Both detachments were kept at one aircraft and two crews unless specific surges were required. The small detachments allowed ATG to support both operations.

Canada's participation in both operations, although small, was effective, as most nations waited far too long to get involved in Rwanda with a large commitment. In particular, the United States (US) deserves the significant criticism it has received for its delaying tactics against UNAMIR expansion. The US had taken 18 casualties in Somalia the year prior and was clearly not about to get involved in another African mission where American lives may have been at risk. At the same time, the US implemented Presidential Decision Directive 25, which reformed US policy on multilateral peace operations. This policy was used as the basis to defend American decisions not to participate in Rwanda.

What is not clear, however, is why the US took matters one step further and delayed the Security Council's ability to respond more quickly in Rwanda. Clearly, other nations on the Security Council played a role in the delays, and one of the individuals who spoke to the Security Council in order to limit the international response was the representative from the interim government

in Rwanda, which was at least passively supporting the genocide. ⁹⁷ In addition, both France and Belgium had complicated histories with Rwanda, which were also factors in the Security Council's deliberations. Belgium argued for complete withdrawal, while France ultimately initiated its own mission in one part of the country, although with the Security Council's support. ⁹⁸ The result was that UN assistance was effectively delayed until the fighting ceased.

The delay left Canada as the only country that provided airlift support to UNAMIR, but it was not the only nation that provided resources. Twenty-four nations contributed troops to UNAMIR throughout the crisis, so there was an international presence. ⁹⁹ The presence was very small in comparison to the thousands of UN and North Atlantic Treaty Organization troops in the former Yugoslavia, but it demonstrated that there was some international agreement that action needed to be taken. The effort that was expended by Canada within the small UN presence was arguably the right thing to do and is an example of a situation where Canada's interests deviate from other Western nations.

The machinations of national self-interest are impossible to accurately forecast, and it is conceivable that another Rwandan-type crisis could develop with limited international assistance. The world had changed after the Cold War, and the UN of the early 1990s was involved in missions everywhere, to varying degrees of success. 100 Since the 1990s, there has been less of a focus on UN missions by Canada, but that could change. There may be times when a crisis begins and a coalition effort is not possible due to other nations' self-interests. Canada acted alone with airlift in Rwanda in 1994 and can do so again, despite the normal procedure of operating within a coalition environment. The capabilities of tactical airlift are such that the risks—within limits—involved are manageable and—in the case of Rwanda in 1994—morally imperative. Operations conducted by the Canadian Armed Forces (CAF) should include challenging tactical-airlift missions as a strategic Canadian response to a crisis.



A review of operations conducted by CAF before and after Rwanda reveals some interesting trends. ¹⁰¹ In the 10 years preceding the Rwanda operation, the CF responded to international mission requirements with 66 operations. Of those operations, 18 involved airlift and fully 13 of those operations were conducted only with transport resources. In the 20 years since the Rwandan operation, the CF responded with 155 operations. Over this period, 23 operations (or 15 per cent) involved airlift, and 12 of these operations were conducted solely with transport resources. The air-transport capability was used in 27 per cent of CF operations between 1984 and 1994 but in only 15 per cent of the CF operations between 1994 and 2014: a reduction of nearly 50 per cent. Clearly, the trend is moving away from the Canadian use of transport aircraft in international operations.

Airlift as a Canadian capability has actually expanded since Rwanda. Within the transport community, the tactical-airlift component in 1994 stood at 30 CC130 Hercules, but 13 of those Hercules were used for domestic search and rescue, so only 17 aircraft were available for tactical missions. Of those 17 aircraft, those fitted with CMS equipment were 25 to 30 years old. Now, however, there are 17 CC130 J Model Hercules dedicated solely to tactical airlift. These new aircraft are state-of-the-art tactical aircraft that were delivered starting in 2010. In addition, Canada has five CC177 Globemaster III aircraft, fully tactically capable, for much larger loads. Tactical airlift in Canada has never been better equipped.

CONCLUSION

The horrors of Rwanda went on while the world was focused on the former Yugoslavia. However, Canada responded admirably with a small detachment of airlift and authorized it to remain throughout the genocide. This airlift was essential for UNAMIR to remain in Kigali, and UNAMIR was essential to the international effort to assist with the resulting refugee crisis. The result was a UN presence that remained within the country at all times to act as a witness to events, keep communications open between warring factions and the international community as well as coordinate the response to the refugee crisis.

The use of tactical transport aircraft in Rwanda in 1994 demonstrated the value of a Canadian military operation to UN objectives. If movement by road, rail or sea is not available, such as the situation in Rwanda, airlift is the only way to provide essential support to ongoing military operations. Food, water and medical evacuations are critical components of an ongoing military operation. An important factor for all such airlift operations is that the detachment does not need to work in a coalition environment. If the supported force is small, a detachment as small as a single CMS CC130 Hercules can prove sufficient to the requirements.

There are some conditions to operating transport aircraft into a dangerous environment. As the risk to the aircraft on the ground is so high, warring factions have to agree to allow the aircraft to land and depart safely. It is understood that not all elements of the factions will obey orders, but without the agreement, airlift will not succeed. As well, consideration needs to be given to the risk of handheld SAMs. Agreement between warring factions and a solid assumption that missiles will not be used represent the minimum requirements for successful tactical airlift.

The tactical-airlift capability in Canada is newer and larger than in 1994, but it has been used less regularly since that time. Given that the overall operational tempo of CAF has not decreased, that suggests a change in approach to crisis resolution that does not appear to take into account the success that airlift achieved in 1994. Recent and ongoing air operations have used detachments of CF188 Hornets (fighter-bomber aircraft conducting bombing missions), but will a review of those

operations demonstrate a success such as, arguably, the airlift detachment in Rwanda in 1994? Before a definitive answer is reached, the Canadian tactical-airlift community needs to be used more often with the objective of recapturing the type of effect achieved in Rwanda.

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ABBREVIATIONS

ALCE Air Lift Command Element

ATG Air Transport Group

CAF Canadian Armed Forces

CF Canadian Forces

CMS countermeasures system

DFAIT Department of Foreign Affairs and International Trade

DHH Directorate of History and HeritageDND Department of National Defence

DOBIS A database used by the National Library of Canada

kg kilogram
lbs pounds
MGen major-general
Op operation

RDP Rwanda Documents Project
RGF Rwandan Government Forces
RPF Rwandan Patriotic Front
SAM surface-to-air missile

SITREP situation report
UN United Nations

UNAMIR United Nations Assistance Mission in Rwanda

US United States

NOTES

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- 16. This author, a navigator, was one of those crewmembers with the required training, deployed to Op SCOTCH in April 1994 as an operations officer and in August of 1994 as a CMS-trained crewmember.
 - 17. Op SCOTCH ATG Op Order 12 0345Z Apr 94, DHH, Major Joost Fonds, Rwanda File 2.
- 18. Letter from Andre Ouellett [Minister DFAIT] to David Collenette [Minister of National Defence], dated 9 April 1994, DHH, Major Joost Fonds, Rwanda File 1.
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 - 21. Airlift Situation Reports Op SCOTCH, SITREP 001, 10 April 1994, DHH.
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- 23. All the information for this paragraph was taken from Ibid., which contains an ATG flying schedule as of 13 2100Z Apr with details of the flights.
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- 25. Airlift Situation Reports Op SCOTCH, SITREP 005, 13 April 1994, DHH.
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- 28. Airlift Situation Reports Op SCOTCH, SITREP 011, 19 April 1994, DHH; and Airlift Situation Reports Op SCOTCH, SITREP 010, 19 April 1994, DHH.
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- 40. Email from Colonel Roeterink to author, 18 August 2015. Then Lieutenant-Colonel Roeterink was the initial ALCE commander for Op SCOTCH.
 - 41. Airlift Situation Reports Op SCOTCH, SITREP 028, 28 April 1994, DHH.
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 - 43. Airlift Situation Reports Op SCOTCH, SITREP 036, 4 May 1994, DHH.
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 - 48. Airlift Situation Reports Op SCOTCH, SITREP 024, 26 April 1994, DHH.
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 - 61. Keene, "River of Death."
 - 62. Ibid.
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 - 70. Dallaire, Shake Hands with the Devil, 335, 341 and 378.

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CHANGING WITH THE TIMES: THE EVOLUTION OF CANADA'S CP-140 AURORA



BY COLONEL IAIN HUDDLESTON

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Author's note: This article was written in collaboration with Major Ray Townsend, 405 Long Range Patrol Squadron, Deputy Long Range Patrol Detachment Commander Operation Impact Roto 0.

n October 2014, two of the Royal Canadian Air Force's (RCAF's) recently modified Block 3 CP-140M Auroras deployed to the Middle East to conduct intelligence, surveillance and reconnaissance (ISR) over Iraq in support of *Operation Impact*. Within 30 hours of the aircraft arriving in theatre, the crews, maintenance and mission support team were ready to launch their first mission—the first operational overland mission flown by the CP-140M. To date, the detachment has completed over 100 missions, cancelling only twice over a period of four months. The performance of the crews and that of the modernized sensor suite on board the aircraft have received a great deal of praise from coalition partners for the accuracy, clarity and timeliness of the resulting ISR product. Canada's Long-Range Patrol (LRP) Force and the CP-140M are paving the way for the establishment of a robust Canadian Armed Forces ISR system.

AURORA INCREMENTAL MODERNIZATION PROGRAM

The sandy landscape of the Middle East is not the traditional operating environment for the CP-140 Aurora, but over the past 10 years this long-range patrol aircraft has undergone a significant transformation and has proven itself capable of adapting to almost any situation. Originally designed for anti-submarine warfare, the Aurora Incremental Modernization Project (AIMP) and Aurora Structural Life Extension Program (ASLEP) are providing the RCAF with one of the most capable, diverse and reliable ISR platforms in the world.

AIMP was proposed in 1998 as a method to gradually upgrade the CP-140 through a series of "blocks" or phases. The approach sought to balance the requirement for a fiscally responsible way to upgrade the technology in the aircraft while minimizing the negative impact of a reduced fleet of aircraft on RCAF long-range patrol operations. An additional consideration was minimizing the personnel costs associated with any conversion training required for crew members and technicians. The pros and cons of AIMP have been debated over the years as budget pressures mounted and military priorities shifted and evolved. The program was actually halted in 2007, but it was restarted and refocused shortly thereafter. A recent commitment by the government has set the final number of upgraded aircraft at 14, an increase from the previous commitment of only 10. The 14 CP-140 aircraft will all undergo the ASLEP and AIMP modifications, allowing the LRP Force to sustain CP-140 operations until approximately 2030. Overall this is a reduction in the total number of available CP-140s, as the fleet was previously comprised of 18 Auroras and three Arcturus, a CP-140 airframe equipped with radar and communications only. This reduction is offset by a significant increase in the capability of each aircraft.

There are currently four incremental "blocks" within AIMP. Each block involves the upgrade or replacement of specific aircraft systems and sensors, with the most significant change in operational capability delivered with Block 3. Block 1 involved the replacement of a variety of legacy equipment and sub-systems, dealing primarily with critical supportability and compliance issues. Block 2 introduced a modern communications management system, including new high (HF), very high (VHF) and ultra-high (UHF) frequency radios, and satellite communications. It also upgraded navigation equipment and provided a modern cockpit which included a new autopilot and flight management system. In parallel with Block 2 but considered separately, an electro-optical infrared camera turret

was installed underneath the nose of the aircraft. This replaced the forward-looking infrared system that was almost entirely ineffective in the traditional mission set. The new Wescam MX-20 and the associated Overland Equipment Mission Suite was the first real leap in operational capability that Aurora crews had experienced.

The current block, Block 3, replaces the mission computer, the acoustics system, electronic warfare system, magnetic anomaly detector and synthetic aperture radar, providing each operator with a modern display screen, touchpad and trackball controls. This is the point at which the old CP-140 earns the "M" for Modernized, reborn as the CP-140M Aurora. Block 4, which is in the design phase at the moment, will add a high-speed beyond-line-of-sight communication system, a modern tactical data link called Link 16 and an aircraft self-defence suite.

THE AURORA INCREMENTAL

MODERNIZATION

PROJECT (AIMP) AND

AURORA STRUCTURAL LIFE

EXTENSION PROGRAM

(ASLEP) ARE PROVIDING

THE RCAF WITH ONE

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DIVERSE AND RELIABLE ISR

PLATFORMS IN THE WORLD.

ASLEP is a parallel effort to AIMP, intended to reset the structural life of the aircraft. It includes replacing the entire wing and horizontal stabilizer, and a number of additional structural problem areas are also addressed. ASLEP will add as many as 15,000 flying hours to the structural life of the aircraft, increased to 40,000 from its original 25,000 hour lifespan. This is a key factor in extending the fleet to 2030. To date, the LRP Force has received half of the Block 3 modified airframes from IMP Aerospace in Halifax, Nova Scotia, with the remainder scheduled to be modified over the next four to five years. This time-frame includes the upgrade of all 14 aircraft to the Block 4 standard.

TRANSITION TO AN OVERLAND ISR ROLE

The Aurora's introduction to the overland ISR role began in 2006 with the installation of the electro-optical infrared camera. With this, crews experienced an immediate improvement to their ability to conduct the maritime mission, primarily by being able to identify maritime vessels beyond visual range. This improved the effectiveness of the aircraft significantly across the traditional set of domestic missions including fishery patrols, northern patrols, and search and rescue operations. Training also began with ground-based units and against littoral target areas.

Extensive collaboration with Canadian and American personnel with previous experience operating unmanned aerial vehicles allowed the crews to gain insight into basic overland missions including reconnaissance, battle overwatch and convoy escort duties. The CP-140 brings significant capabilities to bear in the overland role, and the crews' experience over water has translated directly to the new mission set, with the learning curve mainly rooted in understanding how the supported ground element thinks, communicates and operates. The CP-140 can be deployed quickly, and its long endurance allows it to contribute significantly to understanding of the pattern of life in areas of interest. Compared to an unmanned aerial vehicle, the Aurora is more capable of shifting its focus "on-the-fly," benefiting both from the size and experience of its crew and also from the fact that they physically are above and still operating within the battlespace.



Since commencing overland operations in 2006, Aurora crews have been fine-tuning their abilities to utilize the electro-optical infrared camera in an operational context. Long-range patrol squadrons have supported a number of high-profile domestic security operations in the recent past such as the Vancouver 2010 Olympics, and the G8 and G20 Summits in 2010. The Block 2 Aurora had its baptism of fire on combat operations during *Operation Mobile*, the 2011 intervention in Libya. The Auroras initially operated over water, then in the littoral regions and finally over land.

And now with the Block 3 sensor suite added to the original camera capability, the aircraft is becoming even more effective. Both electronic warfare and synthetic aperture radar systems have been added to the mix in order to refine the information it is providing to ground and air elements. This evolution has created a high demand for the asset, with the Aurora recognized internationally as a platform of choice for ISR collection almost 10 years later.

THE FIRST OVERLAND SUCCESS STORIES

In 2009, the CP-140 was fitted with a high-resolution mapping camera, the Canadian-made Applanix DSS, in a belly bay originally fitted with a large format film camera system which was used for maritime reconnaissance. A two-aircraft, 60-person detachment was charged with the task of mapping the terrain of a large area of Afghanistan so that accurate maps could be created for Canadian and coalition partners. Given the high speed and endurance of the Aurora, it was ideally suited for this mission. With guidance and technical expertise from the Mapping and Charting Establishment, the Aurora and its crews completed the mapping mission in only one month of flying, mapping over 100,000 square kilometres in detail.

The ability to plug and play specialized equipment such as the mapping camera and various role-specific communication systems is testament to the versatility of the aircraft. The LRP fleet leverages the expertise in the Maritime Proving and Evaluation Unit to explore new technology to augment the standard sensor suite in support of particular missions. In addition to equipment, the size of the Aurora allows the core crew to be increased, assigning subject matter experts and liaison officers who can add value directly to the mission at hand. In 2011, *Operation Mobile* was the test

case for this approach, and such augmented crew coordination achieved great success. First steps were taken by integrating Forward Air Controllers from the British Royal Marines in order to conduct naval gunfire support missions along the shoreline of Libya. Subsequently, Canadian Joint Terminal Attack Controllers joined the CP-140 crew for overland strike coordination and attack missions during which the crew was tasked to locate and identify specific targets within designated areas of operation before coordinating fighter strike assets to engage them. Domestically, the CP-140 has often integrated Environment Canada officials into the crew. This occurred, for example, in 2014 in order to provide accurate assessments of flooding in and around Winnipeg.

As the LRP Force prepared to deploy on *Operation Impact*, the Canadian mission to Iraq that began in the fall of 2014, it was immediately apparent that the mission would be quite different from *Operation Mobile*. The strike coordination and attack missions during *Mobile* took place at a point in the operation where the battlespace was relatively well defined, the enemy had been identified and a robust coalition command and control structure established. *Operation Impact*, however, would begin with very little in place, and the aircraft and crews would immediately be over hostile territory, with no previous confidence-building period. The number of crew members with experience of *Operation Mobile* who remained in Greenwood and Comox was low, adding to the challenge of training and preparing them for this new fight. And this would be the first operational deployment of the CP-140M Block 3, with the associated support network that the new systems require being stress-tested for the first time in anger.

The Islamic State of Iraq and the Levant (ISIL) is more dispersed than forces in Libya, and given its early successes against the Iraqi security forces, ISIL forces are armed and equipped in a way that makes them almost indiscernible from allies on the ground. Also, there are no Western coalition ground elements supporting the operation, reducing overall situational awareness of the ebb and flow of the "front lines." Points of interest are, as a result, less obvious, and the enemy is well versed in the need to utilize natural defences such as darkness and cloud cover to cloak their movements.

It is in this environment, though, where the Block 3 aircraft comes into its own. Undercast cloud cover and darkness certainly ALTHOUGH THE AIRCRAFT
ITSELF HAS BEEN
DESCRIBED AS HAVING
JAMES BOND PROPERTIES,
THE SLEUTHING SKILLS OF
SHERLOCK HOLMES MORE
ACCURATELY DESCRIBE THE
WORK OF THE CREW.

still hinder ISR operations; however, the CP-140M is equipped with a multitude of sensors to collect essential information even when objects of interest are obscured by cloud. The inverse synthetic aperture radar / synthetic aperture radar enables the aircraft and crew to collect large amounts of radar data and identify vehicular movement on the ground when weather is an issue for other types of sensors. In addition, the tried and true "Mark 1 eyeball" has again proven its worth, allowing the crew to scan the horizon for breaks in the cloud and thereby providing opportunities to gather video information despite the weather. Adding modern night vision goggles to standard crew equipment has also proven to be an enabler, allowing crew members visually to cue the tactical crew and sensors to points of interest within the battlespace below and around the aircraft.

Although the aircraft itself has been described as having James Bond properties, the sleuthing skills of Sherlock Holmes more accurately describe the work of the crew. While the pilots scan the skies for breaks in the clouds and for conflicting air traffic, the tactical navigator acts as the maestro

of the sensor operators and communicators, orchestrating the simultaneous gathering of information in several formats. The information is recorded, with an initial correlation performed immediately as part of the ongoing mission. Information can be immediately transmitted to ground stations within line-of-sight of the aircraft for further processing and exploitation. All the while, crew members are manning the observer windows looking for significant activity on the ground that might merit further investigation or require the aircraft to manoeuvre for safety reasons. The observations and information recorded during each ISR mission reveal clues as to how the enemy conducts operations and what he might be planning next. The CP-140M Block 3 and crews have been persistently collecting clues since October 2014, and they are improving their investigative abilities with time.

As mentioned, the CP-140M is currently limited in that it can only transmit information in real-time to ground stations within line-of-sight of the aircraft. This results in a time delay in the passage of potentially critical information. In order to address this limitation, the Commander of the RCAF recently approved the installation of an interim Beyond-Line-of-Sight (iBLOS) VIASAT ArcLight capability on three CP-140M. This upgrade, involving among other things the installation of a new satellite antenna on the upper fuselage of the aircraft, was accomplished in record time through collaboration with key industry partners, IMP Aerospace, L3 Electronic Systems and General Dynamics Canada. Two of these aircraft have already been utilized in theatre, and the new capability has proved useful in providing near real-time information to Canadian and coalition partners. Beyond-line-of-sight capability is the capability most easily associated with what one would see in the movies if James Bond were to ask for an ISR feed. The ability for the theatre commander to see what the crew in the aircraft is seeing reduces the ambiguity of combat engagements and allows for a faster targeting process. It also enables a more dynamic tasking process which helps make the time the aircraft spends on-station more effective.

CREW TRAINING

For the first time in the history of the LRP Force, a comprehensive pre-deployment simulator-enabled training package has been developed in order to prepare crews for the operational theatre. 404 Long Range Patrol and Training Squadron and the Maritime Proving and Evaluation Unit combined forces to provide flight deck and tactical crew training in the overland mission prior to departure. Flight deck training was conducted using detailed visual simulation of the theatre operating environment in the CAE Full-Motion Flight Simulator, while tactical training took place in the new Procedural Crew Trainer (PCT) that replicates the tactical crew stations of the CP-140M. Within the PCT, 3-D targets are generated which allow Airborne Electronic Sensor Operators to operate their systems, including the electro-optical infrared camera, and the refinement of crew tactics, techniques and procedures. The advantages of simulation in this context include the ability of the simulator and training staff to inject challenging scenarios to gauge crew preparedness and to provide a detailed replay, debrief and evaluation of crew performance.

In the near future these efforts will be augmented by the arrival in Greenwood of an immersive Operational Mission Simulator (OMS). This device is more capable than the PCT and simulates the look and feel of the Aurora's tactical compartment, as well as the sensor capabilities. Operating in the OMS it is easy to lose oneself in the simulated mission—the crew is effectively transported into the area of operations, and benefits hugely from the experience gained.

DEPLOYED MISSION SUPPORT CENTRE

The long-range patrol contingent established itself for operations in theatre very quickly thanks to a robust Deployed Mission Support Centre (DMSC) and a comprehensive self-sustaining supply maintenance kit that arrived courtesy of a single CC-177 Globemaster flight. The DMSC is a

home-grown command and control capability which proved its worth during *Operation Mobile* and which has been critical to the success of CP-140M ISR operations from the outset of *Operation Impact*. Contained within two Mobile Expandable Container Configuration shelters, the DMSC houses all of the required communications, briefing, replay and exploitation equipment to support Aurora operations. The DMSC is unique to the Aurora fleet and has been designed to "plug and play" into any long-range patrol operation—over land or over water.

The LRP self-sustaining supply kit is another innovation that supports the operational readiness of the aircraft and the effectiveness of deployed maintenance crews. Given the large number of sensors and corresponding parts associated with the effective operation of the aircraft, preparing the spare parts list for a prolonged deployment can be overwhelming. The LRP maintenance community has refined the supply requirements from *Operation Mobile* for Block 3 operations and evaluated and prioritized the spare parts and tools required to support this first CP-140M deployment. As the logistical chain for aircraft parts into theatre can be cumbersome, the combination of parts and support material that was provided in the initial supply kit has mitigated delays that might have been necessary to repair aircraft. To date the detachment has lost only one mission due to unserviceability, which is testament both to preparation and planning and to the dedication of the team on the ground.

GET-WELL-PROGRAM

The RCAF has been armed with cutting-edge technology in the form of the CP-140M Block 3 Aurora. However, while AIMP and ASLEP have addressed a range of technological and structural issues, the airframe and a lot of its constituent parts are original and are, today, as much as 35 years old. The previous Commander of 1 Canadian Air Division, Major-General Pierre St-Amand, identified historical poor serviceability and spare parts availability as long-term problems for the Aurora that could undercut the advantages gained through the two upgrade programs. In order to take full advantage of the investment made, the LRP Force will need to improve the way it conducts maintenance activities.

These aren't the only problems facing the fleet, of course. The new sensors, systems and expanding mission set meant that the entire family of tactics, training and procedures had to be reviewed and revised—and in many instances created from scratch. This was a daunting challenge in and of itself, but paired with the scope and scale of the maintenance issues, it seemed truly formidable. In an effort to frame the problem in a more constructive way, these two challenges have been captured in a long-term roadmap, called the LRP Get-Well-Program (LRP GWP).

The LRP GWP has two internally focused thrusts: Thrust 1, Operationalize the CP-140M Aurora; and Thrust 2, Aviation Maintenance Renewal. A third thrust, which focuses on linking the LRP community with all of its external stakeholders, is called Thrust 3, Leadership Engagement.

Initiated in late 2013, the LRP GWP uses the concept of "incremental and early success" to motivate and drive the team forward, and over the past 18 months, these successes have been many. On the maintenance front, changes to unit mandates and manning, the adoption of civilian best practices and a more effective distribution of authority and accountability have resulted in overall fleet serviceability increasing from an average of 40% to almost 55%.

In the same time-frame, on the operational side, the approach to force development and training has been reviewed and streamlined. The CP-140M has been cleared for operations across its mission set, despite significant technical issues with the radar system in particular. Incremental improvements have stepped the aircraft forward to the point where we now stand, entirely capable of prosecuting the overland mission in Iraq. These efforts have been characterized by a renewed focus on collaboration

between the LRP Force, supporting engineering organizations in Winnipeg and Ottawa, and industry partners. This focus on collaboration is also opening doors to strengthened operational links within the RCAF and externally with the Canadian Army and Royal Canadian Navy.

FINAL WORDS

With the recent emphasis on overland operations, it would be easy to forget the traditional strength of the CP-140 in anti-submarine warfare. International exercise opportunities and local missions with the Royal Canadian Navy allow crews to hone their skills on the new Block 3 acoustics system. With vastly increased processing power, new digital sonobuoys and a colour-mapping display system, the original capabilities of the aircraft have been significantly enhanced. Crews are capable of monitoring more sonobuoy channels and have more control over the buoys once they are launched and in the water, improving the accuracy and usefulness of the acoustic data collected. Paired with the improvements in the mission simulator and other training devices, the LRP Force will be much better prepared for operational missions in the challenging and complex underwater battlespace of the future. Initial results against a variety of live submarine targets have been very encouraging—again underlining the impressive multi-role character of the new CP-140M.

While technological challenges remain, the flexibility offered by the Aurora is simply unmatched by any remotely piloted ISR platform, and the capabilities inherent to the new Block 3 rival those of any other manned ISR aircraft. The Long-Range Patrol Force is well equipped to meet future challenges. The contribution to *Operation Impact* has been a successful joint effort between the teams at 14 Wing Greenwood and 19 Wing Comox, which is commanded by Colonel Tom Dunne and where one of the two operational LRP squadrons is located. The CP-140M Block 3 Aurora is rapidly being established as the pillar upon which Canada's overall intelligence, surveillance and reconnaissance system will be built. Canadians should be proud knowing that these capabilities exist to defend the country and to contribute to its international commitments.

AUTHOR'S POSTSCRIPT

This article was originally published in the Canadian Naval Review in March 2015. Since that time the LRP Force has maintained its commitment to Operation IMPACT, now with more than 200 overland ISR missions flown. While the tactics, techniques and procedures required to effectively collect battlefield information are well developed, those focused on making best use of that information are not. The challenges include hard-to-solve issues such as communication capabilities and information-technology infrastructure, but there are also many easier-to-solve issues associated with improving the accuracy and clarity of reporting, refining RCAF targeting methodologies and further developing ISR doctrine. In order to begin addressing these issues within the RCAF, the Commander 1 Canadian Air Division directed the ISR Functional Integration Team (FIT), led by Lieutenant-Colonel Paul Johnston and myself, to develop an RCAF ISR directive, the first version, released in June 2015, is called "Spiral Zero." This directive establishes an initial framework within which the interaction between command and control elements, collection platforms, intelligence support organizations and other ISR stakeholders can be characterized. "Spiral Zero" is the first cut—meant to focus and promote discussion—and is expected to evolve as lessons are captured and learned. It has been primarily driven by the experiences of the LRP Force, and its scope must also be expanded over time to include the range of RCAF ISR capabilities. Colonel Pat Thauberger, the new Wing Commander at 14 Wing, is focused on these issues and many others. There is a lot of work to be done, but the bar is being moved forward in important, even critical, ways in support of flying in formation and improved integration across the Canadian Armed Forces.



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ABBREVIATIONS

AIMP Aurora Incremental Modernization Project

ASLEP Aurora Structural Life Extension Program

DMSC Deployed Mission Support Centre

GWP Get-Well-Program

ISIL Islamic State of Iraq and the Levant

ISR intelligence, surveillance and reconnaissance

LRP long-range patrol

OMS Operational Mission Simulator

PCT Procedural Crew Trainer

RCAF Royal Canadian Air Force

Technological Intelligence

and the Radar War in World War II

By Azriel Lorber

Introduction

here were few wars or campaigns that were decided by a single device or weapon whose absence likely would have resulted in a different outcome. One outstanding example of this was the English longbow during the Hundred Years' War. Another was the use of radar in World War II: by British in the Battle of Britain and by the Allies in the Battle of the Atlantic. A German victory in either would have had a decisive effect on the course of World War II, possibly changing its final outcome. The Battle of Britain also shows that creating or even adapting a suitable doctrine for the use of a novel weapon will maximize its benefits and make it prevail, even if said weapon is technically inferior to that of the enemy.





Some history

The idea to use reflected radio waves to detect "objects" at night or in fog was first broached by Christian Hülsmeyer, a German engineer, in 1905. He tried to interest Von Tirpitz, then the head of the Kriegsmarine (German navy), but was told that German naval personnel had better ideas. Although demonstrated successfully, Hülsmeyer never managed to garner financial interest for his invention and eventually it was forgotten.

During World War I, the Germans used Zeppelins and aircraft for bombing raids against Britain with some measure of successes. The British tried to discover the approaching attackers by means of the Observer Corps, but they could operate only during daylight. They tried acoustic detectors (which at least worked at night), but their effective range hindered their usefulness and usually the first indication of a raid was the blast of the exploding bombs.

The large strides made by aviation between the wars brought home to the British that the English Channel, which foiled both the Spanish Armada and Napoleon's troops, would no longer serve as an impassable barrier guarded by the Royal Navy. Aircraft could cross this barrier in a few minutes. This feeling was compounded by former British Prime Minister Stanley Baldwin, who in November 1932, spoke on the subject in Parliament. Among other things, he said: "I think it well also for the man in the street to realize there is no power on earth that can protect him from bombing, whatever people may tell him. The bomber will always get through The only defense is in offense, which means you have got to kill more women and children quicker than the enemy if you want to save yourself."

The followers of Douhet² (especially in the United States [US]) who supported the concept of heavy bombardment considered the speech a holy writ and Baldwin its prophet. Here was proof—and from no less a persona than a former British prime minister—that a strong bomber force will prevent war, and if war did come, then heavy bombers would quickly bring the enemy to its knees. Both in the US and England, air power advocates stressed the offensive dominance of the bomber.

The speech shook the British people to the core, but it did have an important consequence. The Royal Air Force (RAF) was leery of the strategic conclusions voiced by Baldwin. Besides, fighter aircraft were much cheaper than bombers. Maybe air defence should be investigated more thoroughly after all?

The CSSAD and the Chain-Home belt

Several exercises simulating bomber attacks were conducted against the south of England, and it turned out that even when the bombers were detected, by whatever means, and the fighters scrambled, it was almost always too late. Obviously, something better was needed, and this line of thought was probably influenced by the reestablishment of the Luftwaffe in Germany. So towards the end of 1934, the British established the Committee for the Scientific Survey of Air Defence (CSSAD)—the Tizard Committee (named after its chair, Henry Tizard). One of the ideas proposed was to use an energetic radio beam to boil the blood of the attacking airplane's crew. Preliminary calculations by Professor Robert Watson-Watt had shown immediately that current technologies were not up to the task.

However, one of Watson-Watt's assistants told him that British Broadcasting Corporation (BBC) broadcasts were often disturbed by aircraft passing near the BBC's tower. Watson-Watt put two and two together, performed several tests and obtained some money from the RAF (with the

help of Air Chief Marshal Sir Hugh Dowding, later Officer Commanding Fighter Command) for further testing. These tests were very successful. By 1937, eighteen Radio Detection and Ranging (radar) stations were constructed along the southern and south-eastern coasts of Britain. Named "Chain-Home," the system was declared operational in 1938. Their task was to give sufficient warning about the approach of enemy aircraft.

Obviously, the sooner this information reached the fighter squadrons the more time to take-off. But here the British came to a very important conclusion. The intuitive solution to this problem would have been to increase the detection range of the radars, but frequent exercises had shown that the real bottleneck was in the control and communications network in this complex battlefield. The RAF understood that collecting and sifting the information from the various radars and the Observer Corps (which was reactivated) and creating a coherent picture ("air-picture," in today's parlance) would improve battle management. Consequently, they created filter rooms at Fighter Command's headquarters (to sift and organize the incoming information); established sector stations to actually manage the battle; and laid down an extensive communications system, which enabled the flow of information between these bodies and down to the fighter airfields. It was the first modern command and control system.

Radar in Germany

The construction of the Chain-Home stations could not be hidden, and tourists from all over the world, including Germans, visited various sites, so the Luftwaffe decided to investigate. They took two Zeppelins loaded with all sorts of radio receivers and, in May 1939, sent them to cruise along the British coast. However, except for annoying "noise" in their earphones, the operators heard nothing. This was not because of equipment problems, but because of an erroneous assumption on the part of the Germans.

Germany already had its own radar, and they were more advanced than those of the British. Thus, they assumed that British radar, if indeed it was radar, operated in a range of frequencies similar to their own, namely about 400 to 600 megahertz (MHz), corresponding to wavelengths of 75 to 50 centimetres (cm), which was the peak of electronic performance at the time. What the Germans did not know or suspect (although in a properly run intelligence organization this should have been one of the first things to ascertain) was that the British radar operated at a lower frequency of 200 MHz. Such radars were less efficient in several respects but sufficed for British needs. The rather mundane reason for this was that lower frequencies enabled the use of commercial radio components—readily available and cheaper. The Germans, always striving for perfection in engineering design, could never imagine that anybody would prefer to work in a less than perfect manner.³

German problems were not limited to technology. The navy was involved in radar work from the early 1930s (because of the need to better control long-range gun fire), but told no one about this. In July 1938, Goering, head of German aviation, found out about it by accident. Understandably enraged at what he saw as a Luftwaffe sphere, he approached the navy for an explanation, but its response was that this was a naval weapon and he should invent his own.⁴

In August 1939, the Zeppelin flights were stopped, with the Germans still not sure if these were operational radars. But then the Germans made another mistake of strategic consequences. Hitler, who wanted to conquer Poland as the first step on the road east, hoped that Britain and France would not honour their pact with Poland and would not go to war against him. Still, it

should have been clear to him that if perchance the British and French chose to fight, the air arms (on both sides) would play a critical role. Therefore, if indeed the Chain-Home towers had anything to do with radar, or were part of Britain's air defence, then the current doctrine of air warfare, partially developed as lessons from the Spanish Civil War, had to be modified, or at least rethought. Since the Germans themselves had radars, this lapse in strategic thought was twice as bad. It was not obvious at the time, but the first technological intelligence battle between the RAF and the Luftwaffe ended in a resounding British victory.

To German surprise, the Allies honored their obligations to Poland, and on 3 September 1939, declared war on Germany. Two days later, the British sent a bomber force to raid the wharves at Wilhelmshafen. German radar detected the bombers at about 130 kilometres, but they had no standing organization to liaise between the radar units, the Luftwaffe command organization, and the fighter bases. The British bombed their targets and turned for home before German fighters even took off. The Germans, who thought in terms of attack, neglected defensive concepts and had not thought of the integration of detection and interception into one system.

This attack, which took place in poor weather, did not achieve much, so the British waited for another opportunity. This came on 18 December, when 22 bombers again approached Wilhelmshafen. The Germans discovered them and scrambled, though barely in time, and shot down 12 of the attackers. Another 3 crashed on landing. Following these raids, the British reached several conclusions concerning bomber operations and equipment. However, because of the slow response of the German fighters, they also concluded that the Germans did not have radar. Yet what happened on the German side was even more interesting. The details of these battles, and particularly the second one, were analysed in minute detail, mostly to confirm or reject pilots' claims about shooting down enemy planes. Everybody agreed that the interception succeeded only thanks to radar's early warning, but this conclusion was not considered important. It was somehow sidetracked and never included in German air-warfare doctrine.

The Battle of Britain

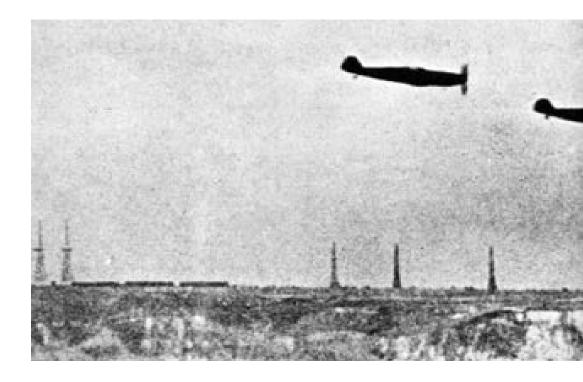
After the fall of France, Hitler decided that he had to conquer Britain to remove a future threat, but an invasion of Britain would be impossible as long as the Royal Navy, supported by the RAF, controlled the English Channel. The required first step was to eliminate the RAF Fighter Command as an effective fighting force. By then the Germans understood that the strange towers on the British coasts were indeed radars, and what's more, they listened to the conversations between the pilots and their ground controllers.

Commencement of operations against Fighter Command was set for 12 August 1940, and Goering predicted that this arm of the RAF would be destroyed in four days. It was obvious that he did not know much about the RAF. In this, he was done a disservice by the Luftwaffe's chief intelligence officer, Major Joseph Schmid. On 16 July, Schmid submitted a report about the RAF, in which he described it in all parameters as inferior to the Luftwaffe. A worse blunder was that the report did not mention radar at all. On 7 August, Schmid wrote another report in which radar was discussed but stated that British fighter planes were controlled from the ground and thus tied down to their controlling stations and limited in their mobility. He wrote: "Consequently the assembly of strong fighter forces at determined points and at short notice is not to be expected. A massed German attack on a target area can therefore count on the same conditions of light fighter opposition as in attacks on widely scattered targets." Schmid understood that radars detected the approach of enemy aircraft, but he did not understand that radar was only a part of an integrated

command and control system, which assigned assets according to need. At that time, the Germans did not have a similar organization. The lessons of the Wilhelmshafen interceptions were forgotten, and the Germans were slow to understand the existence and role of such an organization. Radar, the focal point of this system, served as a "force multiplier" because it enabled the controllers to direct the fighters to the approaching German formations and prevented day-long patrols, saving wear and tear of both aircraft and pilots.

Schmid was hampered by his own inadequacies. He was not a pilot and did not speak any language except German; his previous career was with the ground forces. (His counterpart on the British side was an air commodore, equivalent to a brigadier-general.) Furthermore, in all of his reports, he badly underestimated British aircraft strength and production capabilities. ¹⁰ His lowly rank may point to the rather low esteem the Germans held for intelligence work and to their limited expectations as to the quality of information which could be obtained from it.

Luftwaffe attacks on 12 August focused primarily on Fighter Command's airfields in order to destroy ground facilities and airplanes on the ground. On the first day, the Germans also attacked four radar stations. Three were lightly damaged, and one was destroyed. The Germans soon discovered that those towers were hard to destroy but did not suspect that the huts scattered around the towers were important, as the radar equipment, operators, and electrical generators were housed in them. In order to save money, the aviation ministry had this critical equipment housed in simple above-ground huts. The same applied to the sector stations. A German change of tactics, for example, switching to carpet bombing, could have wiped out the whole British air-defence system in one morning. German thoroughness probably assumed that the "real" equipment was underground, under 10 feet [3 metres] of concrete (at least they would have done it that way) and that those huts were dining and storage facilities, not worth the price of the bombs. This highlights the mistake of projecting one's own thought processes and operating procedures onto the enemy.



The British also used some deception by activating a dummy transmitter at the destroyed station. ¹² It could not receive anything, but the Germans did not know this. Goering's conclusion was that the effort invested in destroying the radar stations was wasted. At a meeting after the first day's operations, attended by Schmid as well as Colonel Paul Deichman, chief of staff within Air Fleet II which ran the campaign, Goering said that the attacks against the radar stations did not put them out of action. Schmid added that these radar stations were not important. But Deichman, who should have known better, ¹³ said: "Leave the British their radar. It will enable them to find our fighter formations, who will thereupon destroy them." ¹⁴ Consequently, attacks against the radar stations were stopped. This was an enormous blunder, and it can be said that on that day, Germany lost the Battle of Britain and, by projection, perhaps the war.

The Germans were not alone in not understanding radar. The American military got interested in a radar-based command and control system only after the Battle of Britain. The fact that the British did not talk much on the subject contributed to this lack of interest. The American failure is emphasized by the fact that the navy's research department had worked on the subject of radar since 1922, with its first radar development project initiated in 1930. 16

The Battle of Britain kept raging through the summer and German losses increased. When a German airplane was shot down, its crew—if it survived—was captured. A downed British pilot, if unharmed, could go back to flying on the same day. After a mission, the Germans still had a long flight home, sometimes in damaged aircraft with wounded crew members. German fighter pilots often ditched in the English Channel for lack of fuel, and although the German air-sea rescue service was most efficient and pulled most of these pilots out, this still was a traumatic experience.¹⁷



During August and at the beginning of September, a change in pilots' reports after returning from missions was evident. Contrary to pre-mission intelligence briefings, which claimed that the RAF was launching its last aircraft, the pilots reported that they did not think that the enemy was seriously hurt. The decisive day was 15 September, with both sides making an all-out effort. Churchill, on a visit to Fighter Command, was told that no reserves were left.

Although German losses were higher than those of the British, the British, too, had serious problems. The pilots were exhausted from the relentless fighting, and the replacements were not adequately trained. Also, because of the incessant bombing, the critical air-defence telephone network was nearing collapse. But then Hitler made another mistake.

A few days earlier, a German bomber made a navigational error at night and bombed London; the RAF retaliated and bombed Berlin. The damage was insignificant, but an enraged Hitler ordered Luftwaffe attacks switched from Fighter Command's airfields to London. The German leadership had no idea of Fighter Command's sorry state, and the sloppy management of the Luftwaffe's intelligence, headed by Schmid, prevented it from getting the real picture.

In the end, the Germans blinked first. Switching the attacks to London gave Fighter Command the breather it needed, as veteran pilots rested, new ones gained experience, and the communications system was repaired. The Chain-Home system enabled Fighter Command to keep its head above water long enough to stop the German onslaught, but the German problems with radar had not ended.

The centimetric radar

Radar of that period operated in the frequency ranges of 200 to 600 MHz, namely wavelengths of 150 cm to 50 cm. It was understood that radars operating in higher frequencies, of about 3,000 MHz [9.99 cm], were better. They required smaller antennas, enabled better resolution of targets, and generally were more efficient. These frequencies could be achieved, but such devices provided only 40 watts of power, much too low for radar. Furthermore, initial calculations convinced the Germans that at these high frequencies, much of the transmitted energy would be reflected in all directions and not enough would return to the receiver, and receiving this reflected energy is, after all, the essence of radar. Arguments in Germany about this topic became emotional, leading to the disruption of orderly work to such an extent that in mid-January 1943, an order was issued to stop forthwith all work on centimetric wavelength radars. In the continuous continuo

The British knew nothing of this German debate. Three years earlier, at the beginning of 1940, two University of Birmingham scientists developed a simple device, partially based on previous American ideas, which worked at the centimetrric range. This was the cavity magnetron which, during the first tests, produced hundreds of watts of power. After some tweaking, there emerged a practical system producing 12 to 15 kilowatts at a wavelength of 9.5 cm.²⁰

The British knew that due to lack of resources they would not be able to mass produce these systems. At the end of August 1940, a British delegation went to the US to discuss scientific and technological cooperation and to ask the Americans for help in finalizing the development and starting production of some of the advanced technologies they possessed. Churchill personally directed that the most advanced technologies be shown to the Americans without any restraints and without asking for quid pro quo. This delegation was headed by Henry Tizard, of CSSAD fame. The Americans showed polite interest in the British developments but were "shaken" by the cavity magnetron. They quickly got organized for further research in this field and for production of these radars for the British.

A centimetric radar was first tested in flight in March 1941, and it was found that it could distinguish ground features such as rivers, towns, and even roads, and do so even through cloud cover. It was quickly understood that this would immensely help night bomber crews who groped their way in the darkness in German skies, especially when flying above the clouds.

The new radar also proved efficient for discovering submarines. Older type radar was already used in this role, but the Germans discovered it in a captured airplane and developed the "Metox" receiver to detect this radar's broadcasts. Here was a new technology, which the Germans believed was impossible to achieve and were not set to detect when they lucked into finding one. This would enable the sub-hunting aircraft potentially months of success without the submarines being the wiser.

British turf wars: Coastal Command vs Bomber Command

A new debate ensued immediately over who was to get the new radars. Night fighters, flying against German bombers, were the first to receive them, but these quantities were small. The real dispute was between Bomber Command, which wanted better means for bombing its targets, and Coastal Command which was in charge of fighting the submarines. Coastal Command had a convincing argument. Since bombers had a tendency to be shot down in enemy territory, the new technology would quickly be handed to the Germans on a silver platter.

Watson-Watt, considered to be the "father of British radar," supported Bomber Command's claims but was astute enough to warn that if such radar fell into German hands it would take them only a month or two to develop some countermeasure. Air Chief Marshal Arthur Harris, in charge of Bomber Command, was not interested in any of this. He wanted to bomb Germany and would not listen to other considerations, even if they affected the conduct of the war as a whole. Churchill, who also passionately hated the Nazis, was convinced by Harris. Towards the end of 1942, Bomber Command started getting the new radars, and at the beginning of 1943, so-equipped aircraft were released to fly over enemy territory. On 2 February 1943, one such bomber was brought down near Rotterdam in Holland. The apparatus was damaged, but the heart of the new radar, machined from a solid piece of copper, survived.

The Germans and the centimetric radar

The radar was taken to a laboratory, and the scientists examined the gift that had fallen from heaven and into their laps. They quickly understood what it was and what were the technical capabilities of the novel device. But instead of being happy, they were struck by gloom. Goering expressed the reasons for this in the best way. "I expected the British and Americans to be advanced, but frankly I never thought that they would get so far ahead. I did hope that even if we were behind, we could at least be in the same race."²³

Here "Lady Luck" intervened in a most bizarre fashion: this radar was captured by the Luftwaffe, but for a long time, the Luftwaffe did not bother telling the German navy about this astonishing find; thus, the navy found about it only in September. This failure was summarized by two American navy researchers. "How this six months' delay occurred is one of the mysteries of the war and a significant factor in the U-boat war (it can perhaps be explained only by a criminal lack of liaison between the German air and naval technical staffs)."²⁴

Finally, several months after Bomber Command, Coastal Command also got its radar. Equipped with an "undetectable" radar, it went after the submarines with a vengeance, and the

growing list of submarines lost started causing consternation in the German navy's high command. Still, even after the navy was apprised of the new radar, it took several months of work to come up with a warning receiver, the "Naxos," for this wavelength and, because of haste, the Naxos' production and installation into the submarines were shoddy. Luck again played a role. When a German radar experimentation team went on a submarine patrol, the submarine was sunk and the team captured.²⁵

The range of these radars was fairly short—several kilometres—but the Germans were never able to ascertain what the detection range was. Once the submarines cleared the Bay of Biscay, the British had difficulty following them. However, two other devices came into play. One was by triangulation of the sources of radio transmissions by means of receiving stations on land or at sea. This was called high frequency direction finding (HF/DF) and often the HF/DF triangulations were combined with Enigma (the code name given to a German coding device) decrypts (the information gleaned from this source was code-named Ultra). The Germans eventually suspected that the locations of their submarines were linked to radio transmissions, but in their ocean-spanning operations, they could not stop using radio. They tried to tighten security by shortening transmission times, changing frequencies, and similar measures, but the Allies needed only approximate positions and the radar did the rest. Ironically, on one occasion, the Germans shot themselves in the foot. German agents in Spain took photographs of British ships in Gibraltar which had the peculiar looking HF/DF antennas on top of the masts, and these photos were to be included in ship recognition books. But an overzealous German security officer painted out the background of the photos, which, together with the tell-tale antennas, might have disclosed their origin.

The increasing losses convinced the Germans that Allied radars had almost mythical capabilities, which enabled them to detect submarines at very long distances in the vast reaches of the ocean. Thus, the centimetric radar did one more service to the Allied cause: the shock of its discovery and the Germans' preoccupation with its performance helped screen the Ultra secret.

Conclusions

Both the Battle of Britain and the Battle of the Atlantic were pivotal campaigns in World War II. A defeat in either could have spelled a total defeat or withdrawal from the war for Britain; the possible defeat of the Soviet Union; and an American return to isolationism, at least until a Japanese attack. Not belittling the dedication and sacrifice of the "few," the outcomes of both of these campaigns and particularly the Battle of Britain were decided by the use of radar.

Germany had an initial lead in radar technology, and the British erred by refusing to accept German possession of it. The initial British blunder with centimetric radar allocations was mitigated by German inefficient handling of technological innovation; in essence, an organizational problem. However, the British perceived that reaping the benefits of novel technologies (whether homegrown or acquired) requires understanding their battlefield potential and the creation of suitable doctrinal and organizational frameworks for their efficient exploitation and improvements. By neglecting to grasp these imperatives, compounded by poor intelligence work, Germany failed to translate its technological lead to a long-lasting operational superiority.

Truly, as author Robert Buderi emphasizes, radar is "the invention that changed the world." ²⁹

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Abbreviations

BBC British Broadcasting Corporation

cm centimetre

CSSAD Committee for the Scientific Survey of Air Defence

HF/DF high frequency direction finding

MHz megahertz

RAF Royal Air Force

US United States

Notes

- 1. Eugene M. Emme, ed., *The Impact of Air Power: National Security and World Politics* (Princeton, New Jersey: Van Nostrand Company, 1959), 51–52.
- 2. Giulio Douhet was an Italian officer and thinker who claimed that in a future war the issue could be quickly decided by air power, particularly bombers, without repeating the horrors of World War I's trench warfare.
- 3. When captured Soviet tanks were first exhibited to Hitler, he commented that they could be no good "because the standard of finish was terrible, and that no one who was doing a decent job would leave his work in that state." R. V. Jones, *The Wizard War: British Scientific Intelligence 1939–1945* (New York: Cowan, McCann & Geoghegan, 1978), 333. We know, of course, that where it mattered, Soviet tanks were well made. It appears that German engineers, in all fields, did not understand where to save effort without compromising performance.
- 4. Louis Brown, *A Radar History of World War II: Technical and Military Imperatives* (Bristol, United Kingdom: Institute of Physics Publishing), 1999, 78.
- 5. Alan Beyerchen, "From Radio to Radar," in *Military Innovation in the Interwar Period*, eds. Williamson Murray and Allan Millett (Cambridge, United Kingdom: Cambridge University Press, 1996), 276. Even in the face of irrefutable evidence, the British held steadfastly to the erroneous notion that they were the sole possessors of radar technology. Luckily for them this mistake did not affect the coming battle.

- 6. Stephen Budiansky, Air Power: The Men, Machines, and Ideas that Revolutionized War, from Kitty Hawk to Iraq (New York: Penguin Books, 2005), 235.
- 7. The literature gives conflicting information about the man's rank and even the spelling of his name, but there is no doubt of his meteoric advancement. Derek Wood and Derek Dempster, *The Narrow Margin: The Battle of Britain & The Rise of Air Power 1930–1940* (New York: Paperback Library, 1969), 90, write that in 1938, when he became chief of Luftwaffe intelligence branch, Schmid was a major. Budiansky, *Air Power*, 220, writes that Schmid was a colonel, still somewhat low for that position. After a stint in North Africa as an armoured division commander, he was extricated from Tunisia on Goering's order and made the commander of the German night-fighters arm. In *Hitler's Blitzbomber* (Maxwell Air Force Base: Air University Documentary Research Study, 1951), 39, Eugene M. Emme states Schmid's rank in that position as *generalleutnant*, which even in time of war was a fast promotion track.
 - 8. Wood and Dempster, The Narrow Margin, 95-99.
 - 9. Ibid., 103.
 - 10. Richard Overy, The Battle (New York: Penguin Books, 2000), 126.
 - 11. Peter Townsend, Duel of Eagles (New York: Simon and Schuster, 1970), 333.
 - 12. Ibid., 313.
- 13. Deichman flew as an observer in World War I and was trained as a pilot in the Soviet Union during the period of cooperation between the Soviets and the Weimar Republic.
- 14. Townsend, *Duel of Eagles*, 333. Even if we disregard the typical military overconfidence and conceit, Deichman made a basic mistake. He should have known that when fighting on a wide front the attacker has the advantage of choosing the point of attack and being able to amass his forces at the *schwerpunkt* (centre of gravity) as Clausewitz called it. The defender does not have this privilege and has to spread his forces along the whole front. Radar, and the attendant control system, enabled the British to concentrate their meager forces where the Germans intended to attack and somewhat redress the balance of forces. If the Germans were looking for a sporting event, it was simpler to broadcast to the British the location and time of the next attack, but as a military move, this was contrary to the principles of war, particularly surprise and dispersal of enemy forces. Again, Clausewitzian concepts.
- 15. Thomas G. Mahnken, *Uncovering Ways of War: U.S. Intelligence and Foreign Military Innovation*, 1918–1941 (Ithaca, New York: Cornell University Press, 2002), 159–60.
- 16. David K. Allison, "New Eye for the Navy: The Origin of Radar at the Naval Research Laboratory," *Naval Research Laboratory Report 8466* (Washington, DC: Naval Research Laboratory, 1981).

- 17. Single-engine fighter planes of the period were notoriously "short legged" and, particularly because air combat, required flight at full throttle. The Messerschmitt Me-109, the German workhorse of that time, had about an hour's endurance, and on too many occasions these fighters had to leave their charges and turn home and often still had to ditch. Cajus Bekker, *The Luftwaffe War Diaries* (London: Macdonald & Co, 1971), 236. Adolf Galland, *The First and the Last: The Rise and Fall of the German Fighter Forces 1938–1945* (New York: Henry Holt, 1954), 31, also complains about the lack of auxiliary fuel tanks, which he says were already tried in Spain, because this limited the bombers' penetration distance. Consequently, the whole area of Britain north of London was an (almost) bomb-free haven.
- 18. David Pritchard, *The Radar War: Germany's Pioneering Achievement 1904–1945* (Somerset, United Kingdom: Patrick Stephens, 1989), 87. The Germans were essentially right, although for this effect to manifest itself, even shorter wavelengths were required, which were not achievable by that time's technology. They probably based their calculations on the work of James Maxwell (1831–1879), which was later broadened by Arnold J. W. Sommerfeld (1868–1951). This work was again broadened in the 70s of the last century by Pyotr Ufimtzev and led the way to stealth and the F-117, although Ufimtzev was not aware of that at that time. See Ben R. Rich and Leo Janos, *Skunk Works: A Personal Memoir of My Years at Lockheed* (New York: Little, Brown & Company, 1994), 19–22. Since the Germans were interested in radar and not in stealth (which at the time smacked of science fiction anyway), they concluded that very high frequency radars were useless.
 - 19. Pritchard, The Radar War, 88.
- 20. For a full account of the development of this device see Robert Buderi, *The Invention that Changed the World* (New York: Simon & Schuster, 1997), 82–88.
- 21. The Tizard mission carried with it all the latest British technological advances, such as the jet engine; data on British research into atomic bombs; rockets; gyroscopic gunsights; submarine detection devices; self-sealing fuel tanks; and the cavity magnetron, the heart of the centimetric radar (Buderi, *Invention that Changed*, 27–28). All of these were freely disclosed to the Americans.
- 22. E. G. Bowen, *Radar Days* (Bristol, United Kingdom: Adam Hilger, 1987), 150–63; and Buderi, *Invention that Changed*, 27–28, 37.
- 23. Alfred Price, Aircraft versus Submarine: The Evolution of the Anti-submarine Aircraft, 1912 to 1980 (London: Jane's Publishing, 1980), 118.
- 24. Philip M. Morse and George E. Kimball, *Methods of Operations Research* (Washington, DC: Operations Evaluation Group, Office of the Chief of Naval Operations, Navy Department, Operations Evaluation Group Report No. 54, 1946), 96. Having now the whole picture, one can speculate if this was Goering's revenge for the incident (described above) when in 1938 he was told by the navy to go and invent his own radars.
 - 25. Morse and Kimball, Methods of Operations Research, 96.

- 26. The coordination of ocean-spanning submarine warfare required large-scale radio traffic, and the German high-command was aware of the danger but considered it a necessary evil. But trusting the Enigma as undecipherable, the "encouragement of communications led to an almost complete relaxation of radio discipline," and so the "U-boat command became 'the most gabby military organization in all the history of war.'" David Kahn, "The Code Breakers" (New York: Scribner, 1996), 503; and Price, *Aircraft versus Submarine*, 125.
 - 27. Price, Aircraft versus Submarine, 143-144.
- 28. In a similar context, although referring to another topic, it is prudent to remember the following observation: "To rely on one's enemy's bungling to prevail on the field of battle was at best a tenuous strategy not conductive to long life and happiness." Wolfgang W. E. Samuel, *American Raiders: The Race to Capture the Luftwaffe's Secrets* (Jackson, MS: University Press of Mississippi, 2004), 426.
- 29. Robert Buderi, *The Invention that Change the World: How a Small Group of Radar Pioneers Won the Second World War and Launched a Technical Revolution* (New York: Touchstone, 1997).





CRISIS IN THE MEDITERRANEAN: NAVAL COMPETITION AND GREAT POWER POLITICS, 1904–1914

By Jon K. Hendrickson

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Review by Major Chris Buckham, CD, MA

he world of today is so radically different from that of pre-First World War that it is difficult to even appreciate the challenges and concerns that nations of that period faced as they struggled with international relations. Central to this, the Mediterranean Sea represented for many nations a key transport and security concern as well as a common border between many of the (then) world's leading powers: Italy, France, the British Empire, the Ottoman Empire and the Austro–Hungarian Empire. Each of these powers had its own agenda and vision of the region, which in many cases were at odds with their neighbours' desires. Hendrickson's book traces the convoluted lines of international naval diplomacy between the nations of the Mediterranean during the period 1904–1914. It reinforces the fact that the consistent underlying themes in international relations are that nations are never altruistic in their dealings with each other and that these relationships are nothing if not flexible.

Crisis in the Mediterranean starts with a synopsis of the environment and a history of the region in order to set the tone as well as to provide a starting point from which to move forwards. The author then takes a chronological approach to the period and focuses each chapter on a specific component of the interactions. His contention is that the natural state of affairs for the Mediterranean is anarchistic with no player clearly holding a dominant position for an extended period of time; thus, the British presence, controlling the Mediterranean for the last quarter of the 19th century, was a deviation from and not the norm. The starting point for the book's narrative is 1904, when the British recognize that they are no longer able to retain their naval hegemony in the Mediterranean. This has a series of knock-on effects for them, including but not limited to: their ability to retain

influence over the Ottomans; the requirement for additional ground forces in order to retain control of their territories in Malta, Egypt and Gibraltar; and the necessity to proactively seek allies with whom to share the burden of "presence."

Hendrickson then goes on to trace and analyse the key milestones that delineated the relations between the international players as the Med came into play once again. Thus, chapters are assigned for the rise of the navies of Italy and the Austro–Hungarian Empire during their war scare between 1909 and 1911, their ultimate rapprochement and the impact that this had on their strength in the Mediterranean. Following this, the decision by the Italians—bolstered by their confidence in their relations with Austria–Hungary and desirous of a greater influence in Med affairs—to invade Libya is discussed. The unanticipated impact of this invasion was profound for Italy's relationship with both the Alliance countries (Germany, Austria–Hungary and Italy) and France. He then looks to the reaction of Britain and France to these unfolding events and how the international situation with Germany forced Britain to adopt agreements that were counter to its natural inclinations. The author goes on to shed light on the deepening relationship between Italy and the Alliance as a result of the reaction of the Entente nations (Britain, France and, eventually, Russia) to Italy's expansionism. He then closes the main narrative with discussion of the strategic impact that the 19th Corps had on France's war plans. Composed of the most hardened and battle-experienced soldiers in the French arsenal, the 19th Corps was stationed in Algeria and needed to be transported to France in order to fulfil its role in the Western campaign plan. The importance of this unit to France and the Entente is underscored by Hendrickson dedicating his final chapter to how France and Britain grappled with this problem.

Hendrickson masterfully balances technical analysis of fleet capabilities with a broader study of the operational and strategic implications of the political manoeuvrings being undertaken by the key players. His narrative style is clear and concise; it facilitates an easy understanding of the complex issues that face the different dancers at the "Med Ball." Hendrickson includes a synopsis of the events covered at the end of each chapter, and for further research, there is a comprehensive bibliography. A fascinating, thoroughly researched and outstanding book, *Crisis in the Mediterranean* provides an in-depth look at the role of Italy and Austria–Hungary in the lead up to the First World War, a topic that is normally overlooked with the coverage of the German–British naval race and the emphasis placed on armies.

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