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CANADIAN FORCES AEROSPACE SHAPE DOCTRINE

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CANADIAN FORCES

AEROSPACE SHAPE DOCTRINE

PREFACE

This manual provides the operational-level doctrine for the Shape sub-function of the Royal Canadian Air Force (RCAF). While intended primarily for the operational level, it also describes fundamentals applicable at the strategic and tactical levels. This manual has been designed for use by the following personnel:

a. RCAF personnel engaged in control of the air, air attack, and information operations, including the planning and conduct of aerospace operations;

b. Canadian Forces (CF) schools and academies that train, indoctrinate, and develop personnel in aerospace operations and operational doctrine;

c. CF aerospace units and headquarters (HQ); and

d. personnel of other CF components engaged in the study of aerospace operations or the planning and integration of aerospace power into joint operations.

This manual is presented in five chapters:

a. **Chapter 1 – Shape Fundamentals.** Provides the rationale for aerospace Shape capabilities and situates the Shape sub-function within the aerospace functional model.

b. **Chapter 2 – Control of the Air.** Details the force application component of Shape as it relates to the control of the air and space.

c. **Chapter 3 – Air Attack.** Details the force application component of Shape as it applies to counter-sea operations, counter-land operations, special air operations, and strategic attack.

d. **Chapter 4 – Aerospace Information Operations.** Introduces information operations (info ops) concepts and details potential aerospace contributions to, and missions within, the info ops campaign.

e. **Chapter 5 – Command and Control.** Provides an overview of the aspects of aerospace command and control (C2) that apply specifically to the Shape sub-function.

The manual is to be used in conjunction with the family of RCAF aerospace doctrine publications, in particular with:

a. B-GA-400-000/FP-000, *Canadian Forces Aerospace Doctrine*;

b. B-GA-401-000/FP-001, *Canadian Forces Aerospace Command Doctrine*;

c. B-GA-402-000/FP-001, *Canadian Forces Aerospace Sense Doctrine*;

d. B-GA-403-002/FP-001, *Aerospace Electronic Warfare Doctrine;*

e. B-GA-404-000/FP-001, *Canadian Forces Aerospace Move Doctrine*;

f. B-GA-405-000/FP-001, *Canadian Forces Aerospace Shield Doctrine*; and

g. B-GA-405-001/FP-001, *Aerospace Force Protection*.

Recommendations for amendments to this publication are welcome and should be forwarded to the Canadian Forces Aerospace Warfare Centre (CFAWC), attention: Branch Head, Doctrine Development.

The Commander 1 Canadian Air Division (1 Cdn Air Div) is the ratification authority for this doctrine.

KEYNOTES

These keynotes summarize the fundamental beliefs upon which Shape doctrine is founded:

- The mission of the RCAF, as an integrated element of the CF, is to provide the Government of Canada (GC) with a relevant, responsive, and effective aerospace instrument of national power. Canada's commitment to domestic and international security and defence demands a robust, agile, flexible, and interoperable force equipped to deliver kinetic and non-kinetic aerospace power, optimizing both agile manoeuvre and integrated info ops. This commitment is captured within the RCAF's Shape sub-function.

- The RCAF identified a Shape sub-function because air assets, based on the inherent characteristics of aerospace power, can *shape* the battlespace throughout the tactical, operational, and strategic levels of conflict in ways that surface forces cannot.

- Aerospace Shape-related operations aim to alter the physical, moral, and informational domains in order to enable friendly force operations and deny the adversary freedom of action.

- Aerospace Shape assets can be used to strike directly at the strategic heart of an adversary, producing disproportionate effects and significantly altering the battlespace.

- Aerospace Shape-related operations may be conducted independently of, or jointly with, land and maritime forces.

- Aerospace Shape-related operations can be offensive or defensive, kinetic or non-kinetic, overt or covert in nature, and can be applied directly or indirectly to accomplish assigned objectives.

- Most aerospace assets are capable of some degree of shaping; however, there are many missions and tasks within the Shape sub-function where specialized capabilities are required.

- The desired effects—not the specific weapon system, delivery platform, or the type of target attacked—are pre-eminent within all phases of the planning process and execution of aerospace Shape-related operations.

- A robust and dynamic aerospace C2 capability is required to allow the aerospace commander to retain firm control of aerospace forces while enabling dynamic employment, tasking, and re-tasking of aerospace capabilities to meet the competing needs of the supported commanders. Aerospace C2 operates under the fundamentals of centralized control and decentralized execution and is structured accordingly. Aerospace Shape-related operations require sufficient flexibility to respond to rapidly emerging and dynamic changes to the battlespace.

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CHAPTER 1

SHAPE FUNDAMENTALS

CF Photo: Sgt Matthew McGregor

INTRODUCTION

Aerospace forces exist to exercise aerospace power on behalf of the nation. This is accomplished through the control and exploitation of the air and space domains to achieve assigned objectives in order to satisfy the commander's desired end state. A century of air warfare has demonstrated that all effective air forces, whether large or small, are capable of performing a number of specific functions. These functions are influenced by the physical possibilities and limitations imposed by the domains and by each other. One cannot work efficiently or effectively without the other; however, it is the unique capabilities of each function that, when integrated, ensure the proper application of aerospace power. Aligned with Canadian Forces (CF) joint doctrine,[2] Canadian aerospace doctrine consists of the following six functions:

Shape

Shape optimizes agile manoeuvre and integrated information operations in the delivery of kinetic and non-kinetic aerospace power to achieve desired effects.[1]

COMMAND – SENSE – ACT – SUSTAIN – SHIELD – GENERATE

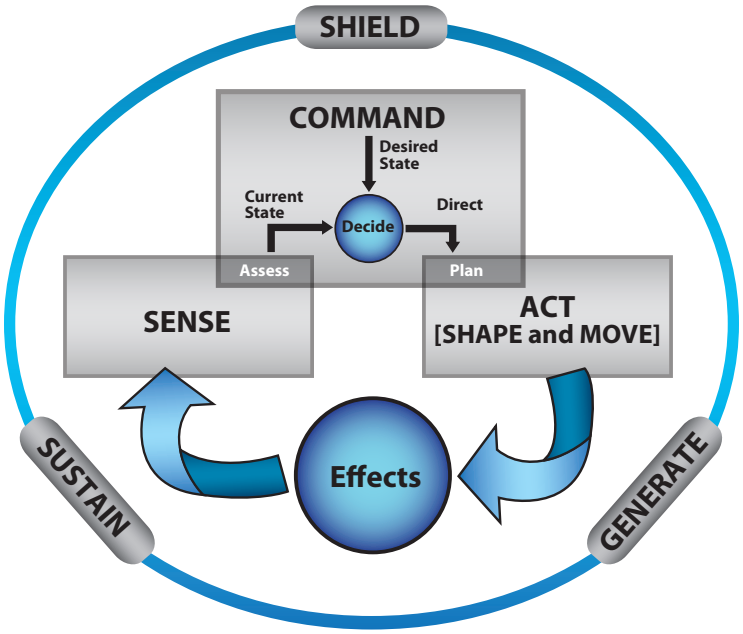

Figure 1-1. The Royal Canadian Air Force functions[3]

1 B-GA-400-000/FP-000, *Canadian Forces Aerospace Doctrine*, 2nd ed. (December 2010), 39.

2 From B-GJ-005-000/FP-001, Canadian Forces Joint Publication (CFJP) 01, *Canadian Military Doctrine* (September 2011), 2-7.

3 The B-GA-400 series of operational-level aerospace doctrine provides a detailed discussion of each function.

In order to conduct aerospace operations, the core functions of Command, Act, and Sense operate within a continuous cycle of activities. The outputs of Sense activities are assessed during Command activities to determine the current state. After evaluating the current and desired states, Command activities direct and plan actions. Act activities then create effects that will achieve the desired state. Sense activities assess the results of these effects, and the cycle is repeated. This cycle of activities influences, or can be influenced by, the enabling functions of Sustain, Shield, and Generate.

The Sustain, Shield, and Generate activities must be performed continuously in order to effectively maintain, protect, and develop RCAF assets and capabilities. Without the activities of these functions, the Command, Act, and Sense activities could be compromised or even eliminated. Consequently, a weakness in, or failure of, one function will negatively impact not only the other five functions but also the force's ability to achieve a desired state.

Within the RCAF, the Act function translates the commander's directives and operational desires into effects. Act integrates agile manoeuvre, firepower, and info ops[4] to achieve desired effects. The Act function is further subdivided into Shape and Move. Move exploits the global reach and speed of aerospace power to rapidly deploy and position personnel and materiel and is fully discussed in B-GA-404-000/FP-001, *Canadian Forces Aerospace Move Doctrine*. Shape optimizes agile manoeuvre and integrated info ops in the delivery of kinetic and non-kinetic aerospace power, influencing the battlespace to achieve military effects in accordance with the commander's intent and campaign plan. Shape affects the physical, moral, and informational domains[5] through force application and info ops.

FORCE APPLICATION

Force application operations are primarily focused on the physical domain. This is the tangible battlespace within which all military forces manoeuvre. Aerospace shaping within the physical domain may be broadly defined as the application of military force by aerospace assets against airborne,

4 "Info ops" is included within the RCAF's Act function as presented in B-GA-400-000/FP-000, *Canadian Forces Aerospace Doctrine*, 39. Info ops is, however, at minimum, a joint activity and encompasses actions across the breadth of military operations (not specific to aerospace power) to dominate the informational domain. Ideally, information operations are also coordinated and synchronized with coalition partners, other government departments (e.g., Department of Foreign Affairs and International Trade), and willing non-governmental organizations (NGOs).

5 The domain concept continues to evolve within CF and RCAF doctrine. For the RCAF and the purposes of this manual, the physical domain includes the air, maritime, land, space and electromagnetic sub-domains. The moral domain includes the psychological, conative (will), cognitive (understanding), and ethical sub-domains. The informational domain includes the information and cyber sub-domains.

surface and sub-surface targets. Force application does not necessarily result in the destruction of a target; rather, it is the selective application of the required, proportional force to achieve the desired effect. It can be kinetic or non-kinetic, direct or indirect, and lethal or non-lethal. Force application occurs across the spectrum of conflict[6] (from peace to war) and ranges in effect from simple presence to the use of deadly force. Aerospace force application missions may take place exclusively in an aerospace context (as is the case with intercepting foreign aircraft in Canadian domestic airspace); be independently applied within the land or maritime domain (an attack on a strategic location or vessel); or fully integrated with land, maritime, or special operations forces (a close air support mission).

Some force application examples designed to create physical effects include:

a. armed fighters intercepting long-range aircraft in Canada's remote and/or Arctic regions;

b. convoy escort missions by armed tactical helicopters and fixed-wing aircraft providing overwatch for land-force vehicles;

c. maritime aerospace power attacking a submarine threatening friendly naval vessels;

d. armed fighters or surface-based anti-air weaponry engaging hostile aircraft (fighters, bombers, or surveillance aircraft);

e. aerial bombardment of infrastructure targets such as bridges, power stations, or an adversary's logistic nodes; and

f. an aerial fire support mission conducted by fighters, armed unmanned aircraft (UA), and helicopters in support of friendly surface forces in close proximity to an adversary.

Force application operations can also have effects on the moral and informational domains. These domains exist in the minds of friendly, adversary, and neutral/uncommitted audiences and in the informational systems that support their activities and understanding of their environment. The successful application of force can create primary and secondary order effects, undermining an adversary's capability, understanding, and behaviour as well as supporting the achievement of friendly force objectives.

6 As defined by Lieutenant-Colonel Bernd Horn in "Complexity Squared: Operating in the Future Battlespace," *Canadian Military Journal* 4, no. 3 (Autumn 2003), http://www.journal.forces.gc.ca/vo4/no3/command-ordre-eng.asp (accessed August 20, 2013).

Some force application examples designed to create effects in the moral and informational domains include:

a. long-range attacks against an adversary's strategic centres of gravity (CGs);[7]

b. a low-altitude show of force by military aircraft over adversarial forces;

c. air policing and patrolling of allied or neutral airspace; and

d. kinetic strikes against an adversary's computer network infrastructure.

INFORMATION OPERATIONS

Information operations[8] (info ops)[9] are designed to shape the physical, moral, and informational domains by focusing on specific sub-domains within each, namely the electromagnetic, psychological, conative (will), cognitive (understanding), information, and cyber sub-domains. Their aim is to change the behaviour of a target audience by influencing its will, perceptions, and ability to process information and communicate. Info ops exert pressure on any cognitive, emotional, moral, and cultural levers that advance friendly objectives. To be successful in this realm, planners must have a complete understanding of the target audience; they must not assume that non-kinetic actions which swayed one populace are equally valid for another. Additionally, info ops is a synchronized iterative process that commonly requires time to build upon successive levers of influence. Therefore, the greatest success is enjoyed when info ops actions, which are carefully designed to support operational objectives, are commenced at the very beginning of an operational campaign. Done correctly, they can produce strategic-level effect and lessen the requirement for kinetic action. Done incorrectly, they can produce negative effects that, in the modern context, have the potential to overshadow all other military activities and successes.

It must be understood that, in the joint context, info ops is principally a synchronizing discipline; it is not truly a separate capability. To the operational commander, joint info ops derives its unique military value

7 Refer to the Strategic Attack section in Chapter 3 of this manual and the associated footnote 45 for an explanation of the term "centre of gravity."

8 Where the terms "information operations" and "info ops" are used they should be understood as referring to joint info ops. The aerospace contribution to joint info ops is introduced in this section and later in Figure 4-2 as the aerospace information operations capability.

9 *Defence Terminology Bank* (*DTB*) record 31721. The abbreviation "info ops" has been accepted for use by the CF and North Atlantic Treaty Organization (NATO) while "IO" is used by United States (US) forces. In NATO doctrine the abbreviation IO refers to international organizations.

by synergistically coordinating the actions of a number of components. The most common of these components are: electronic warfare (EW), psychological operations (PSYOPS), operational security (OPSEC), computer network operations (CNO), military deception, public affairs (PA) and civil-military cooperation (CIMIC). In this manual, the components of joint info ops that are utilized in aerospace Shape-related operations are grouped together as the aerospace info ops capability.

While most info ops are non-kinetic, if the underlying rationale for a specific kinetic action is the psychological impact it will have on neutral or adversarial groups, physical attack can also be part of an overarching info ops plan. There can also be notable physical effects associated with other info ops techniques, such as an electronic attack (EA) or computer network attack (CNA). A CNA was used to great effect by the designers of the Stuxnet computer virus, which crippled a significant portion of Iran's uranium enrichment infrastructure in 2010 by reprogramming the equipment's control parameters, effectively causing the machines to self-destruct.

WHY ROYAL CANADIAN AIR FORCE SHAPE?

> *Space in which to maneuver in the air, unlike fighting on land or sea, is practically unlimited, and . . . any number of airplanes operating defensively would seldom stop a determined enemy from getting through. Therefore the airplane was, and is, essentially an instrument of attack, not defence. … The only proper defence is offence.*[10]
>
> – Air Vice-Marshal J. E. (Johnnie) Johnson

The mission of the RCAF, as an integrated element of the CF, is to provide the GC with a relevant, responsive, and effective aerospace instrument of national power. Canada's commitment to domestic and international security and defence demands a robust, agile, flexible, and interoperable force equipped to deliver kinetic and non-kinetic aerospace power, optimizing both agile manoeuvre and integrated info ops. While aerospace forces can aim to achieve these effects purely in the air domain, they can also achieve them on the surface in support of maritime, land, and special operations forces. With control of the air, friendly surface forces enjoy significantly increased freedom of action in the pursuance of their objectives. The RCAF identified a Shape sub-function because air assets can shape the battlespace throughout the tactical, operational, and strategic levels of conflict in ways that surface forces cannot.

10 United States Air Force, Air Force Doctrine Document (AFDD) 3-01, *Counterair Operations*, 1 October 2008, 22. http://static.e-publishing.af.mil/production/1/af_cv/publication/afdd3-01/afdd3-01.pdf (accessed August 20, 2013).

Generally speaking, an attacking land force requires superior forces to overtake entrenched defensive positions. The armies of the Clausewitzian era strove for both military superiority and the ability to conduct offensive manoeuvres in order to achieve victory. Given equal strength between attackers and defenders, the defender had the advantage. Aerospace power has changed this dynamic.

An air attacker may strike from virtually any direction, whereas an attack by surface forces can often be constrained over a predictable route. Air attackers can use terrain-masking techniques, electronic countermeasures, careful route selection, and stealth technology to make it even more difficult for a defender to anticipate and prepare for an air assault. Unlike a purely surface defender, the air defender has no implicit advantage. An air attacker does not necessarily require the force superiority required by the land-based attacker. In fact, the air defender may often need more forces than the attacker—the opposite of the situation on the ground. Therefore, the advantage of aerospace power lies in the offensive use of the aerospace domain.

CF Photo: Cpl Pierre Habib

AEROSPACE POWER

Aerospace power brings capabilities to military operations that are unique. They are both different from and complementary to the capabilities of other environments. It is essential that these capabilities be employed with due consideration for the principles of war,[11] taking into account the specific characteristics and tenets that govern their use, and that the impact of accomplishing objectives be balanced against the associated risk to friendly or neutral forces. Those principles of war that provide the primary considerations when employing Shape assets are: selection and maintenance of the aim, offensive action, security, surprise, concentration of force, economy of effort, flexibility, and cooperation.

The Shape sub-function is that part of aerospace power that captures the offensive advantages of the air environment, primarily using the principles of concentration of force, flexibility, and cooperation to focus limited resources on well-defined critical points across the battlespace. The characteristics of aerospace power that embody these inherent advantages include elevation, reach, payload, precision, and speed.

Reach is measured in terms of distance—hundreds or even thousands of kilometres—and speed is measured in time—minutes or hours; combined, these characteristics demonstrate the responsiveness of aerospace power. This is aerospace power's greatest strength, providing an ability to coerce an adversary by presenting a continuous risk of being attacked at a time and place of friendly choosing while denying this same capability to an adversary. The resulting freedom of action may be used to strike a wide range of mobile and fixed surface targets across multiple theatres, control airspace, or even strike at the strategic heart of an adversary.

Tenets of aerospace power are fundamental to aerospace operations and facilitate optimal employment of aerospace assets. Those that apply to Shape include centralized control and decentralized execution, flexibility and versatility as well as synergy, persistence, concentration, priority, and balance.

Flexibility and versatility are key tenets of aerospace power. Inherently flexible and uniquely versatile, aerospace resources can be quickly and decisively shifted from one objective to another across a broad spectrum at the strategic, operational, or tactical levels of conflict.[12] For example, long-range bombers that were originally designed for strategic attack are also capable of executing close air support (CAS) missions in the tactical battlespace. Similarly, traditionally tactical fighters or attack helicopters are capable of achieving strategic effects if targeting an adversary's CGs.

11 Defined in B-GA-400-000/FP-000, *Canadian Forces Aerospace Doctrine,* 23 and 69.

12 B-GA-400-000/FP-000, *Canadian Forces Aerospace Doctrine*, 28.

THE STRATEGIC EFFECT OF AEROSPACE POWER

Aerospace power is flexible, rapidly employed, versatile, and lethal. For these reasons, attack by aerospace power is often considered the "response of first resort." Economic and political sanctions are often ineffective and disproportionately impact the poor and most vulnerable. Strategic deterrent weaponry or weapons of mass destruction are indiscriminate, unacceptable socially, and have legacy effects (in addition to being contrary to international law). Ground forces of suitable mass to be noteworthy are often slow to mobilize and are high risk to a "casualty averse" state. As a result, a credible aerospace Shape capability can be both a strategic and statecraft tool.

Careful consideration must be given to the question of how aerospace Shape capabilities can contribute to the strategic aim. Aerospace Shape capabilities of any type, while not strategic assets per se, can convey strategic intent and, by association, have a strategic effect of their own. This may be considered the coercive nature of aerospace power. While this effect increases with increased aerospace Shape capabilities (particularly true of stealth technology and special weaponry such as bunker busters and precision land-attack missiles), the strategic effect of aerospace power is not exclusively dependent upon sophisticated means. Aerospace power used to attack the strategic heart of an adversary is dynamic and tailored to the situation. Indeed, the simple unopposed presence of aerospace power in an adversary's battlespace may be enough to shape the situation in favour of friendly aims and prevent an adversary from making cohesive, strategic decisions, known as strategic paralysis.[13]

A desired strategic effect might be as easily accomplished through a small operation as by a large operation involving significant forces. The Doolittle raid against Tokyo (see Vignette 1), largely a tactical failure when contrasted against the massive strategic bombardment of Germany, did far more to shape the mostly psychological battlespace in favour of friendly objectives. Thus, the strategic effect should not be measured by the target or the asset being used to strike it, but rather by its impact, intended or not.

13 The notion of strategic paralysis in contemporary military philosophy can be found in the theories of John Boyd and John Warden. Boyd emphasizes the psychological isolation of an adversary's decision-making process, while Warden emphasizes an unrelenting assault on the pillars of an adversary's warfighting ability (leadership in particular). Both strategies are complementary, both require shaping of the psychological and physical battlespace, and the aim of both is strategic paralysis of an adversary. See Frans P. B. Osinga, *Science, Strategy and War: The Strategic Theory of John Boyd* (New York: Routledge, 2007); and John A. Warden III, "The Enemy as a System," *Airpower Journal* 9, no. 2 (Spring 1995).

Vignette 1: Strategic "value added." The Doolittle raid (dubbed the "do-nothing raid" by the Japanese) was an attack on Japan in April of 1942 and was the first strike by American forces on the Japanese homeland during the Second World War (WWII). Targets included 13 different industrial and military sites in and around Tokyo. The raid was composed of 16 B-25 bombers launched from the aircraft carrier United States Ship (USS) *Hornet*; due to the range of the mission, each bomber carried only one-third of its possible bomb load.

The raid had two aims: to impact Japanese industrial production (specifically, oil refinement) and demonstrate American resolve and ability to strike. The actual physical damage was inconsequential; the only damage of military significance was to the dry-docked light aircraft carrier *Ryūhō,* bomb damage delayed its launch by six months. The impact on morale was significant, and the strategic effects were considerable:

- The raid was a blow to the previously held belief that the islands were impregnable; Japanese naval, army, and air force assets were subsequently recalled for homeland defence:
    - o The Imperial Japanese Navy (IJN) high-seas carrier fleet was withdrawn from the Indian Ocean even though the IJN was on the verge of defeating the Royal Navy in that theatre. Removal of the IJN main fleet allowed the British to regain control of shipping in the Indian Ocean, solidifying their supply lines while denying the Germans and Japanese the same.
    - o A portion of the already strained Japanese submarine fleet was recalled for patrol duties around the home islands. This significantly reduced intelligence gathering aimed at the United States (US) and counter-shipping operations attempting to isolate Australia.
    - o Air Force assets in China were reduced; this included fighters but also medium transport aircraft whose role was now rapid evacuation of senior military and political leaders at home. This reduced air mobility capability in China, slowing the operational tempo there.
    - o Infantry divisions, earmarked for the invasion of New Guinea and, thence, Australia, were recalled. This made invasion of Australia impossible without first freeing units in China (still years away from happening). Invasion of Australia certainly would have drawn Commonwealth and probably US troops, reducing the available forces for fighting in North Africa and Southern Europe, prolonging (or potentially changing) the war there.
- Japanese intelligence resources were diverted to analyse the attack. The (incorrect) assessment that the bombers originated from Midway Island was said to be fundamental to Yamamoto's unrelenting resolve to capture Midway and the ill-fated mission therein.
- American relations with other allied combatants (Russia, in particular) were improved sharply and American morale, still stinging from the attack on Pearl Harbor, was significantly boosted.[14]

14 For additional information on the Doolittle Raid, see Clayton Chun, *The Doolittle Raid 1942: America's First Strike Back at Japan* (Oxford: Osprey Publishing, 2006).

In some cases the outcome / strategic impact of an operation is neither planned nor intended. German bombardment of British cities (including the Royal personage) was intended to compel the British population to negotiate an end to the conflict with Germany (British popular support for an ongoing war with the Germans was low). However, the German campaign had a pronounced opposite effect; British citizenry support for the conflict was galvanized and anti-Nazi sentiment reached fever pitch; a negotiated peace was no longer a realistic goal. In Afghanistan and Iraq, aerospace force application missions, particularly CAS missions, were of primary importance to the combat effort. However, errant bombs in urban areas can and have caused significant collateral damage. This collateral damage substantially erodes local support for allied operations. As such, strict rules on the use of aerospace force are imposed, particularly with respect to CAS in urban situations, in some cases rendering it tactically ineffective.

At the national level, the potential threat or application of aerospace power can be used for political signalling and serves as a flexible and responsive instrument for crisis management. Aerospace power can punish aggression, deter impending aggression, signal resolve, threaten escalation, and demonstrate capability. Such strategic effects are often associated with CGs; however, they are not limited to these. Striking an adversary's vital points or acting in any manner that changes the behaviour of the opposing forces at the strategic level is strategic in effect. Within a campaign, aerospace operations for strategic effect are balanced against required tactical and operational levels of activity to achieve overall mission success.

SHAPE CAPABILITIES AND ROLES

The aerospace Shape sub-function seeks to influence the battlespace to create favourable circumstances for friendly forces and unfavourable circumstances for an adversary. These efforts can be focused at the strategic, operational, and tactical levels. Air forces shape the physical, moral, and informational domains by applying the following capabilities: control of the air, air attack,[15] and aerospace information operations. Shape-related aerospace operations can be offensive or defensive and can be applied either directly or indirectly. Figure 1-2 depicts the three Shape capabilities and their subordinate aerospace roles, which will be explained in subsequent chapters.

15 "Air attack" has been chosen as an RCAF Shape capability since it is more descriptive than "support to land and naval forces" as described in B-GA-400-000/FP-000, *Canadian Forces Aerospace Doctrine*, 41. Additionally, air attack is more consistent with NATO terminology and that of the CF's closest allies (the Royal Air Force uses "attack" and the Royal Australian Air Force uses "strike").

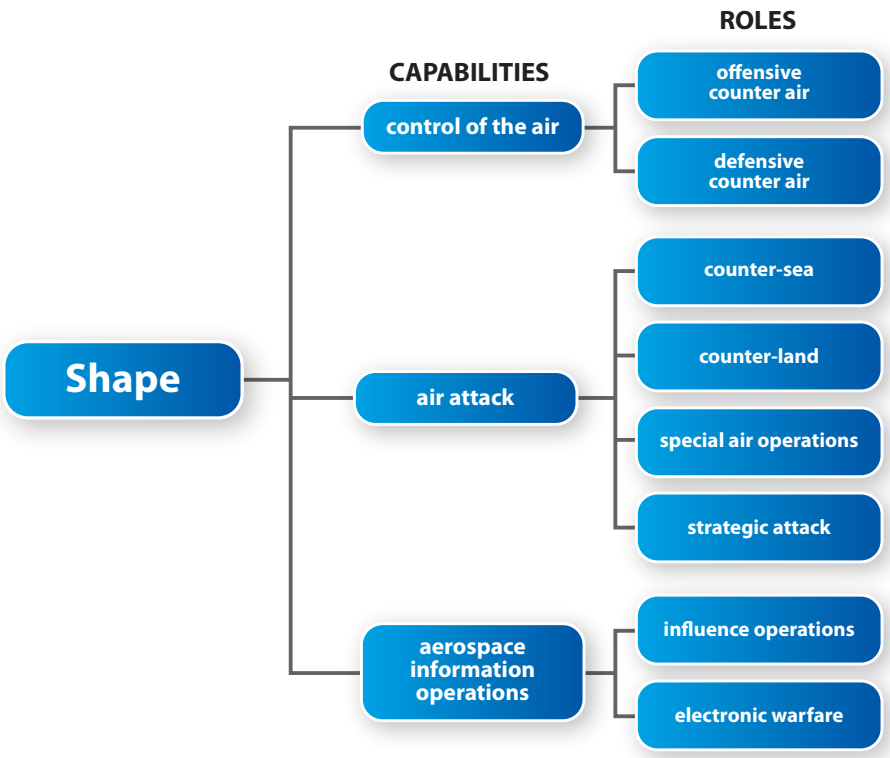

Figure 1-2. The RCAF Shape sub-function[16]

SHAPE AND THE SENSE FUNCTION

The aerospace activity of intelligence, surveillance and reconnaissance (ISR)[17] is described primarily from an intelligence perspective in B-GA-402-000/FP-001, *Canadian Forces Aerospace Sense Doctrine*. For Shape, it is important to differentiate between the overall ISR activity[18] and its constituent parts; each of the three parts can be individually defined and is distinct from the others. Coming together in the ISR activity, they form a more complete collection capability that, through the intelligence

16 A placement within this schematic is not meant to reflect the significance of the capability or role, but only how it relates to other capabilities and roles.

17 In *Air Force Vectors*, the RCAF's strategic guidance released in 2012, the ISR activity is presented as the surveillance and reconnaissance air-power capability. Whether ISR is a capability or activity will continue to be debated, but the outcome is not critical to understanding the information presented in this manual. As the ISR concept is developed further, by both the intelligence and operations communities, it will be introduced appropriately within operational-level doctrine. See http://airforce.mil.ca/dairsp/Documents/AFV_e.pdf. (accessed August 20, 2013).

18 Canadian Army doctrine also uses the term intelligence, surveillance, target acquisition and reconnaissance (ISTAR) to describe this activity. See *DTB* record 35628.

cycle and well-defined collection management principles, provides the warfighter with decision superiority. Accurate and timely intelligence is critical to maximizing the inherent offensive advantages of aerospace power.

While the intelligence effort is the cornerstone of effective Shape-related aerospace operations, these same operations can also make significant contributions to that effort. Streaming video from UA flying overwatch above a convoy and an electronic warfare support measures (ESM)-equipped aircraft triangulating the position of an adversary's air defence emplacement are examples of combat information that can be provided by assets conducting Shape-related aerospace operations. A common thread seen in many of these contributions is that they provide real-time (RT) or near-real-time (NRT) information to the commander. This is where the specific capabilities of a sensor platform create overlap between Shape and Sense. A platform which is capable of both collecting information and acting upon it blurs the line between intelligence collection and operations, emphasizing the flexibility, versatility, and responsiveness of aerospace power.

This blurring of the line between ISR activities and the operations they underpin has resulted in the term "ISR" being applied to the operations themselves, which is somewhat confusing but nonetheless understandable. Within the Shape sub-function, ISR is not presented as a unique capability, role, or mission. The ISR capabilities inherent to modern sensors and aerospace platforms are enablers; they enable the aircraft and crew to locate, identify,[19] track, and target; all key elements of a successful Shape mission. That said, the overwatch mission mentioned above can be considered an ISR mission, as can a pattern-of-life mission providing real-time video to a special operations force (SOF) strike team. From a maritime perspective, the development of the recognized maritime picture (RMP) or an antisubmarine warfare (ASW) prosecution can also be considered ISR operations. The Shape aspect of these ISR efforts is their immediate utility to the warfighter and the mission. The intelligence cycle and cognitive hierarchy defining the Sense function are accelerated, sometimes even being conducted within a single aerospace platform and crew.

This overlap between collection operations and the operations themselves creates command and control challenges. Both the importance of the product and the scarcity of available resources require well-defined apportionment, allocation, and prioritization at the command level. Aerospace ISR assets—whether fixed or rotary wing, manned or unmanned—are rapidly

19 Where the word "identify" is used in this context, it encompasses a number of specific requirements. Theatre rules of engagement (ROE) will specify the degree to which positive identification (PID) must be achieved under various circumstances, particularly where a target is to be engaged as opposed to simply being tracked. In modern conflict, the requirement to avoid mistakenly engaging a non-combatant often overrides any other military consideration.

becoming the most sought-after battlespace enablers. Managing these resources carefully and using them effectively is a key requirement of the Shape sub-function.

SUMMARY

Shape is a sub-function of Act. By definition, Shape optimizes agile manoeuvre and information operations in the delivery of kinetic and non-kinetic aerospace power. Aerospace forces shape the battlespace through the use or threatening the use of force as well as through force application and information operations.

Force application operations are primarily focused on the physical domain. This is the tangible battlespace within which all military forces manoeuvre. Shaping within this domain may be broadly defined as the application of military force by aerospace assets against airborne, surface, or sub-surface targets. Force application does not necessarily result in the destruction of a target; rather, it is the selective application of the required, proportional force to achieve the desired effect. It can be kinetic or non-kinetic and lethal or non-lethal. Force application operations can also have effects on the moral and informational domains. A successful application of force will have an obvious effect in these domains, undermining both an adversary's leadership and morale.

Info ops are designed to shape the physical, moral, and informational domains by focusing on specific sub-domains within each. Info ops, a series of processes and technologies integrated with force application campaign planning, influence the perception and capability of an adversary to render and transmit decisions, affect the will of the opposing populace, while protecting friendly information capabilities.

The RCAF identified a Shape sub-function because air assets can *shape* the battlespace throughout the tactical, operational, and strategic levels of conflict in ways that surface forces cannot. Canada's commitment to domestic and international security and defence demands a robust, agile, flexible, and interoperable force equipped to deliver kinetic and non-kinetic aerospace power, optimizing both agile manoeuvre and integrated information operations.

Aerospace power influences the battlespace from the air environment, exploiting the offensive advantages inherent to it. The aerospace characteristics of reach, speed, and elevation contribute to this superior application of force but also present a need for specialization in planning

and execution. Aerospace power used to attack the strategic heart of an adversary is dynamic and tailored to the situation. The simple, unopposed presence of air power in an adversary's battlespace may be enough to shape the situation in favour of friendly aims and prevent an adversary from making cohesive decisions or taking effective action. A strategic target can be of military, political, or economic significance and is specifically selected in order to achieve military strategic objectives.

The aerospace Shape sub-function seeks to influence the battlespace to create favourable circumstances for friendly forces and unfavourable circumstances for an adversary. Air forces shape the physical, moral, and informational domains by applying the following capabilities: control of the air, air attack, and aerospace information operations.

The aerospace activity of ISR provides the warfighter with decision superiority. The ISR capabilities inherent to modern sensors and aerospace platforms are enablers. That is, they enable the aircraft and crew to locate, identify, track, and target; all key elements of a successful Shape mission. A platform that is both capable of collecting information and acting upon it blurs the lines between intelligence collection (Sense) and operations (Shape), emphasizing the flexibility, versatility, and responsiveness of aerospace power.

CF Photo

CHAPTER 2

CONTROL OF THE AIR

CF Photo: Cpl Pierre Habib

INTRODUCTION

The only real security upon which sound military principles will rely is that you should be master of your own air.[1]

– Sir Winston Churchill

If we lose the war in the air, we lose the war, and we lose it quickly.[2]

– Field Marshal Bernard L. Montgomery

Gaining and maintaining control of the air[3] is an essential capability for successful military operations. Having control of the air safeguards sovereignty in peacetime, controls access in times of tension, and provides safety from air attack in war. Control of the air shapes the operational area by providing friendly forces with the freedom to conduct operations at the time and place of their choosing without prohibitive interference from an adversary. It may be thought of as the level of influence over the aerospace domain that friendly forces exert relative to the aerospace capabilities of the adversary. Achieving control of the air is a vital joint task force commander (JTFC) objective.

Establishing control of the air depends upon many factors, including the operational situation, resources available, and the capabilities of the adversary. Against an adversary with little counter-air capability, total control of the air may be established rapidly and maintained at little cost (during a counter-insurgency operation, for example). Against an adversary possessing robust offensive and defensive aerospace capabilities, gaining control of the air may only be possible for a short period of time or in a discrete area of the battlespace. In such cases, the effort required to gain control of the air must be balanced against the risks created by insufficient control. The JTFC must determine the necessary degree of control of the air required to achieve mission success, articulate control-of-the-air objectives, and then apportion sufficient resources to the task.

Determining the necessary level or degree of control of the air that can be reasonably achieved depends on understanding the threat, friendly offensive and defensive capabilities, battlespace, time available, and the strategic intent. Regardless of this understanding, the JTFC's control-of-the-air objectives must be accurately identified, clearly articulated, and appropriately resourced.

1 Richard M. Langworth, ed., *Churchill by Himself: The Definitive Collection of Quotations* (United Kingdom: Ebury Publishing, 2008), 205.

2 See Canadian Forums "Fighter aircraft: Characteristics and roles," http://www.canadaka.net/forums/canadian-militaryf23/fighter-aircraft-characteristics-and-roles-t94954.html (accessed August 20, 2013).

3 This chapter is based, to a large extent, on information found in the NATO Allied Joint Publication (AJP) 3.3.1(B), *Allied Joint Doctrine for Counter-Air*, July 2010.

Assuring access to space and preserving unhampered exploitation of space capabilities are essential to contemporary military operations and are an integral part of the control-of-the-air campaign. This necessitates operations to guard space assets and associated critical surface infrastructure. Operations to prevent an adversary's use of space capabilities through denial, deception, disruption, degradation, or destructive measures may also be required.

This chapter provides a general overview of the control of the air aerospace capability and its associated roles and missions. As seen in Figure 2-1, the control-of-the-air capability is divided into two roles: offensive counter-air and defensive counter-air.

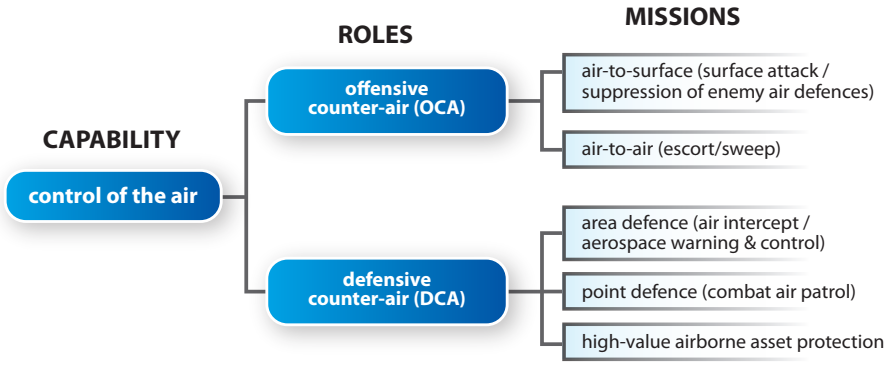

Figure 2-1. The aerospace control of the air capability[4]

COUNTER-AIR OPERATIONS

Counter-air operations are fundamental to achieving control of the air. They shape the physical battlespace in the vertical dimension in order to permit friendly freedom of action and deny an adversary the same. Achieving control of the air demands that the friendly counter-air capability is commensurate with the threat and has sufficient mass and resource depth. Counter-air targets include the breadth of adversarial aerospace capabilities including:

4 This categorization of the control-of-the-air missions is presented from the doctrinal perspective in order to link concepts logically and generate learning. These missions do not necessarily equate to the aircraft mission management codes as used by 1 Canadian Air Division (1 Cdn Air Div) in the coordination and tracking of Air Force flying activities. See 1 Cdn Air Div Orders, Volume 1, 1-617, "Mission Management Codes," http://winnipeg.mil.ca/HQSec/1cadordr/cadvol1/1-617.doc (accessed August 20, 2013). This applies equally to the missions identified under both the air attack and information operations aerospace capabilities.

a. aircraft and missiles;

b. specialized aerospace infrastructure such as airfields, sensors, C2 nodes, and systems;

c. stockpiles of fuel, munitions, special lubricants, and gasses;

d. aircraft parts; and

e. personnel possessing specific skill sets.

Counter-air operations are focused on reducing or destroying an adversary's aerospace capabilities, preferably as close to the source as possible and, ideally, before they can be launched or affect friendly operations. Effective counter-air operations require:

a. a means to survey and monitor airspace, which consists of:

(1) ground, space, or airborne active and passive sensors to detect, identify, and monitor the atmospheric and orbital battlespace; and

(2) a combat identification capability, to include determining point of origin, alignment (friendly, enemy, neutral), type, and intent. This is particularly important in contested airspace where civil air activities are occurring;

b. a means to exercise C2; and

c. a force application capability commensurate with the anticipated threat, consisting of aircraft supported by space-based capabilities and capable of applying decisive, precision force against ground, airborne, and atmospheric threats.

CF Photo: Sgt Joanne Stoeckl

Vignette 2: The Two-Hour War. Southern Lebanon had been used by para-military groups, terrorists, and Lebanese ground forces as a training haven and forward base to conduct attacks against Israeli civilians throughout the late 1970s and early 1980s. Lebanese, Palestinian, and Syrian ground forces were building in southern Lebanon through 1981, and small-scale attacks on Israel were commonplace.

Syria was well aware of the danger posed by Israeli air power and took steps to secure the gateway to the airspace of southern Lebanon, that above the Bekaa Valley. They had positioned 19 modern Soviet-built, radar-guided surface-to-air missiles (SAMs); numerous radars; anti-aircraft artillery (AAA); and communication facilities in the valley and conducted regular combat air patrols in the area. Their intent was to deter Israel from responding to the aggression and provide safety from Israeli air power.

The Israeli Air Force (IAF) had gathered a great deal of intelligence in or near the valley. The Syrian order of battle, tactics, doctrine, operational methodology, and use of the electronic spectrum were all very well known. Additionally, the IAF had developed a training area in the Negev desert, which was nearly identical to the Bekaa Valley, and trained there frequently. By June of 1982, diplomatic efforts to ease the mounting tensions had stalled; with attacks occurring almost daily and civilian casualties mounting, inaction was no longer an option.

Operation PEACE FOR GALILEE was launched in the summer of 1982. Operation DRUGSTORE, the offensive counter-air campaign, commenced on 9 June; the aim was air supremacy over southern Lebanon. Helicopters, artillery, fighters, EW and C2 aircraft, commandos, and UAs were dedicated to the task in a well-coordinated strike against Syrian surface and air threats in the valley.

The first strikes occurred at 1410 local time; 17 of the 19 SAM installations, most AAA, all of the sensors, and some C2 facilities were destroyed. The Syrians responded by sending fighters to regain the airspace, but 29 were shot down without a single loss to the IAF. Two hours after it had begun, the IAF had achieved control of the airspace over the Bekaa Valley. Over the next two days, further sorties were carried out to consolidate this success. Both remaining radar-guided SAMs were destroyed, along with all remaining C2 facilities and sensors. Fifty-three additional Syrian fighters were shot down.

Over two days, IAF losses were less than 10 aircraft of all types. Syria lost 82 fighters (over 30 per cent of its air force) and its entire surface-based anti-air capability in Lebanon, a loss from which it has never recovered. Without the counter-air protection, Lebanese, Palestinian, and Syrian ground forces were thereafter savaged by Israeli air power and eventually routed completely. Lebanese-based attacks posed no serious threat to Israeli civilians for the next 18 years.[5]

5 For additional information on this conflict see T. N. Dupuy and P. Martell, *Flawed Victory: The Arab-Israeli Conflict and the 1982 War in Lebanon* (Fairfax, VA: Hero Books, 1986).

Counter-air operations may be categorized as either offensive counter-air (OCA) or defensive counter-air (DCA) missions; competency in both disciplines is essential for effective control of the air. OCA and DCA differ in where and when the counter-air missions occur:

a. OCA missions are conducted in hostile or contested territory and at the initiative of friendly forces. OCA operations prosecute both air and surface targets; are heavily intelligence reliant; and employ air-to-air, air-to-surface, and surface-to-surface fires and capabilities.

b. DCA missions are conducted in neutral or friendly territory and are generally reactive to an adversary's capabilities, operations, or intent. DCA targets are exclusively airborne; DCA operations may be active or passive, are heavily reliant upon surveillance and warning, and employ air-to-air as well as surface-to-air fires and capabilities.

OCA and DCA missions must be coordinated and integrated at all levels; they draw upon resources across the joint force and include the use of aircraft, surface-to-surface and surface-to-air fires, as well as information operations. OCA and DCA operations are conducted across the entire battlespace and range from seeking out and destroying the adversary's ability to conduct air and missile attacks to simply minimizing the effectiveness of these attacks while maximizing attrition. The overall situation and friendly campaign plan determine when, where, and how these operations are used to gain and maintain the desired degree of control of the air.

The flexibility of modern aerospace power is such that aerospace platforms may swing from OCA to DCA missions and back with little or no advanced planning. Though OCA and DCA are distinct and separate, they utilize similar assets and personnel; synchronization of these operations from the earliest stages is vital.

The requirements for OCA and DCA operations will vary as a military campaign progresses. During the initial stages, OCA and DCA apportionment will be balanced in accordance with the threat and an adversary's capabilities. As intelligence and understanding of the adversary's aerospace order of battle grows, a comprehensive OCA campaign can be planned and executed. A successful OCA campaign will, over time, lessen the required DCA weight of effort.

DOMESTIC CONTROL OF THE AIR / AIR SOVEREIGNTY

In a domestic setting, control of the air is considered the capability to monitor and influence the security of friendly airspace and its approaches, activities that primarily fall under the DCA role. Domestic control-of-the-air / air sovereignty operations are "all military measures conducted across the spectrum of conflict to control sovereign airspace. Such an operation does not need to have aircraft airborne. The airspace is being controlled, not protected."[6] Control of Canadian domestic airspace is the responsibility of the RCAF. Creation of the mutually beneficial North American Aerospace Defence Command (NORAD—a bilateral agreement between the United States and Canada) has significantly increased the overall effectiveness of North American air defence. These efforts are closely coordinated with both countries' civilian aviation controlling and regulatory agencies. Domestic control-of-the-air operations are the area defence missions of aerospace warning and aerospace control. While these are presented here in the domestic context, both aerospace warning and aerospace control can also be conducted in an expeditionary setting:

a. **Aerospace warning** is "a warning based on the detection, assessment and validation of an impending or actual intrusion into an airspace of interest by aircraft, missiles or spacecraft."[7] This includes capabilities for maintaining awareness of all civil and unknown activity within the designated airspace. This mission is primarily carried out by a robust ground- and space-based system of sensors and communication links, supported in specific circumstances by airborne assets.

b. **Aerospace control** is "the implementation and coordination of the procedures governing airspace planning and organization in order to minimize risk and allow for the efficient and flexible use of airspace."[8] Aerospace control is underpinned by the aerospace warning mission and includes the capability and authority to monitor, control, and prosecute all unauthorized activity approaching and operating within the designated airspace. The aerospace control mission involves a number of related air operations and a range of aerospace capabilities (ground-based, space-based, and airborne). Aerospace operations can be:

6 Air sovereignty operations, *DTB* record 44195.

7 *DTB* record 44191.

8 Aerospace control is synonymous with this *DTB* record 3422 definition for airspace control.

(1) **Air surveillance operations**, which are "conducted to monitor designated airspace by detecting and tracking operations or intrusions";[9]

(2) **Air enforcement operations**, which are conducted in a permissive environment to support law enforcement operations and exert control over designated airspace; and

(3) **Air defence operations**, which are "conducted to nullify or reduce the effectiveness of hostile air action through active measures."[10]

EXPEDITIONARY CONTROL OF THE AIR

In an expeditionary context, and principally in the context of hostilities, the friendly aerospace power available determines the degree of control of the air that can reasonably be achieved. The degree of control of the air achieved is categorized as unfavourable, parity, air superiority, or air supremacy.[11] These terms, used to clarify the overall situation and can be used as goalposts when the JTFC establishes the objectives of the air campaign, are:

a. **Unfavourable.** The condition of the air battle where friendly aerospace capability is unable to gain or maintain control of the air in the face of the adversary's aerospace capability.

b. **Parity. "**In air battle, a condition of the air battle in which one force does not have an advantage over other forces."[12]

c. **Air superiority.** That degree of dominance of one air force over another which permits the conduct of operations by the former and its related land and sea forces at a given time and place without prohibitive interference by the opposing air force.[13]

d. **Air supremacy.** "That degree of air superiority wherein the opposing air force is incapable of effective interference."[14]

9 *DTB* record 44196.

10 *DTB* record 44192.

11 One should note that the degrees of control of the air do not apply exclusively to friendly forces, and these terms are simply measurements of the level of control within the air battle and not objectives. Control-of-the-air situations could exist where an adversary may, either temporarily or on a continuing basis, have air superiority. The negative impact that this would have on friendly surface operations is clear; ergo, establishing friendly air superiority (at a minimum) should be a fundamental priority.

12 *DTB* record 44208.

13 *DTB* record 3364, modified.

14 *DTB* record 3366. It must be understood that achieving air superiority or air supremacy does not imply that an adversary's aerospace power and counter-air capability will be completely impotent, nor that friendly land, sea, or air operations will be unopposed by adversarial aerospace power. Rather, these terms describe an adversary's ability to use their aerospace capabilities to influence or interfere effectively with friendly operations. Friendly air and surface losses to adversarial aerospace capabilities can still be anticipated in conditions of both air superiority and air supremacy.

Vignette 3: Control of the air. Prior to hostilities in Operation DESERT STORM (1991), Iraq had the fourth-largest standing army in the world; a sophisticated, integrated air-defence system; and a large and capable air force. Freedom of action for friendly aerospace and surface operations was a vital condition for military success. The control of the air objective for Operation DESERT STORM, therefore, was to establish air superiority over the battlefield, and this was a precursor for surface operations.

The coalition control-of-the-air campaign began on January 17, 1991, and was largely concluded by February 23. During this time, more than 100,000 coalition offensive and defensive counter-air sorties were carried out. This campaign was utterly successful and resulted in the total destruction of the Iraqi air force, the integrated air defence system, and the Iraqi command and control network. Total air supremacy had been achieved.

The ground invasion of Kuwait and Iraq began with the ground war that lasted only 100 hours. Coalition ground, maritime, and air operations were unopposed by Iraqi air power for the entire campaign, and the Iraqi command was unable to relay any timely information to the field units.

The results of the conflict were the decimation of the Iraqi military and a convincing coalition victory based significantly on the initial success of the control-of-the-air campaign.[15]

Photo: US Air Force

15 For additional reading, see B. S. Lambeth, *The Transformation of American Air Power* (Ithaca, NY: Cornell University Press, 2000).

OFFENSIVE COUNTER-AIR

Find the enemy and shoot him down! Anything else is nonsense.[16]

– Manfred von Richtofen, April 1917

OCA operations support the control-of-the-air objectives by preventing the launch or employment of adversarial aerospace capabilities. The aim of OCA is to disrupt, neutralize, or destroy those aerospace capabilities as close to their source as possible, ideally before they are launched or can affect friendly operations. OCA operations range throughout neutral and contested battlespaces, are executed at the initiative of friendly forces, and are categorized as either OCA air-to-surface (A/S) or OCA air-to-air (A/A).

Effective OCA requires a comprehensive understanding of an adversary's aerospace doctrine and a detailed assessment of their aerospace capability. Additionally, OCA missions depend upon timely and accurate intelligence. This is particularly true where unanticipated, mobile, or time-sensitive targets are concerned.

Detailed and thorough planning is vital to an effective OCA campaign; adherence to key principles of war is also critical, specifically selection and maintenance of the aim, concentration of force, and economy of effort. These planning steps include:

a. **Set objectives.** OCA objectives must relate directly to the commander's stated control-of-the-air objectives and higher commander's intent.

b. **Determine targets**. OCA targets must encompass all adversarial aerospace capabilities that could adversely affect friendly control of the air.

c. **Allocate resources**. OCA targets must be within the realistic reach of friendly capabilities, and missions must be appropriately resourced and prioritized.

The success of OCA operations depends on the availability and the capabilities of the systems assigned to the OCA mission. The choice of a particular system depends on target characteristics, threats, environmental conditions, intelligence, and the potential for fratricide and collateral damage. OCA joint resources include but are not limited to:

16 See "Military-Quotes.com," http://www.military-quotes.com/database/r.htm (accessed August 20, 2013).

a. fixed- and rotary-wing aircraft;

b. specially equipped suppression of enemy air defences (SEAD) platforms;

c. UA;

d. ballistic missiles, cruise missiles, and other surface fires such as artillery;

e. special operations forces, including direct action, terminal guidance (for precision weapons), special reconnaissance, and target marking;

f. EW capabilities; and

g. satellites for surveillance, reconnaissance, navigation, and communication.

Vignette 4: OCA failure equals campaign failure. Following the defeat of the Allied armies in mainland Europe during the Second World War, the Germans contemplated an amphibious invasion of England (Operation SEA LION). Air superiority was required if this invasion was to be successful. Operation ADLERANGRIFF (eagle attack) was launched in July 1940; this was a Luftwaffe OCA campaign, the aim of which was the destruction of the Royal Air Force's (RAF's) fighter capability and subsequent control of the air.

By early September, conditions were desperate for the RAF; Fighter Command's back was to the wall, as 11 Group's personnel, airfields, and radar sites were being decimated by Luftwaffe bombers, and their pilots and fighters by Luftwaffe escort fighters. 11 Group was within mere days of being withdrawn north to consolidate resources with 12 Group; this would have left the Luftwaffe largely unopposed in the airspace above the English Channel and southern England, giving them local air superiority and paving the way for invasion by sea.

In mid-September (arguably in response to the British bombardment of Berlin), the Germans shifted priority from aerospace capability targets to British civilian, industrial, and political targets. This shift away from aerospace infrastructure staved off certain disaster for 11 Group. Fighter Command rapidly regained its strength during this respite and successfully fought off the Luftwaffe raids for the remainder of September.

With the initiative lost and the level of attrition untenable, German air superiority was no longer a realistic goal. Operation SEA LION was postponed indefinitely by Hitler in October of 1940, ending the period known as the "Battle of Britain" and marking a pivotal turning point in the Second World War in Europe.[17]

As stated by historian Richard J. Evans: "Irrespective of whether Hitler was really set on this course, he simply lacked the resources to establish the air superiority that was the sine qua non of a successful crossing of the English Channel." [18]

17 See Peter Fleming, *Operation Sea Lion* (London: Macmillan, 2002).

18 Richard Evans, "Immoral Rearmament," *The New York Review of Books* 54, no. 20, (December 20, 2007): 76–79.

OFFENSIVE COUNTER-AIR OPERATION MISSIONS

Air-to-surface. While it is perhaps difficult to envision that an offensive counter-air campaign includes striking surface targets, OCA A/S missions, which destroy an adversary's aerospace capability on the ground, are actually the most effective use of available OCA resources. This is a far more efficient use of the limited aerospace Shape capabilities than engaging an adversary's air power after it is airborne. Surface attack and SEAD are the two OCA A/S missions.

OCA surface-attack operations differ from traditional counter-surface operations in that they are directed exclusively at an adversary's aerospace capability on the surface; this includes aircraft on the ground as well as specialized aerospace infrastructure (including personnel). The aim is to prevent an adversary from employing their aerospace power. By destroying key infrastructure, particularly airfields, significant degradation of an adversary's aerospace capability may be realized. This infrastructure can be targeted by weaponry and fires of all types; even a minor amount of damage can have a significant impact on an adversary's ability to generate, control, and sustain aerospace operations.

As aerospace power is vital to military success, it is expected that adversarial aerospace surface infrastructure will be heavily defended. A surface-attack operation against such targets is one of the most demanding, high-risk, and resource-intensive objectives of the OCA campaign. These operations, therefore, demand a high percentage of friendly resources and require detailed operational- and tactical-level planning. OCA planners must utilize the full range of OCA missions and their associated tasks to ensure friendly success. In addition, special operations forces and joint fires (artillery, cruise missiles, naval bombardment, etc.) must be integrated, and coordinated, where applicable.

Outright destruction of an airfield may not be possible or practical. Purposely leaving an airfield partially intact may also be desirable to allow for future operations by friendly forces or for humanitarian or civil reasons. Airfield attack objectives must, therefore, be synchronized with strategic and operational aims during planning and execution. Total destruction of an airfield is rarely necessary to achieve the desired level of degradation; simply cratering a runway or disabling other critical infrastructure may render an aerodrome unusable for the required period of time.

SEAD operations are missions targeting an adversary's surface-based air defence weapons, surveillance, and C2 capabilities. SEAD is "that activity which neutralizes, degrades, or destroys an adversary's air defences by a

destructive and/or disruptive means."[19] These include conventional weapons (such as bombs and cannons), specialized weapons (such as anti-radiation missiles [ARM]), and electronic attacks (using chaff, jamming, and/or deception).

Effective SEAD operations against sophisticated surface-to-air threats or integrated air defence systems (IADS) require highly specialized equipment, weapons, and specially trained crews.[20] In areas where a significant surface-to-air threat exists, SEAD assets will be assigned as escorts to those platforms with little or no capability to defend themselves from surface-to-air threats. Such SEAD escort missions allow the opportunistic suppression of threats, as known threats would have been previously targeted or avoided. Specialized SEAD platforms include the ECR Tornado, F-16 CJ, and EA-18G Growler.

SEAD requirements vary widely according to the level and complexity of the threat and available resources to counter it. Against a more dispersed or less sophisticated threat, SEAD missions may be conducted by a wide variety of platforms, including armed helicopters and UA. Surface component commanders may also contribute fire support elements using field artillery, mortars, naval surface fire, EW, and surface-to-surface missiles (SSM). To ensure unity of effort and avoid interference, close coordination is required between the planning staffs of surface component commanders and the joint force air component commander (JFACC).[21] SEAD operations require high-fidelity intelligence, real-time ISR cueing, detailed planning and integration, a rapid and free exchange of precise targeting information, unity of effort, and close coordination. EA operations[22] must also be thoroughly deconflicted from friendly usage of the electromagnetic spectrum.

Destroying an adversary's entire air defence capability may not be necessary (or even realistically achievable). Simply creating a temporary gap or degradation in coverage and capability may be sufficient to enable the success of other missions. SEAD operations may be broadly categorized

19 *DTB* record 5469, modified.

20 While the SEAD mission could include any aircraft engaging a surface threat with conventional weaponry, dedicated SEAD platforms are fitted with sensors purpose-built to detect and identify threat systems and optimized to feed such information to specialized weaponry. One example is the high-speed anti-radiation (anti-radar) missile (HARM) targeting system (HTS) and the AGM-88 HARM fitted to the F-16CJ. SEAD aircraft may develop, perfect, and employ distinct flight profiles that have been designed to reduce threat effectiveness.

21 This position and role are further explained in Chapter 5 of this manual and in B-GA-401-000/FP-001, *Canadian Forces Aerospace Command Doctrine*. Throughout this document, the terms JFACC, CJFACC, and ACC are used. The intent in each instance is to refer to the senior aerospace authority within the context of the setting (domestic, expeditionary, joint, or combined).

22 Electronic attack operations involve the use of electromagnetic energy for offensive purposes (see *DTB* record 30833). For further explanation of this term and electronic warfare (EW) in general, refer to B-GA-403-002/FP-001, *Aerospace Electronic Warfare Doctrine*.

as area suppression, localized suppression, and opportune suppression and are defined as:

a. **Area suppression**. Disables an adversarial air defence system over a wide area of the battlespace. Area suppression is achieved through kinetic and non-kinetic (electronic) means and is generally achieved by destroying critical command and control nodes rather than specific threats. Area suppression is desirable but is very resource intensive.

b. **Localized suppression**. Focuses on a specific portion of the battlespace and may be defined in terms of physical proximity of threats; impact on adversarial detection abilities; or the destruction of a specific, high-priority threat. Localized suppression is less resource intensive in the short term than area suppression but commits friendly forces to maintaining a SEAD capability throughout a campaign.

c. **Opportune suppression**. SEAD assets target pop-up surface-to-air threats (often mobile threats) and may be conducted either as self or strike-package protection or as a result of "hunting" for threats.

CF Photo: Cpl Pierre Habib

Vignette 5: A tale of two SEAD campaigns. The DESERT STORM SEAD campaign was a resounding success, easily one of the clear successes of the war. In 1991, the City of Baghdad had the most dense air defence coverage of any city in the world except Moscow, and throughout the country, highly interlinked and integrated air defence weapons, facilities, C2 nodes, and sensors made up the world's second-most comprehensive IADS.

By the commencement of hostilities, the IADS had been well mapped and SEAD missions were the first sorties flown. Radar jammers, ARM, and conventional bombs were used to devastating effect on key IADS components, preventing centralized control of the defensive effort. Devoid of integration and fearful of being targeted by anti-radiation weaponry, air defence operators resorted to using visual sensors and operating independently (which was not doctrinally practiced); all air defence sites were eventually destroyed.

The DESERT STORM SEAD campaign planners were targeting a very well-mapped IADS operating within a well-understood doctrinal framework. The campaign was given a high resource priority, a great deal of operational flexibility, and tactical freedom at the crew level. Four days after the conflict began, Iraqi air defence emissions had decreased 95 per cent from pre-war levels, and coalition aircraft enjoyed near complete freedom of action above 10,000 feet (3,050 metres). Total area suppression had been handily achieved.

By contrast, the Serbian air defence system in the Balkans was much smaller than the Iraq IADS and had only a limited number and type of threats. The SEAD campaign during Operation ALLIED FORCE (Kosovo), however, was not nearly as successful as that during DESERT STORM.

The ALLIED FORCE SEAD campaign had to contend with numerous constraints, tactical limitations, and a highly mobile threat which was not well defined prior to hostilities. Significant operational restrictions were imposed (mainly for political reasons), and the confined airspace made SEAD efforts very predictable. Restrictions on the use of force with respect to opportune suppression were strict, and each target had to be approved by the NATO combined aerospace operations centre (CAOC) prior to engagement, effectively negating opportune suppression possibilities entirely. Early warning of inbound strikes was also being provided to an adversary by states not engaged in the hostilities (therefore, not targetable).

For their part, the Serbs had learned a great deal from the ARM threat. Through a combination of low-technology tactics, swift learning, and astute improvisation, they rapidly operationalized their lessons learned, significantly reducing the effectiveness of coalition SEAD tactics and ARMs. The situation was further complicated because an adversary's IADS operations were not doctrinally aligned with recognized methodology, and a great deal of tactical freedom was given to lower-level commanders.

While NATO aerospace forces enjoyed relative freedom of manoeuvre, area suppression was by no means achieved, and NATO was forced to commit SEAD assets to each strike mission. The Serbian radar-guided SAM threat remained a real and viable threat throughout the campaign and after cessation of hostilities.[23]

23 For additional reading, see Lambeth.

Air-to-air. OCA air-to-air includes escort and sweep missions. If it is not possible to destroy the capability on the ground, adversarial aerospace capabilities have to be dealt with in the air. This reality demands a robust ability to counter any real, perceived, or potential airborne threat. Traditionally, these missions have been flown solely by fighter aircraft. More recently, however, other platforms, including armed helicopters and UA, have also been equipped with significant OCA A/A capabilities.

OCA escort and sweep and DCA missions are often executed by the same assets. Though the missions are mutually supporting, competing priorities and resource demands must be carefully balanced with consideration of the larger aim in mind. Additionally, there is often pressure for close escort missions to take precedence over sweep or detached escort missions. Over-apportionment of OCA assets to the close escort mission may decrease the chances of successfully engaging an adversary's aircraft, thereby increasing and prolonging the risk they represent.

OCA escort missions use A/A capable aircraft to protect friendly aircraft. Escort can be considered a DCA mission when flown in friendly airspace or where the escorted aircraft is a high-value air asset (HVAA). In the context of offensive action in hostile airspace, the escort mission is clearly OCA.

Escort formations may be tied to a single aerospace asset or strike formation from friendly or neutral airspace into contested airspace and back, or the escort may join the escorted force at any point during the mission. The escort force may also be positioned within hostile airspace and provide protection for successive waves of friendly formations. Platforms requiring dedicated escort could include fighters or fighter-bombers, air mobility aircraft, or helicopters. While many different force application platforms can be assigned the escort mission, the escort force must be capable of countering the expected air threat in both mass and capability. OCA escort[24] may be:

a. **Attached (or close) escort.** The escort formation is tied, in terms of proximity and/or time to the escorted formation or platform. Detailed tactical-level integration is necessary both between the escort and the escorted force and with the controlling air C2 organization. Attached escort is less resource intensive from an enabler (AAR, air C2, etc.) standpoint but places much greater demands on OCA resources.

24 It should be noted that "escort" or "armed overwatch" of a surface formation (such as a naval surface group or vehicle convoy) is not escort in the OCA context; this is a counter-surface mission and will be expanded upon in Chapter 3.

b. **Detached escort.** The escort formation is not directly tied to the escorted formation in terms of distance, but it remains within effectual proximity for a specified period of time. Detached escort formations are often staged well along the anticipated threat axis or may be assigned an operating area from which they may provide support to more than one formation. Detached escort requires less-detailed tactical integration and increases the survivability of the assigned OCA assets due to increased tactical freedom.

c. **Organic escort.** Many current aerospace platforms have both A/S and A/A force application capabilities (multirole fighters such as the F-15E Strike Eagle and CF18A/B Hornet); armed appropriately, they can protect themselves. A significant drawback of this organic escort capability is the high probability that A/S stores will have to be jettisoned, in the event of an A/A engagement, in order to maximize A/A manoeuvrability. If such an engagement occurs prior to the intended target, the aim of the strike mission will not be achieved. Additionally, most multirole fighters have a limited number of stores stations; therefore, configuring aircraft with both A/A and A/S weaponry limits the numbers of each type of ordnance the aircraft may carry. Multirole platforms capable of organic escort include the F-35 Lightning II Joint Strike Fighter, the F-15E Strike Eagle, the Su-30 MKI Flanker, and the Eurofighter Typhoon.

OCA sweep operations are often more effective than the escort mission in defeating an adversary's aerospace assets. Aircraft are launched over hostile territory to seek out, engage, and destroy all adversarial fighters, EW, reconnaissance and collection, C2, AAR, and mobility platforms. The sweep force, though it is usually synchronized with other operations, operates independently of other friendly formations and, if a fighter force, is ordinarily assigned a fighter area of operations/responsibility (FAOR) for a period of time or proceeds along a specified route of flight.

Sweep is a very flexible and dynamic mission. Sweep formations may originate as sweep and then remain in an area to become detached escort for follow-on formations. Effective sweep operations require strong air C2, comprehensive battlespace awareness, a combat identification capability, and clearly defined rules of engagement (ROE). Autonomous sweep operations are possible with aircraft using integral sensors and tactical data-link systems. Sweep operations are less resource intensive than escort and require little planning or coordination at the tactical level; however, comprehensive operational-level planning and strong aerospace control is essential both for mission effectiveness and fratricide avoidance.

DEFENSIVE COUNTER-AIR

> *Fighter aircraft are the watchdogs of our sovereignty. They are primarily designed to safeguard our airspace so friendly forces—both military and civilian—can freely use the area thus protected. Not only are fighters the best tool that a military force has at its disposal to accomplish this task, fighters, because of their strong ability to "act," also represent a strong deterrent to any threat that might potentially enter the airspace—domestic or deployed. As no other weapons platform is yet available or mature enough to provide the range of capabilities that fighters provide, Canada will continue to need fighters and their pilots for at least another generation of aircraft.*[25]

DCA operations protect friendly forces, equipment, personnel, infrastructure, and vital interests from an adversary's aerospace power. The aim of DCA operations is to detect, identify, intercept, nullify, and/or destroy aerospace threats, ideally as far from friendly forces and/or their intended targets as is possible. Pre-emptive, proactive OCA is the preferred method of securing control of the air over reactive, resource-intensive, around-the-clock DCA. However, air forces may be forced into a DCA posture because of political, legal, operational, or resource limitations. Even with an aggressive and successful OCA campaign, the requirement for at least some level of DCA must be anticipated.

By nature, DCA operations are reactive to adversarial OCA, strategic attack, and counter-surface operations. They usually take place in closer proximity to friendly forces than OCA. DCA is primarily surveillance driven, while OCA is intelligence driven. Effective DCA demands a C2 structure and process specific to this mission; DCA C2 processes must be centralized, streamlined, and agile in order to permit timely and appropriate responses to airspace incursions.

DCA is the air combat element of the larger air defence (AD) effort, forming only one part of an integrated air defence system. Given the lethality of modern weaponry, the immediate consequences of unsuccessful DCA can be severe and the effects disproportionate to the actual physical damage inflicted. DCA is a high-risk, no-fail mission which must be resourced appropriately and executed effectively.

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25 See Canadian Forums "Fighter aircraft: Characteristics and roles."

Vignette 6: DCA failure equals strategic failure: The battle of Midway was a WW II naval battle fought in the Pacific theatre in June 1942 between the Imperial Japanese Navy and the United States Navy (USN). Though known as a naval battle, the engagement was fought entirely with air power.

When the IJN fleet was located west of Midway Island by USN reconnaissance aircraft, strikes were launched using both Midway-based bombers and carrier-based air power. The carrier-based strike aircraft had to cover a much greater distance, and the two attacks were not synchronized. The land-based strike was tactically ineffective, but it did serve to alert the IJN that they had been located; they subsequently launched their own strikes on Midway Island. The Japanese strike aircraft had just returned to their carriers when the fleet was spotted by the USN carrier-based strike force.

The first to attack were torpedo bomber squadrons VT-8 and VT-6. The torpedo attack aircraft were slow and vulnerable during their attack runs and, without fighter support, both squadrons were obliterated by the superior Japanese fighters. The attack did, however, draw the Japanese DCA combat air patrol (CAP) to low altitude and away from the carriers. VT-3 arrived shortly after the first attack, and the remaining Japanese fighters descended to engage. At that moment, USN dive-bombers, alerted to the Japanese location and linked-up with their escort fighters, closed in at high altitude. The American fighters surprised their Japanese counterparts and attacked with an altitude advantage; the dive-bombers were, therefore, unopposed during their attack.

The coordinated dive-bomber attack began at 1022, striking the carriers *Kaga, Soryu, Akagi* and *Hiryu,* their decks laden with the reconstituting strike aircraft. By 1028, only six minutes after locating the enemy, the dive bombers had reduced the IJN carriers to burning wrecks, all of which eventually sank.

Had the Japanese DCA followed a more disciplined game plan or had they been in position to engage the dive bombers, the result may have been different. As it was, the IJN was never able to recover from this strategic loss. This battle is largely viewed as the pivotal engagement between the belligerents in the Pacific war and was critical to the eventual victory over Japan.[26]

The DCA contribution to the overall air defence mission can be broadly divided into active and passive measures:

a. **Active air defence** measures engage, destroy, nullify, or reduce the effectiveness of an adversary's aerospace power, including air and missile threats. Active air defence may be further separated into air and missile defence. These are complementary but involve vastly different weapon systems as well as tactics, techniques and procedures (TTP). Surface-to-air weaponry and DCA aircraft

26 C. L. Symonds, *The Battle of Midway* (Oxford: Oxford University Press, 2011).

have individual strengths and limitations and must be arrayed in overlapping, mutually supporting, defensible positions to create a layered defence in depth. Domestically, given the vast and austere nature of the Canadian land mass, the RCAF primarily uses DCA fighters supported by ground- and space-based assets to carry out the air defence of Canada.

b. **Passive air defence** measures minimize the effectiveness of hostile air and missile threats. They encompass several categories which span the breadth of force protection, including but not limited to:[27]

(1) detection and warning;

(2) chemical, biological, radiological and nuclear (CBRN) defence;

(3) hardening, battle-damage repair and reconstitution;

(4) mobility and dispersal;

(5) redundancy;

(6) EW;

(7) cyber defence;

(8) camouflage; and

(9) countermeasures, decoys, and deception.

DEFENSIVE COUNTER-AIR OPERATION CONTROL AND COORDINATION

Control of the air from a DCA perspective involves a mix of sensor, communication, and force application means, which, when linked, form an IADS. An effective IADS will be commanded and controlled through a unified chain of command centrally reporting to a single authority, ostensibly the area air defence commander (AADC). An IADS must be flexible and robust and have redundant systems, as it will be the first target of adversarial OCA activity. DCA force application platforms, as part of the IADS, are commanded by a single authority. The Shape portion of an IADS is its weapon systems.

The coordination and functioning of an effective IADS is very complex and resource intensive. NORAD is an excellent example of the potential size and complexity involved. Each defensive system and capability has different advantages and limitations in terms of range, reaction time, and flexibility of operation. The disadvantages of one system must be balanced

27 Passive air defence measures are expanded upon in B-GA-405-001/FP-001, *Aerospace Force Protection.*

by the advantages of another. Effective air defence requires a mix of capabilities, which can include:

a. fixed- and rotary-wing aerial interceptors; and

b. ground-based air defence (GBAD), including:
   (1) mobile and fixed, tactical and strategic SAMs;
   (2) AAA;
   (3) directed-energy weaponry (DEW); and
   (4) shipborne AD weapons (SAMs and AAA).

Effective DCA operations require positive control of the affected airspace through an integrated and centralized C2 system. The variety of surveillance, tracking, and weapon systems involved require detailed planning and coordination to allow rapid AD warnings, effective C2, and timely weapons employment. A large air defence area may be divided into sectors for more effective operations. As an example, a maritime task group, aircraft carrier battle group, or amphibious task force within an area of operations (AOO) may require the establishment of a locally coordinated AD area within which the anti-air warfare (AAW) commander or supporting arms coordination centre is responsible for the coordination of AD operations.

Most aerospace force application assets are capable of DCA operations to a limited extent,[28] but to be capable of the full spectrum of DCA operations, the asset must have specialized A/A sensors and weaponry, be manned by highly proficient crews, and be controlled by experienced and well-trained air-defence controllers.

Interceptor aircraft are the most flexible weapon systems available to the AD commander. These aircraft are designed to fly at high altitudes and employ A/A weaponry at long ranges. They rely primarily on area surveillance systems such as long-range radars and airborne C2 but also have integral C2 and sensor systems that allow them to conduct limited autonomous operations. Contemporary DCA interceptors become a node in the broader air-defence network of systems and can contribute passively and actively to the common operating picture. Air interceptors are often capable of both the DCA and OCA A/A role. Purpose built A/A interceptor aircraft include the F-22A Raptor, the MiG 31 Foxhound, and the Mirage 2000 F-5.

28 CH124 Sea Kings were used in the DCA role during the Vancouver 2010 Olympics, and CH146 Griffons were used during the 2002 G-8 Summit in Kananaskis, AB, and 2010 G-20 summit in Toronto. CP140 Auroras have also been used for DCA intercepts in the Arctic. While not equipped for traditional air-to-air force application, these aircraft were effective in visually identifying slow-moving or compliant targets of interest (TOIs). In the case of the Griffon examples, in particular, both door guns and snipers provided the ability to engage other aircraft.

DEFENSIVE COUNTER-AIR OPERATION MISSIONS

DCA missions vary greatly but may be broadly categorized as area defence, point defence, and HVAA protection. These missions can be staged on ground alert or may be airborne, which is more resource intensive but also more reactive to threats:

a. **Ground alert.** Aircrew and aircraft are brought to and maintained in a state of launch readiness tailored to the situation. Alert aircraft will be launched (scrambled) by their controlling agency based on triggers determined by the area air defence commander. Where possible, fighters will remain under the control of air surveillance and control systems. Alert postures vary principally according to the threat but also in accordance with other factors such as aircraft type, crew experience, location, weather and resources; readiness postures can be tailored from minutes to hours.

b. **Airborne alert.** Interceptors are airborne and either proceed to a point where a threat is anticipated or are assigned specific patrol tasks. DCA assets may also be ordered airborne to provide gap coverage should another air defence sensor or weapon system become unavailable or inactive. Airborne alert enables the most rapid reaction to adversary intrusion or otherwise unauthorized entry into a designated airspace.

Area defence missions are conducted for the defence of a defined area of operations, theatre, or even continent. Interceptors conducting wide-area air-defence DCA missions are normally staged on ground alert but, as in the case of an established no-fly zone, may also be airborne. In the ground-alert model, DCA aircraft are launched at a predetermined time, cued by intelligence or surveillance, to intercept a known or anticipated threat. In the airborne model, interceptors are assigned to patrol along predetermined routes (notably along or adjacent to political borders) or in a defined FAOR. This may be used to maintain a desired level of control of the air or enforce no-fly restrictions over friendly territory. This mission is akin to OCA sweep; however, it occurs in friendly airspace and is reactive to an adversary's operations, intent, or capabilities. Air policing interceptors will ordinarily have tight restrictions on their use of force and will generally operate overtly (presence being one of the desired effects).

Point defence missions are undertaken for the protection of a defined area or location (normally a specific installation, facility, or concentration of friendly forces). Point defence DCA missions involve interceptors either on ground alert or established airborne as a CAP in a fixed orbit.

Interceptors remain proximal to the protected area in space or time and will not normally be available for other missions. Regardless of specific employment, maintaining a continuous CAP is very resource intensive. When CAP assets are committed to a target, replacements may be required to launch if available. CAPs operate in fixed orbits or along a route when the area or force being defended is large or dispersed. Interceptors operating in fixed orbits fly legs of a determined distance or time, anchored in a tactically relevant location and oriented to the anticipated threat axis. Point defence assets may operate covertly or overtly as determined by the threat.

Point defence is often executed with a combination of GBAD and interceptors using defence in depth and separate missile and fighter engagement zones (FEZ). Highly accurate combat ID, disciplined execution, a dynamic C2 framework, and clearly defined engagement criteria are necessary to both protect the facility and reduce the possibility of fratricide.

HVAA Protection. Airborne interceptors are assigned to protect HVAA assets which are so important that the loss of even one could seriously impact friendly warfighting capabilities or have broader strategic consequences. While any aircraft could be declared an HVAA and assigned DCA protection, typical HVAAs include specialized airframes such as C2, AAR, EW, ISR, and air-mobility assets carrying designated special persons. The interceptors are ordinarily tied to the HVAA for the duration of its mission and remain proximal in space, time, and effectiveness. HVAA protection missions place significant resource demands on enablers as well as interceptors and require detailed tactical and operational planning and coordination. The lines between OCA and DCA blur with respect to the HVAA protection mission; the principal differentiation being where the HVAA protection occurs (in friendly or hostile airspace). The aim, however, remains the same: defend the designated platform against air attack.

CF Photo: MCpl Marc-André Gaudreault

SUMMARY

Control of the air is vital to achieving the JTFC's objectives. The level or degree of control of the air that can be realistically achieved depends on many factors including resources, relative military capabilities, and the physical environment. The JTFC must accurately articulate control of the air objectives and then apportion resources accordingly. The degree of control of the air achieved may be categorized as unfavourable, parity, air superiority, or air supremacy.

Control of the air allows for friendly freedom of movement, friendly freedom to execute operations, and friendly freedom from air attack; it denies an adversary the same. Control of the air shapes the physical, moral, and informational domains in favour of friendly operations.

The control-of-the-air capability is divided into two roles, namely OCA and DCA. The two are complementary and draw upon similar resources and aerospace capabilities. They must be fully integrated and synchronized at the strategic, operational, and tactical levels.

OCA operations are intelligence driven. The aim of OCA is to seek out and destroy an adversary's aerospace capabilities as close to their source as possible, preferably before launch. OCA has air-to-surface and air-to-air missions and draws upon resources across the joint force. The air-to-surface portion of OCA includes surface attack and suppression of enemy air defence. The air-to-air missions include escort and sweep missions. In cases where an adversary has a credible aerospace capability, the OCA campaign will be the JTFC's first priority. OCA missions are pre-emptive, conducted at friendly initiative, and take place principally in non-permissive or hostile environments.

DCA operations are surveillance driven and resource intensive. The aim of DCA is to detect, identify, intercept, nullify, and/or destroy adversarial aerospace threats in order to protect friendly equipment, operations, interests, and installations; in other words, to minimize the damage done by an adversary's aerospace power and maximize attrition. DCA draws upon air, space, and surface-based capabilities. DCA is reactive in nature and demands centralized, streamlined, flexible command and control procedures as well as agile force application means. DCA fixed- or rotary-wing interceptors may operate independently or as part of a larger IADS and may be staged from ground alert or established as airborne patrols. They may be used to defend defined areas (area defence) or specific locations (point defence) or to protect HVAA. DCA is a no-fail mission which must be resourced appropriately.

CHAPTER 3

AIR ATTACK

CF Photo: MS Steeve Picard

INTRODUCTION

Force application against targets on the surface shapes the physical and psychological battlespace in favour of friendly objectives. This includes aerospace operations that directly support friendly surface forces and those which target joint-priority or strategic targets independently of friendly surface forces. Just as in the counter-air battle, demand for an air-attack capability against surface targets nearly always exceeds resource availability. Centralized command, coordination, tasking, and control are vital to meet the many competing warfighting priorities.

By nature, aerospace Shape-related operations contribute to joint fires, manipulate the battlespace in support of the attainment of military objectives, and are normally associated with the operational and tactical levels of war. When deliberately targeting adversary centres of gravity (CGs), air attack missions can have significant strategic effect and typically involve:

a. destroying adversarial surface forces and their supporting infrastructure;

b. curtailing interference from hostile surface forces;

c. inhibiting an adversary's ability to manoeuvre;

d. denying an adversary the ability to concentrate their forces; and

e. disrupting an adversary's command, control, and communications capabilities.

The aerospace characteristics of speed, reach, elevation, payload, and precision enable shaping of the battlespace in ways that surface forces cannot. Joint operations directly supporting the maritime, land, or special operations forces require detailed planning and synchronization at both the operational and tactical levels. Independent operations require an equal degree of planning but are synchronized at an operational level and conducted against prioritized targets in support of the JTFC's intent and desired end state.

Air-attack operations require enabling support from other air assets including AAR, C2, EW, and ISR. Air attack operations are in large measure condition dependent and demand an acceptable level of control of the air. Should an adversary possess a credible counter-air capability, these operations may be curtailed or rendered less effective.

This chapter provides a general overview of the aerospace air attack capability, which includes the aerospace roles of: counter-sea, counter-land,

special air operations,[1] and strategic attack.[2] These roles, along with the associated aerospace missions, shown in Figure 3-1, are further described throughout this chapter.

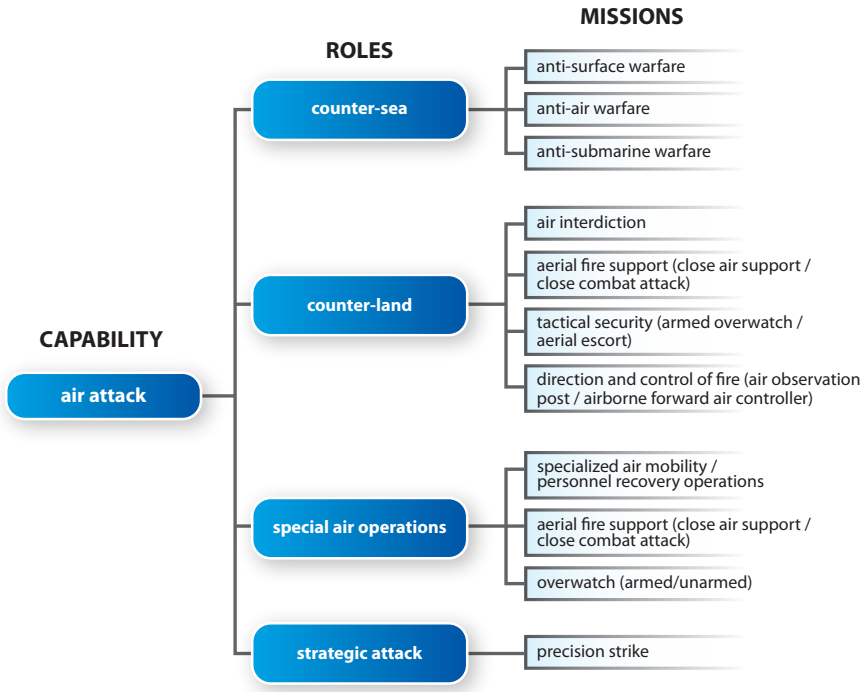

Figure 3-1. The aerospace air-attack capability

COUNTER-SEA OPERATIONS AND SUPPORT TO MARITIME FORCES

THE MARITIME PERSPECTIVE

Counter-sea aerospace operations are conducted to attain and maintain a desired degree of maritime superiority through the destruction, disruption, delay, diversion, or neutralization of adversary air, surface, and subsurface threats in the maritime domain. Air operations that are not conducted in

1 Within the Move function, "special air operations" is considered a mission within the airlift role. This mission encompasses the insertion, extraction, and resupply of special operations forces, often via covert means. Within the Shape function, the significance and span of potential special air operation missions raise its profile to that of a role within the air attack capability. Within this special air operations role, the specialized air mobility / personnel recovery mission equates to the special air operations mission defined within the Move function doctrine.

2 Special air operations and strategic attack have been separated from counter-sea and counter-land in order to emphasize their importance within the air-attack capability.

direct support of maritime objectives but overfly or occur in close proximity to maritime forces still require significant coordination.

Maritime forces are organized and deployed based on the general concepts of containment, defence in depth, and initiative, and maritime power is well suited to meet the challenges of each; however, by partnering with kinetic and non-kinetic aerospace power, the limitations of line of sight and relative slow speed can be mitigated or overcome. Aerospace power in the maritime environment extends the reach of maritime operations, facilitates manoeuvre, and enhances awareness, through the following aerospace characteristics:

a. **Elevation**. An aircraft significantly extends the sensor range of traditional naval systems which are, practically speaking, near-surface based. By linking with an aircraft at 30,000 feet (9145 metres), the Navy's RMP / radar horizon is extended to over 200 nautical miles (370 kilometres [km]); thus adding to the Navy's defence in-depth and containment efforts. Furthermore, the ability to manoeuvre in elevation facilitates combatant identification, over-the-horizon targeting (OTHT), and independent attack, while remaining relatively safe from adversarial contact, thus contributing to a commander's initiative.

b. **Speed and reach.** Aircraft can rapidly investigate many areas of interest and can be dynamically re-tasked and moved to developing areas of vulnerability/breakout more rapidly than a surface vessel. Aircraft can detect, reach, and engage targets at distances that would require hours or even days of sailing to reach. Therefore, with the ability to reach further, react more quickly, and switch rapidly from defence to offence, aerospace power can greatly enhance the Navy's ability to address the concepts of containment, defence in depth, and initiative.

From a C2 perspective, airborne assets may be employed on operations in the maritime domain either independently or integrated with a maritime force (joint):

a. **Independent operations** involve aircraft operating remotely from a surface force and under shore control. These operations normally involve long-range patrol aircraft (LRPA), which can still interact with maritime elements but often operate beyond surveillance range and without direct communications requirements. Independent operations are normally planned and coordinated by the shore headquarters but will be synchronized with the efforts

of the maritime force commander. The aircraft crew is responsible for navigation and collision avoidance and has tactical freedom to accomplish its task.

b. **Joint operations** involve aircraft operating in the vicinity of a surface force under the control of a ship-based commander, known as the officer in tactical command (OTC).[3] Both LRPA and ship borne air assets (also known as organic air) can operate as an integrated element of the maritime force, prosecuting targets and conducting tasks based on the tactical and operational requirements of the force.

Maritime aerospace operations. In the maritime domain, independent and joint aerospace operations are further defined using the terms direct support (DS), associated support (AS) and area operations.[4] DS is a joint operation; area operations are independent of the maritime force, and AS is a blend of the two:

a. **Direct support.** Aircraft assigned in DS to a maritime force operate under the tactical control (TACON) of the OTC. Operational control (OPCON) remains with the tasking authority, and tactical command (TACOM) is normally delegated to the aircraft mission commander. The C2 of organic assets is somewhat different in that they are under the OPCON of their ship's commanding officer (CO). Organic assets are assigned tasks as directed by the OTC or naval warfare commander[5] through the CO. DS operations are normally conducted in close proximity to the maritime force. The radius of direct support operations about the force will be determined by the OTC and will vary according to:

(1) the threat;

(2) the aerospace resources available; and

(3) area coverage desired.

b. **Associated support.** Aircraft tasked on AS operate independently of other maritime and aerospace forces; however, their tasking is in support of a specific maritime force and the force commander's mission. The aircraft crew will interact with the maritime force, receiving and providing intelligence and establishing any required

3 See *DTB* record 4961.

4 NATO AJP-3.3.3, *Air-Maritime Co-ordination* (2005), 0503.

5 The OTC may delegate responsibility for a specific area or maritime warfare to a subordinate commander. The three principal areas of maritime warfare are antisurface warfare (ASUW), anti-air warfare (AAW), and anti-submarine warfare (ASW).

area deconfliction measures. Generally, aircraft on AS operate at a distance from the supported maritime force, but within surveillance and communications range. The OTC of the supported force cannot take TACON of the aircraft unless authorized by the aircraft tasking authority, who retains OPCON.

c. **Area operations** are conducted in areas within which adversary forces are known to be located, through which they are likely to pass, or within which it is desirable to deny them freedom of action. Area operations may be related to the protection of maritime forces scheduled to enter the area in the future or to provide defence in depth to distant forces. Land-based aircraft on area operations are under the OPCON of a shore-based authority (this authority will often be the maritime component commander [MCC]). TACOM of the aircraft conducting the mission is normally delegated to the aircraft mission commander by the tasking authority. Aircraft mission commanders will be briefed on the whereabouts of friendly maritime forces and whether they may react to a request from these forces to assist in the prosecution of contacts within the aircraft's operating area.

CF Photo: Sgt Norm McLean

AIR-MARITIME COORDINATION

In maritime aerospace operations, land- and sea-based aircraft work in close coordination with naval surface and sub-surface forces to ensure the most effective use of available assets. Their aim is to detect, monitor and neutralize/destroy the opponent; achieve defence in depth; and seize and retain the initiative. Underpinning these efforts is the accurate and timely compilation of the RMP, which is shared electronically and aims to present accurate position and vector information for all units, friendly or otherwise, within a defined battlespace. It is fed by the sensors and the intelligence generated by all participating platforms, whether land, sea, air, or space based. RMP can be developed at a tactical level, as in the case of a single maritime task force, or on a strategic and national level. An accurate RMP enables the maritime commander to manoeuvre and address threats efficiently and effectively. The characteristics of aerospace power provide obvious advantages over surface-based assets in the development of the RMP.

Maritime forces have three distinct warfare areas: antisurface warfare (ASUW), anti-air warfare (AAW) and underwater warfare (UWW), which is further sub-divided into ASW and mine countermeasures (MCM). In order to more efficiently use available combat systems and resources against threats, the OTC can establish C2 sub-groupings along these lines, often appointing naval warfare commanders responsible for fleet ASUW, AAW, and ASW as well as a warfare coordinator for mine countermeasures. This division of responsibilities varies with the complexity of the tactical situation faced and will be detailed in mission message traffic. Aircraft supporting the maritime force will be assigned to one of these commanders and tasked accordingly. This assignment is often specified by the tasking authority but can also be made flexible in order to allow reassignment during a single mission. In all cases, execution of these operations requires deconfliction measures, particularly in littoral/near-land waters.[6] These deconfliction measures are critical to avoiding blue-on-blue situations in a complex operating environment.

Maritime forces may be assigned operational areas that underlie or are in close vicinity to civilian air traffic areas/corridors. The situation can be further complicated if the force is within range of an adversarial air or maritime force. In these situations, maritime forces will comply with regional airspace control procedures and must be linked into any friendly air defence network and conversant with the DCA plan. This is a situation where the OTC could be expected to assign a separate anti-air warfare commander who will be in charge of the surface force's air defence.

6 Deconfliction measures incorporate safety of flight considerations for aircraft operating in the same general area of operations. They can include geographic restrictions as well as altitude restrictions or blocks and will dictate standard joining procedures, timings, routes, altitudes, and speeds to follow inbound to the force and outbound after mission completion. Additionally, where a naval force is concerned, deconfliction measures will govern the use of antisubmarine weapons in particular, restricting their use in geographic areas where friendly submarines may be operating. These last are termed water space management (WSM) procedures.

THE LITTORAL

The term "littoral" can be defined in many ways, but most simply, it refers to coastal zones. The Royal Canadian Navy (RCN) defines the littoral as coastal areas and that portion of land which are susceptible to influence or support from the sea, generally recognized as the region which horizontally encompasses the land-watermass interface from 100 km ashore to 200 nautical miles (370 km) at sea, and extending vertically into space from the bottom of the ocean and from the land surface.[7] This roughly equates to the nearshore area within which conventionally armed naval vessels can exert an influence. Carrier-based aircraft, helicopters, and surface-launched land attack missiles change this dynamic, significantly extending the range and impact of a naval force on the land battle. The littoral battlespace is uniquely complicated in that littoral operations require close coordination of the capabilities of all three environments: air, land, and maritime. While littoral operations are often associated with some form of coordinated attack from the sea where friendly forces conduct an amphibious or marine air assault operation, a friendly coastal defence position or a friendly land force—with integral tactical aviation assets in support—advancing along the coastline with naval and air assets in support would also qualify. Each of these examples implies significant overlap between capabilities, effects, and operating areas, particularly those of the assigned aerospace forces. The littoral battlespace also offers an adversary opportunities in terms of using terrain and shallow waters to mask attacks conducted by land-based fires, mines, aircraft, fast patrol vessels, and submarines. Friendly aerospace forces play a significant role in neutralizing these threats. Ensuring the most efficient use and effective deconfliction of aerospace assets and effects in this complex environment requires robust joint doctrine and the close synchronization of TTP.

MARITIME AVIATION

Shipborne air assets pose unique C2 challenges, whether they are fixed-wing carrier-based air assets, helicopters, or UA. Shipborne air assets are often identified as "organic air," a term that emphasizes their close link to their respective ships. In many navies around the world, shipborne air assets are collectively known as naval aviation. This differentiates these assets from maritime aviation, a term which refers to aircraft operating in a maritime role but under the command of non-naval forces. Currently, Canada's only organic air assets are maritime helicopters (MH), which are detached from the RCAF to the RCN on-board surface combatant or

7 This definition is found in the RCN's strategic-level document: *Leadmark: The Navy's Strategy for 2020*, 3, http://www.navy.dnd.ca/leadmark/pdf/ENG_LEADMARK_FULL_72DPI.PDF (accessed August 20, 2013).

support ships.[8] Despite these close links, within the CF, MH and LRPA are still considered maritime aviation vice naval aviation assets. While operating from a ship within littoral or joint operating areas, organic assets must nonetheless conform to the external aerospace structure. The greatest weakness of these assets is their sensitivity to the environmental conditions at sea. Aerospace power is typically sensitive to inclement weather, but at sea this can be exacerbated. While MH can operate effectively in conditions of very poor visibility and low ceilings, the lack of precision navigation aids can significantly limit carrier-based air operations. High sea states can also limit air operations.

MH and LRPA have similar capabilities and roles, particularly the more modern examples of each, such as the CH148 Cyclone and the CP140/A Block III Aurora. Each aircraft type provides a maritime force with an extensive array of sensors, including acoustic sensors and sonobuoys, radar, EW, and electro-optical/infrared (EO/IR) cameras. MH possess an advantage, given their ability to hover and high degree of integration with the supported force. LRPA possess an advantage in speed, range, endurance, and operating envelope, providing significant flexibility in terms of overall responsiveness and the ability to conduct very diverse missions.

Tactical air support for maritime operations (TASMO)[9] is that support provided by land-based fighters to maritime forces. While not normally considered maritime aviation, appropriately armed fighter aircraft can be significant force multipliers, particularly for a maritime force that does not include carrier-based air assets. TASMO can be offensive or defensive in nature, encompassing both the ASUW and AAW missions described in the following paragraphs, and is similar in scope to the counter-land air interdiction mission and the control-of-the-air DCA role. Detailed TTP govern and guide the use of fighters during these operations, streamlining the C2 challenges and minimizing the potential for fratricide.

COUNTER-SEA MISSIONS

ASUW employs airborne, surface, and subsurface assets to locate, deter, track, and/or destroy maritime surface targets (surface combatants, merchant shipping, and coastal facilities). Aerospace capabilities of differing types and roles may be placed under control of a single commander to maximize weapon effects, minimize own losses, and optimize mutual

8 Various UA are being tested in the maritime role, one of which is the Boeing Scan Eagle. Whether this capability is considered maritime or naval aviation is somewhat academic, though the assets would certainly be considered organic.

9 The term TASMO is no longer used by the CF's NATO allies, who have begun using the more general concepts of air-maritime coordination (AMC) and air-maritime coordination procedures (AMCP) to encompass all interaction between aerospace and maritime forces. See NATO AJP 3.3.3, *Air-Maritime Co-ordination* and its subordinate ATP for a more detailed treatment of this subject area as a whole.

support, while causing maximum attrition and saturation of adversarial air defences en route and in the target area. Aerospace assets armed with stand-off precision weapons (particularly when armed with maritime-specific weapons) are ideally suited for the ASUW role. Besides striking directly at an adversary's shipping, aerospace assets can also be used to restrict an adversary's freedom of movement through aerial mining.

The aim of ASUW is to prevent an adversary from effectively employing their surface forces and weapon systems. Fixed- and rotary-wing aircraft, submarines, and surface vessels can carry out this task independently, but preferably as part of a coordinated attack. Aerospace assets extend force capabilities far beyond the line of sight of surface ships. Over-the-horizon targeting, conducted by both LRPA and maritime helicopters, significantly enhances a ship's offensive effectiveness, allowing the vessel to engage with long-range weaponry while remaining relatively covert and outside of counter-engagement range. Historically, targeting information was passed by voice communications, but the advent of modern data-sharing systems such as Link 11, 16, and 22 simplify ASUW engagements significantly, providing all assets on the link with precise targeting information. ASUW action culminates in the targeting and attack of an opponent's vessels, attacks which can be carried out by surface forces, both land- and sea-based, or by other airborne assets (an example of this is the TASMO mission mentioned previously). These operations can be carried out as offensive or defensive actions:

a. **Offensive surface action**. To destroy, neutralize, or deter adversarial forces in order to maintain control of the sea area involved.

b. **Defensive surface action.** To prevent adversarial surface forces from locating, pursuing and/or engaging friendly surface forces, convoys, or high-value units.

AAW involves operations intended to destroy or reduce an adversary's air and missile threat. From a naval perspective, this is a defensive posture rather than an offensive one; therefore, all AAW missions conducted by aerospace assets are DCA missions focused on protecting the fleet. However, maritime power in the form of carrier-based air assets, naval surface fires, and SSMs may be called upon to participate in the OCA campaign or be part of a larger air defence network.

AAW operations protect maritime forces, high-value units, or other vital assets from attacks from the air. Air threats represented by armed aircraft and anti-ship missiles generally develop rapidly; anti-ship missiles in particular can originate from air, surface, or subsurface and constitute a

significant threat to surface vessels. Integrating airborne assets into naval AAW defences requires a significant degree of coordination and control due to the nature of this threat. Naval formations often possess significant anti-air capabilities in the form of point- and area-defence weapons. Aerospace power can contribute to the air defence mission by delaying, disrupting, or destroying the launch platform (ship, submarine, aircraft, or UA) before it launches a weapon. Deconfliction zones must be established around the fleet to delineate a transition from this airborne defence to a ship-based defence. In this way, the maximum effectiveness of all defensive weapon systems is ensured and blue-on-blue engagements can be avoided. These zones will normally be based on the longest range, ship-based anti-air weapon. DCA operating areas are established at an appropriate range beyond this zone along the threat axis. Picket ships may also be positioned up-threat of the force to act as either a passive or active tripwire. These are normally smaller units such as frigates, possessing effective point-defence and radar systems but no area-defence weaponry. This layered approach to air defence serves to increase the reaction time available to the maritime force and impair an adversary's ability to develop a targeting solution or reach a firing position.

CF Photo: Cpl Mathieu St-Amour

ASW denies an adversary the effective utilization of their submarines. The ASW protection of a force depends on the defence in depth and close coordination between ships, aerospace assets, shore-based facilities, and friendly submarines. Submarines are a significant strategic threat to shipping of all types, and countering this threat demands an extensive range of specialized capabilities to search for a submarine, localize, track, and then attack it.[10] ASW tactics are driven by whether the main aim is to detect or to simply deter the submarine from conducting operations in a given area. Blocking key avenues of subsurface approach (also called barrier operations), sanitizing a vital area through constant patrolling, and prosecuting submarines located by subsurface arrays are examples of ASW operations.

MH and LRPA are equipped specifically for ASW, carrying surface search radars, electronic warfare support measures, magnetic anomaly detectors, EO/IR, and both passive and active sonobuoys. In the Canadian context, the MH is the only aircraft organic to the ship. Taking advantage of an aircraft's speed, range, and on-board sensors and weapons, the ASW warfare commander is able to seize the initiative by rapidly searching large areas, sanitizing the planned route of travel, or establishing barriers to protect the maritime force. These operations can be done independently or in cooperation with other air, surface, and subsurface assets; the most effective ASW team is actually a combination of MH, LRPA, and submarines. LRPA can be assigned independent ASW operations where strategic lines of communications (LOC) can be blocked (such as the Greenland–Iceland–United Kingdom [UK] Gap in the North Atlantic) or intelligence generated by subsurface arrays can be prosecuted. The long range and endurance of an LRPA is critical to its ability to conduct these missions. Close coordination between maritime and air assets as well as sound water and airspace management through effective deconfliction measures are essential to the ASW battle.

COUNTER-LAND OPERATIONS AND SUPPORT TO LAND FORCES

THE LAND PERSPECTIVE

Counter-land operations are conducted across the land domain against land-based targets in order to achieve the JTFC's intent. This can be accomplished either independently of, or jointly with, land-component operations. Aerospace counter-land operations produce effects in the short, medium, and long terms by delaying, diverting, disrupting, or destroying adversarial forces in close proximity to friendly forces, or follow-on forces,

10 The five phases of an ASW prosecution are search, localize, track, attack, and re-attack.

before they can be brought to bear. These efforts degrade the adversary's overall ability to execute a coherent land campaign. When conducted independently of tactical objectives or where no friendly land forces are present, these missions target operational and strategic objectives such as an adversary's LOC; command, control and communication (C3) nodes; and support elements located in the deep battle area.[11]

Aerospace counter-land operations enable friendly manoeuvre and freedom to attack while denying an adversary the same. These operations can be conducted across the battlespace from the close battle to the deep battle within an adversary's strategic areas. Aerospace forces are generally unconstrained by battlespace boundaries and the topographical limitations that hamper land force manoeuvre and sensors. Aerospace counter-land missions can be executed by a variety of aerospace platforms; some are purpose built for the mission (such as the A-10 Thunderbolt II or Su-25 Frogfoot), but almost any air asset (fixed and rotary wing, manned and unmanned) with a counter-land force application capability can be utilized.

Aerospace power is fundamental to the success of the land battle, and when true integration of aerospace and land capabilities is achieved, mission success is likely to follow. In the littoral/near-land battlespace, naval capabilities such as ship-based air assets, naval surface fires, and SSMs must also be integrated. Dedicated air and aviation specialists embedded within the headquarters and operational elements of supported land forces are key to achieving synergy and effective integration. The level of coordination required to successfully integrate and conduct the mission largely defines the type of counter-land mission undertaken. Aerospace component commanders must be intimately aware of ongoing surface operations and their rationale.

AIR-LAND COORDINATION

The critical factor in the success of joint air/land operations is mutual understanding. For the supporting aerospace force this means a comprehensive understanding of the aims, intent, plans, and objectives of the supported land force commander. For the supported land force, this means a detailed knowledge of the strengths, constraints, limitations, and capabilities of the supporting aerospace force. This mutual understanding is fostered by integrated liaison, detailed joint planning, and effective communication.

The principal air-land coordination elements within the RCAF are the tactical air control party (TACP) and the G3 Aviation (G3 Avn) or air

11 These types of missions were extensively employed during Operations DESERT STORM (Iraq and Kuwait) and ALLIED FORCE (Kosovo).

liaison officer (ALO) detachments. The TACP is an air force unit which forms just one component of the overall theatre air control system (TACS).[12] TACS includes various RCAF C2 elements, all of which are more completely explained within B-GA-401-000/FP-001, *Canadian Forces Aerospace Command Doctrine* and its subordinate publications. An RCAF TACP is staffed with specialist personnel and embedded within the HQs of subunits of the supported formation.[13] In the context of the Canadian Army (CA), a TACP, G3 Avn, and/or air liaison officer is normally established at the brigade level or higher but may be established at a lower level where and when feasible and effective. Each layer is operationally subordinate to higher-level detachments.

The TACP is **responsible** to the air component commander (ACC) but **responsive** to the designated supported commander. The TACP has two principal roles:

a. for the supported commander: advise on aerospace matters and enable the safe, effective, and efficient integration of aerospace capabilities with surface forces to achieve the tasks, missions, intent, and desired end state; and

b. for the ACC: provide an intermediate-level aerospace C2 capability for airspace and aerospace assets and enable the safe, effective, and efficient execution of aerospace operations at the tactical level.

The G3 Avn detachments have similar responsibilities as mentioned above for the TACP; however, they are primarily focused on providing advice and C2 assistance for rotary-wing (RCAF tactical aviation) assets. ALOs may represent any specific aerospace asset or capability which may not be satisfactorily represented by either the TACP or the G3 Avn detachment, or in some instances, one or more ALOs may be the only aerospace coordination element provided to a specific land formation or unit.

TACTICAL AVIATION

Many allied armies have aerospace forces (primarily rotary wing, but in some cases smaller fixed wing and/or UA) which are integral to their organizations in order to provide dedicated force application, mobility, and

12 TACS (also known as the tactical air control system) is a network of systems and organizations necessary to plan, direct, and control tactical airspace and tactical aerospace operations and to coordinate the same with other components of the joint force. It is composed of control agencies and centres, communications systems, sensors, and computer networks which provide the means for centralized control and decentralized execution of aerospace operations. (*DTB* record 1430.)

13 The land component commander has traditionally been the supported commander; TACP capability nonetheless applies equally to any supported force including units from the maritime component, special operations component, or allied forces. The TACP capability may also be seconded to work with other government departments / the civil authority or even NGOs who have been allocated military support.

reconnaissance capabilities. Attack helicopters are examples of aviation assets which normally belong to an army. In the Canadian context and similar to the RCAF MH force which is considered an organic air asset of the RCN, the 1 Wing tactical aviation force[14] is the RCAF element whose primary function is "to support land force operations through the provision of aerial firepower, reconnaissance and mobility."[15] Hence, they are closely associated with the Canadian Army, are normally assigned tasks under the OPCON of the land force during operations, and provide a key air/land integration function on behalf of the RCAF.

Certain tactical aviation operations include elements of both the Shape and Move sub-functions. Air assault operations, defined as "airmobile operations in which combat forces land within direct fire range and conduct an assault,"[16] imply the use of a mix of air assets and normally involve transport helicopters supported by armed helicopters or other aerial fire support assets. Albeit these joint operations shape the battlefield, both the airmobile operation[17] and the related air assault operation are covered in more detail in B-GA-404-000/FP-001, *Canadian Forces Aerospace Move Doctrine*.

COUNTER-LAND MISSIONS

In broad terms and in the Shape context, aerospace forces have four missions in the counter-land battle: AI, aerial fire support, tactical security, as well as direction and control of fire. AI is distinct in that it requires a much lower level of integration with friendly land forces than the other missions. The remaining counter-land missions occur in closer proximity to land forces and, therefore, demand varying degrees of integration, specialized procedures, proficient crews, and specially trained ground personnel.

Certain key conditions tend to produce more favourable results for counter-land missions:

a. a high degree of control of the air, either theatre-wide or local (an OCA intensive effort);

b. the existence of target sets critical to an adversary and vulnerable to attack (an intelligence intensive effort);

14 This tactical aviation force comprises the helicopters, personnel, vehicles, and equipment integral to 1 Wing HQ and its subordinate units.

15 B-GA-440-000/AF-000, *Tactical Helicopter Operations*, Change 1, (February 24, 1999), 1, http://trenton.mil.ca/lodger/CFAWC/CDD/Doctrine/Pubs/Tactical/440_Series/B-GA-440-000-AF-000.pdf (accessed August 20, 2013).

16 *DTB* record 43604.

17 There are two accepted definitions for airmobile operation in accordance with *DTB* record 196: "An operation in which military forces and their equipment are transported about the battlefield and landed by aircraft, in support of tactical objectives on the ground" (Army Terminology Panel); and "An operation in which combat forces and their equipment manoeuvre about the battlefield by aircraft to engage in ground combat" (NATO). They are both acceptable, but the recent Army definition is the most applicable from an RCAF Act doctrinal perspective.

c. sustained pressure from ground combat and continued air attack (the requirement for the synchronization of effects and the concentration of fires); and

d. favourable environmental conditions.

Counter-land missions require significant planning and coordination at the operational and tactical levels as well as significant levels of support from enabling resources such as air C2, AAR, and others. Similar to OCA and DCA in the counter-air context, different counter-land missions can often be accomplished by the same platforms and draw upon common resources. The four missions, however, are distinct with respect to the targeting process, TTP, and degree of integration with surface forces.

Air interdiction is defined as "air operations conducted to divert, disrupt, delay, degrade, or destroy an adversary's military potential before it can be brought to bear effectively and at such distance that detailed integration of each air mission with the fire and manoeuvre of friendly land forces is not required."[18] The aim of AI is to attack an adversary's fighting capability; targets may include adversarial combat capability and manoeuvre elements in the field or supporting components such as operational C2 nodes, communications networks, transportation systems, logistic nodes, supplies, and other vital infrastructure. Interdiction attack is a term which aviation assets integral to land forces use to describe their AI-related missions and tasks.[19]

The AI mission reflects the flexible and lethal nature of aerospace power. An effective AI campaign must be directed by a single commander who can exploit and coordinate all the forces involved. This may be conducted in support of surface operations or as a main effort against an adversary without the presence of friendly land forces. When integrated into a ground campaign, AI is used to channelize movements, disrupt logistics and communications, and deny terrain. AI can have a profound effect on the morale of an adversary and may lessen the requirement for ground combat. The AI mission can be conducted by a range of aerospace platforms including fixed-wing, rotary-wing, and unmanned assets.

In the joint counter-land battle, land commanders[20] will nominate specific targets, either individually or as target sets, for the respective phase of a campaign. Once approved, these targets will be integrated into a joint

18 *DTB* record 3343. While there is no pressing need for detailed deconfliction of AI with friendly movement and operations, there remains an enduring requirement to synchronize all counter-surface missions with the joint commander's aims.

19 AI is considered synonymous with the term "interdiction attack" (IA), which is used by NATO when discussing attack helicopter operations in support of land operations. See in NATO ATP-49(F), *Use of Helicopters in Land Operations Doctrine* (October 15, 2012).

20 While any CC can nominate AI targets, the LCC will normally lead in this regard. Targeting processes are discussed in more detail in Chapter 5 of this manual.

prioritized target list (JPTL), and deliberate AI targets will be assigned to the available AI assets. AI missions can also be planned within a geographic area where lucrative targets are known or suspected to exist. The area may be defined by geographic boundaries or other spatial dimensions. In this case, aircrew would be tasked to locate, identify, and attack valid targets of opportunity in the assigned area.[21] Finally, AI assets can be tasked with XINT (on-call air interdiction) with no designated target or operating area. In this instance, specific targets are assigned dynamically, using time-sensitive or dynamic targeting procedures. XINT can be an inefficient use of resources unless there is an abundance of assets and only a small number of pre-planned (deliberate) targets available. This condition is typical of the late stages of an aggressive and successful AI campaign. As demand nearly always outstrips capacity, overall AI efforts are prioritized by the JTFC.

Aerial fire support includes two main mission subsets: CAS, which is traditionally associated with fixed-wing assets, and close combat attack (CCA), which is a rotary-wing mission that is very similar to CAS in terms of effect but quite different in terms of execution.[22] The proximity of the action to friendly ground forces and the required level of integration with those forces differentiate aerial fire support from AI.[23]

CF Photo: Cpl Mathieu St-Amour

21 The majority of AI missions are against deliberate targets. AI missions of a dynamic nature include the AI subordinate tasks of armed reconnaissance (AR), strike coordination and reconnaissance (SCAR), and XINT. AR tasks are solely dynamic, in that aircraft seek and engage targets of opportunity. While SCAR is primarily a direction and control of fire task with aircraft identifying and handing valid targets to AR-tasked aircraft, SCAR aircraft can also execute strikes (if so equipped) as a secondary task.

22 Current RCAF tactical aviation doctrine (e.g., B-GA-440-000/AF-000, *Tactical Helicopter Operations* and its subordinate publications) presents counter-land missions differently from those presented in this manual, in part due to their direct links to Canadian Army doctrine. For example, the provision of helicopter fire support is defined as a specific mission and the terms AI and CCA are not included or defined. This emphasizes the evolving nature of doctrine and the current effort to make RCAF doctrine less platform specific than it has been in the past. Both approaches are valid but serve different purposes, with RCAF doctrine addressing the operational level and tactical aviation doctrine the tactical.

23 An evolving ISR mission that underpins both aerial fire support and AI is the SCAR mission, which is discussed in more detail in Chapter 5 of this manual.

Vignette 8: Broken Arrow. The battle of la Drang was the first engagement between regular US Army forces and the People's Army of Vietnam (PAVN, the regular army of North Vietnam); it was fought in November of 1965 in the la Drang Valley of South Vietnam.

The US force, 1st Battalion 7th Cavalry Division (the 1/7th), was an under-strength infantry unit consisting of approximately 450 soldiers with light squad support weapons, all lifted by 12 helicopters. The 1/7th was deployed on what amounted to a "reconnaissance-in-force" operation to ascertain the disposition of PAVN forces along the Cambodian border. Unbeknownst to US intelligence, a PAVN forward operations base had been established in the area (all underground) housing over 1600 soldiers. Both belligerents were surprised by the presence of the other; fighting along a hasty and irregular front erupted upon first contact. By the morning of the second day, after a full day and night of fighting, the situation for the 1/7th was desperate; low on ammunition and with mounting casualties, one platoon (now down to eight men) was completely cut off and surrounded, and remaining forces were dug in facing a 360-degree perimeter. Throughout the early morning, PAVN forces probed the American lines while their main fighting force moved into position; the all-out assault on the American position began at 0730. Enemy fire was intense and evacuation or resupply by helicopter impossible. As the battle intensified, it was clear the perimeter was in danger of collapsing. The battalion commander, Lieutenant Colonel Hal Moore (his command position now receiving direct fire), transmitted the phrase "Broken Arrow," code signifying that a US unit is about to be overrun.

All available aerospace power in the theatre (either airborne or on ground alert) was immediately dispatched to the battle area. This included bombers, fighters, gunships, and attack helicopters and amounted to a substantial amount of firepower. Lieutenant Charlie Hastings, a United States Air Force (USAF) forward air controller embedded with the 1/7th, controlled the aircraft and conducted strike after strike with guns, rockets, bombs, and napalm (some engagements occurring with no more than 20 metres between combatants); the attacks successfully kept the PAVN forces at bay throughout the morning.

Their attack blunted and casualties mounting, Vietnamese forces withdrew at 1000 after two-and-a-half hours of fierce fighting; hundreds of dead PAVN infantry littered the battlefield. It is estimated that more than 60 per cent of the Vietnamese casualties from the battle occurred during this engagement. At the end of the third day of fighting, the US position was secure and the 1/7th was ordered relieved. They suffered 234 wounded / killed in action (W/KIA), 50 per cent of the original force. The PAVN suffered over 1300 W/KIA, 80 per cent of their original force. Aerospace fire support is credited with saving the 1/7th from being overrun by a significantly larger enemy force and avoiding certain defeat for US forces in the valley.[24]

24 For more, see Harold G. Moore and J. Galloway, *We Were Soldiers Once ... and Young: la Drang - The Battle that Changed the War in Vietnam* (San Francisco: Presidio Press, 2004).

The CAS mission is "air action against hostile targets that are in close proximity to friendly forces and which require detailed integration of each air mission with the fire and movement of those forces."[25] It is generally understood to refer to air action conducted by fixed-wing platforms. The term "close" does not strictly entail a physical distance; rather, it is situational, and proximity may relate to time, space, or effect. Therefore, the determining factor as to whether CAS techniques and protocols should be used is the need for detailed integration rather than proximity.[26]

CAS missions can be defensive and/or offensive in nature, but in either situation are intended to fix, delay, disrupt, or destroy adversarial forces. CAS missions ordinarily target adversarial combat elements and are one of the most flexible and dynamic force-application means available on the modern battlefield. The firepower and mobility of aircraft can make an immediate and direct contribution to the land battle, especially against targets that are either inaccessible or invulnerable to available surface weapons. CAS can be used to rapidly mass a lethal capability at decisive points in order to achieve local ground superiority or as a flexible reserve, allowing the commander to take advantage of battlefield opportunities. CAS effects can be kinetic or non-kinetic,[27] and as such, CAS should not be considered as simply another type of artillery. CAS missions can be used to deny key terrain, influence an adversary's operations (this is particularly true with unsophisticated or inexperienced troops), and assist friendly forces with navigation or by marking targets. CAS has applications across the spectrum of ground operations, including offence, defence, stability, and enabling operations.

The key factor to success of the CAS mission is detailed integration between each air mission as well as the fire and movement of the supported surface forces. This minimizes the risk of fratricide while achieving maximum effect. CAS control requires specially trained and experienced ground personnel; these personnel are authorized and accredited by the air component commander to integrate aerospace fires. These personnel may be attached to surface formations as a TACP or be integral to the land unit as in the case of a forward air controller (FAC).[28] Effective CAS

25 *DTB* record 23335.

26 Proximity is not necessarily linear distance between mission effects and friendly forces. It may also mean mission effects in terms of impact on friendly operations and the achievement of their mission. A force application mission far removed from friendly forces may have an immediate impact on friendly operations in a mission-achievement context and thus require detailed integration and/or deconfliction.

27 One example of a non-kinetic CAS mission is a low-level show of force. This is also a form of information operations and is discussed in more detail in Chapter 4 of this manual.

28 The term "joint terminal attack controller" (JTAC) may be used synonymously with FAC. FAC in the Canadian context generally refers to a member of the Land component who has been trained in the ground side of the CAS mission. The term JTAC refers to a member of USAF who is employed in the same role with the US Army. UK forces also use the term JTAC. In any case, this person is imbedded within, or integral to, surface manoeuvre forces and specializes in the integration of aerospace power on the battlefield.

demands strict adherence to established TTP as well as highly disciplined and thoroughly proficient aircrew and controllers. Effective CAS also demands a high level of friendly control of the air; CAS is much less effective in cases where adversarial counter-air capability exists. Pre-planned CAS missions are scheduled and planned via the air tasking order (ATO) planning process but must always be reactive to the dynamic situation on the ground. CAS assets often assume an alert posture on the ground or airborne as on-call CAS (XCAS), allowing them to be more reactive to the commander's requirements.

Close combat attack is a rotary-wing mission defined as "coordinated attack by armed aviation against targets that are in close proximity to friendly forces."[29] CCA represents firepower used to destroy, neutralize, suppress, or harass an adversary. In land force terminology, firepower is viewed as a joint concept; it encompasses the collective and coordinated use of target acquisition data from all sources, the use of direct and indirect fire weapons, attacks by armed aircraft of all types, and the use of both lethal and non-lethal means. Tactical aviation resources may contribute to the firepower function as independent manoeuvre elements or may add their fires to those of the ground commander. Tactical aviation units enhance the firepower function by acquiring and designating targets, adjusting indirect fire, and directly engaging targets.

CAS and CCA are largely synonymous in that they both apply kinetic and non-kinetic force in support of friendly ground forces across the spectrum of land operations. Each demands detailed integration with, and occurs in close proximity to, friendly forces. CCA procedures differ from CAS in control methodology and in the tasking process that assigns the mission to assets. Any armed rotary-wing asset may execute the CCA mission. These assets may have a direct command relationship with the supported land force unit, and the provision of CCA may only be one of a series of fire support tasks assigned. In terms of tasking, a CCA mission will not be identified as such on the ATO; the helicopter tasking will normally be much more generic, allowing the supported commander greater tactical freedom. In terms of control, the CCA crew is assigned a target and then conducts the attack relatively independently of the controller. By contrast, fixed-wing CAS missions are controlled quite rigidly.

Tactical security includes the armed overwatch and aerial escort missions. While the gathering of information about an adversary is primarily an element of the Sense function, these missions provide early warning, manoeuvre space, and protection for the main body, which are elements of both Shield and Shape. A tactical security mission is an ISR operation that is focused on providing protection for a specified force. The advent

29 *DTB* record 34045.

of new sensor technologies—in particular, electro-optical devices coupled with video downlink capabilities—has enhanced ISR capabilities and their application in the battlespace. Tactical security missions use ISR TTP but they are sufficiently distinct; thus, it remains useful to define them separately. A wide variety of aerospace assets can be tasked to conduct these missions, from helicopters to UA (armed and unarmed), LRPA, and fighters.

The armed overwatch mission can be considered part of the aerospace Shield function, but as it often involves the potential of offensive as well as defensive action, it is considered here as part of the aerospace Shape sub-function. The primary objective of armed overwatch provided by an aerospace force[30] is to deter attack and deny an adversary the opportunity to interfere with a friendly unit's movement (dismounted patrols or ground convoys) or defence of a fixed location. These missions may be executed over any type of terrain and in all weather conditions; however, missions involving urban centres present unique hazards and substantial challenges. Normally, in built up areas, there are more obstructions and fewer landing spots for helicopters. Communications between land and aerospace forces may be interrupted by buildings or high ground. Traffic presents unpredictable hazards and may obscure otherwise predictable threats. The use of force in urban areas also comes with substantial collateral damage challenges and ROE considerations. Aerial convoy escort, one specific type of armed overwatch, operates in close proximity to both the route of advance and the convoy itself and requires close coordination between the aerial escort and the ground convoy. Armed overwatch missions routinely demand highly dynamic use of airspace and air C2, sound intelligence, and comprehensive surveillance.

Vignette 9: Griffon armed overwatch. With the addition of the Dillon Aero M134 Minigun and the WESCAM MX-15 sensor, armed overwatch in support of troops on the ground became a viable task for the CH146 Griffon helicopter. The M134, with its precise, high volume of fire, is an ideal anti-personnel weapon in a counter-insurgency environment such as Afghanistan, where the enemy is dismounted and often in close proximity to civilians. The M134/MX-15 pairing allows the Griffon crew to positively identify contacts from a stand-off position and then manoeuvre to engage. Armed overwatch tasks fall broadly into two types: deliberate—where Griffon crews plan the mission in advance with the supported ground forces and develop a common understanding of terrain, threat, and ground scheme of manoeuvre—and hasty—where crews respond to a developing situation such as an improvised explosive device (IED) strike resulting in a troops in contact situation—and are initially handicapped by limited situational awareness (SA).

30 The aerospace force may be rotary or fixed wing, or a combination thereof. UA are the normal type of fixed-wing asset, whereas manned fighters conducting this overwatch mission are more routinely considered to be conducting a non-traditional ISR mission.

By 2010 during Operation ATHENA, a Griffon weapons team (GWT) section of two CH146s would typically launch on a routine armed overwatch mission in support of a Canadian battle group. Standard configurations saw each aircraft equipped with one sensor and two miniguns with ammunition. Additionally, one of the aircraft would be TCDL (tactical common data link) equipped and thus able to downlink its video to a ROVER (receive-only video enhanced receiver) station. While observing an area where a patrol had been ambushed by insurgents earlier in the day, the call "contact, wait out" comes across the radio: a JTAC has been monitoring the lead Griffon's MX-15 feed using their ROVER laptop back at the combat operations centre and, thus, will be able to watch the entire contact unfold.

The section lead immediately asks for a grid reference, and the ground unit responds. The aircrew can hear the crack of a rocket-propelled grenade explosion and automatic weapons firing in the background of the radio call. Each MX-15 operator immediately inputs the grid into the sensor system, slews their sensors onto that location, and starts recording the video for later intelligence and operations analysis. The troops can be seen in a line, firing from behind a low mud wall a few kilometres to the south of the Griffons' location. The troops are firing to the west, and the GWT can see the impact of the patrol's rounds near the treeline from where they are taking fire. The GWT, en route to the troops in contact, calls the patrol and requests the enemy location be marked with smoke. On the way, the GWT section lead conducts a quick scan of the tree line, seeing that the intervening field is empty and confirming there are no locals caught in the crossfire. Within seconds, an M203 smoke grenade lands just short of the treeline, and via a series of short radio calls, the GWT verifies the exact location of the insurgents.

The same talk-on occurs in the second aircraft, to ensure that all crew members have shared situational awareness. The section lead conducts a quick attack brief on the shared communications link, and then the GWT rolls in overhead of the patrol's position to allow the troops to continue firing without endangering the aircraft. The Griffons fire a 20-second burst, putting thousands of rounds of 7.62 millimetre fire into the treeline. The enemy is now being engaged from the ground and from above. While the GWT executes a sharp 180-degree turn to set up for an attack with the left-side weapons systems, the left gunner observes two insurgents with weapons running towards a hut. The MX-15 operator slews the turret to the new location and spots the insurgents; when cleared to engage, the gunner fires another 10-second burst—the firefight is over.

While the GWT continues to circle overhead of the patrol to scan for additional threats, the situation report goes out, and they standby to continue their support to the patrol.[31]

31 Adapted from Canada, DND, *Project LAMINAR STRIKE, Canada's Air Force: Post Op ATHENA* (Ottawa: Department of National Defence, 2011).

The aerial escort of tactical aviation assets again overlaps between aerospace Shield and Shape. It is similar in principle to the OCA escort or DCA HVAA protection missions, with the exception that the escorting platforms are focused on protecting the escorted asset(s) against ground activity. Should an adversary possess a credible counter-air capability, counter-air fighters must be assigned to protect the entire aviation force, which would be a counter-air HVAA protection mission. Aerial escort missions are flown to protect aircraft when commanders determine the threat is such that intimate protection must be provided to utility and transport aircraft. The escorted force is referred to as the protected force (PF) and may be a single aircraft or a large formation. The purpose of aerial escort is to facilitate the safe passage of the protected force, allowing it to complete its assigned mission by detecting, suppressing, and deterring ground-based threats. Within tactical aviation doctrine, the three basic aerial escort techniques are attached, detached, and combined.[32] Regardless of the specific technique, the escort plan must be flexible, fluid, and capable of changing escort coverage as the situation dictates.

Direction and control of fire is another counter-land mission that has evolved greatly with the advent of new technologies. In the Canadian context, this mission has traditionally been conducted solely by tactical aviation forces but is now expanding into the LRPA and fighter communities. Subordinate tasks, requiring specialized training or additional crew members, include air observation post (air OP),[33] airborne forward air controller / forward air controller (airborne) (either ABFAC or FAC[A]),[34] and SCAR. The airborne adjustment of fire, whether these fires originate from field artillery, mortars, naval gunfire, armed helicopters, UA, or fighter aircraft, is an important force multiplier, dramatically enhancing responsiveness and overall accuracy.

SPECIAL AIR OPERATIONS

SPECIAL OPERATIONS - GENERAL

Special operations may be described as "military activities conducted by specially designated, organized, trained, and equipped forces using operational tactics, techniques, and modes of employment not standard to conventional forces."[35] These activities are conducted across the spectrum of conflict

32 Further information on these techniques can be found in B-GA-442-001/FP-001 *Tactical Aviation Tactics, Techniques and Procedures*, Change 5, (June 2010), http://trenton.mil.ca/lodger/CFAWC/CDD/Doctrine_e.asp (accessed August 20, 2013).

33 *DTB* record 3351.

34 *DTB* record 36620. While the CF has officially adopted the abbreviation ABFAC, USAF owns the accreditation for the CF's FAC capability and the US joint publication, JP 3-09.3, *Close Air Support* uses the abbreviation FAC(A). Within NATO, the term FAC(A) is most commonly used.

35 *DTB* record 18752, modified.

independently of, integrated with, or in coordination with the operations of conventional forces to achieve political, military, informational, and/or economic objectives. Politico-military considerations may require low prominence, covert or discreet techniques, and the acceptance of a degree of physical and political risk not associated with conventional operations.[36]

Within a Canadian context, SOF units and personnel are organized, trained, and equipped to accomplish the following operations:[37]

a. **Counterterrorism (CT) operations**. CT refers to the offensive and defensive measures taken to prevent, deter, pre-empt, and respond to terrorism. CT measures are mostly offensive actions such as hostage rescue, recovery of sensitive material, and strikes at infrastructure, but additionally, they can include mitigation and deterrent activities.

b. **Maritime counterterrorism (MCT) operations**. MCT refers to operations within the maritime domain that are extremely complex, requiring a high level of expertise and special equipment to effectively and safely insert, fight, and extract from a target area.

c. **High value tasks (HVT)**. HVT refers to other operations, at home or abroad, that may be assigned by the GC. They may be kinetic or non-kinetic and could include tasks embedded across the entire spectrum of conflict. Some examples include tasks such as:

   (1) **Counter-proliferation**, which refers to actions to limit the possession, use, acquisition, or transit of weapons of mass effect (WME). It includes actions to locate, seize, capture, and recover WME and in some instances under the Proliferation Security Initiative, prevent the improper employment of dual-use materials.

   (2) **Special reconnaissance**, which are tasks conducted to collect or verify information of strategic or operational significance. These actions complement and refine other collection methods but are normally directed upon extremely significant areas of interest.

   (3) **Direct action**, which are short-duration strikes and other precise small-scale offensive actions conducted by special operations forces to seize, destroy, capture, exploit, recover, or damage designated targets. Direct action differs from conventional offensive actions in the level of physical and political risk, operational techniques, and the degree of discriminate and precise use of force to achieve specific objectives.

36 NATO AJP 3.5, *Allied Joint Doctrine for Special Operations*, January 2009, 1-1.

37 Canada, DND, Canadian Special Operations Forces Command (CANSOFCOM), *An Overview*, 2008, 9.

(4) **Defence, diplomacy, and military assistance**, which refers to operations that contribute to nation building through assistance to select states through the provision of specialized military advice, training, and assistance. Canadian Special Operations Forces Command (CANSOFCOM) contributions are managed within the command's areas of expertise.

SPECIAL AIR OPERATIONS OVERVIEW

Special air operations (SAO) are activities conducted by specially organized, trained, and equipped air and aviation forces to support military strategic or operational objectives by unconventional military means in hostile, denied, or politically sensitive areas. SAO differ from conventional air operations in degree of physical and political risk, operational techniques, methods of employment, and independence from friendly support.[38] A special operations task group/force/unit (SOTG/SOTF/SOTU) is usually supported by a special operations air task unit (SOATU) or a formation of SOATUs in a special operations air task group (SOATG). A SOATG is a tactical-level group of special operations forces and conventional air and aviation elements that are specially trained and equipped to conduct or support special operations.[39] When conventional air/aviation units are assigned to support special operations forces (SOF) for the duration of an operation or a campaign, they are called a direct support aviation task unit (DSATU).[40] While some SAO may require discreet, covert, or low prominence techniques that may include air/aviation operations by, with, and through indigenous forces, which a SOATU could provide, other air/aviation operations may only require habitual relationships with the ground or maritime SOTUs; thus, a direct support aviation task unit would suffice.[41]

SPECIAL AIR OPERATIONS MISSIONS

There are a range of fundamental operational activities conducted by organic and direct support air and aviation forces in support of SOF to achieve operational and strategic effects. Specialized air mobility is one of the primary missions of SAO forces and can be conducted by fixed-wing, rotary-wing, or tilt-rotor aircraft. These missions might involve air-to-air refuelling (AAR), forward arming and refuelling point (FARP) operations, and personnel recovery operations. Other SAO missions include CAS, CCA, air-land integration (ALI), and ISR support.[42] Additional aircraft in a direct support

38 Ibid., 2-5.

39 Within the RCAF, 427 Special Operations Aviation Squadron (427 SOAS) is an SOATU which has been placed under the operational command of CANSOFCOM.

40 NATO Special Operations Headquarters (NSHQ) 80-004, *Special Air Warfare Manual*, March 2012, 1.

41 Ibid., 3.

42 Ibid., 5.

role, but not certified as specifically SAO qualified, may augment the airlift, fire support, or ISR capabilities of a special operations force. These resources offer an important additional capability that helps the SOF commander address the full range of threats, environments, and requirements.[43]

In Figure 3-1, the following three air attack SAO missions summarize the wide range of missions that can be conducted in support of SOF operations:

a. **Specialized air mobility / personnel recovery operations.** This mission includes the range of air mobility as well as the three personnel recovery operations of combat recovery (CR), combat search and rescue (CSAR), and hostage rescue.

b. **Aerial fire support**. This mission includes both CAS and CCA as described earlier under the counter-land role.

c. **Overwatch (armed/unarmed)**. This mission includes overwatch by manned and unmanned aerospace ISR platforms, often operating as integral parts of a SOF operation. During the Finish phase of a Find-Fix-Finish direct action mission, manned ISR assets are considered critical to success.[44] This mission overlaps into the Sense (the ISR aspect) and the Shield/Shape (tactical security) functions as previously discussed.

STRATEGIC ATTACK

Aerospace strategic attack utilizes aerospace forces that can generally penetrate deeper into adversary territory than other forms of military force and, thus, can threaten, disrupt, or destroy adversary CGs at the military, political, or economic levels.[45] Such operations can involve destructive and non-destructive actions, or a combination of both, to create effects that result in the disruption of an adversary's cohesion, will, or ability to wage war. By simply possessing the capability to conduct such operations, an air force can deter aggression, signal resolve, and reassure allies. When the willingness to conduct aerospace operations for strategic effect is demonstrated through presence or the suggested use of force, these

43 NATO AJP-3.5, *Allied Joint Doctrine for Special Operations*, 2-5.

44 CF SOF experience in Afghanistan indicates that manned ISR assets retain specific advantages over unmanned assets, particularly during the final phases of a SOF mission. Generally speaking, these advantages are reduced latency (of communications, imagery, and analysis), reduced vulnerability (to jamming and weather effects, primarily), and increased trust (between SOF leadership and the individuals operating the asset; in the developing unmanned model, the operators can be well removed from the theatre of operations and are thereby less aware overall and less engaged in the fight).

45 The concept of the centre of gravity originates from the writings of Clausewitz, who expressed it as "the hub of all power and movement, on which everything depends." Even today, there remains some debate over how Clausewitz's concept should be translated and interpreted. For a summary of this discussion, see Antulio J. Echevarria, *Clausewitz's Center of Gravity: Changing Our Warfighting Doctrine – Again!* (Carlyle, PA: Strategic Studies Institute, September 2002).

deterrent and reassurance effects are multiplied. Force application in a controlled and graduated manner can and has been used to convince an aggressor to cease undesirable behaviour. Aerospace forces can conduct coordinated parallel attacks aimed at overwhelming an adversary or specific critical portions of their system, thereby inducing decision-making paralysis.[46] A pronounced strategic success may also erode the adversary's civilian support for government, national policies, or aggressive activities.[47]

The key advantage of aerospace power is its ability to strike directly at the heart of an adversary, while avoiding both symmetric force-on-force attrition battles and the need to sequentially fight through layers of surface forces. Expected effects—not the specific weapon system, delivery platform, or the type of target attacked—define a strategic attack.

Strategic attacks can be part of a campaign, major operation, or be conducted independently as single missions. Used in this sense, the term "strategic" does not limit the strategic attack to the strategic level of warfare. Strategic attacks may be targeted against both strategic- and operational-level CGs and associated critical vulnerabilities, depending on what the JTFC's overall objective is. Equally, when targeted at the strategic level, such attacks may achieve strategic objectives without necessarily having to achieve operational objectives as a precondition. Ultimately, the focal point of strategic attack is an adversary's C2 system and their ability to render decisions or carry out a cohesive strategy or operational plan. The strategic importance of a target may either be its practical output or the psychological impact of the attack itself. Precision and target discrimination are crucial requirements of a strategic attack, as undesirable strategic effects can result from poorly planned or executed aerospace operations, undermining friendly strategic objectives. The unrestricted use of force and resulting collateral damage can sway public opinion against friendly forces and serve as a rallying cry for an adversary.

STRATEGIC ATTACK MISSION

With this discussion in mind, the single aerospace strategic attack mission is identified as precision strike.[48] The characteristics of aerospace power enable aircraft to strike almost anywhere within the battlespace. Key to modern warfare, however, is the precision with which these strikes are carried out.

46 While this idea was expressed as early as 1954, the modern understanding of parallel attack is based on the writings of Colonel John Warden. See John A. Warden III, "The Enemy as a System," *Airpower Journal* 9, no. 2 (Spring 1995).

47 While aerospace power can have significant morale effects on adversary populations, this is only important if that will is necessary for governmental continuity. Japanese public morale in the spring of 1945 was very low and their support for continued aggression was nil; however, the psychological conditioning of the Japanese populace was such that they would do whatever the emperor (through the government) told them to do.

48 In this context, the term "strike" is considered synonymous with "attack."

All too often in the recent past, poorly coordinated air strikes have resulted in significant collateral casualties or damage with an equally significant negative impact on the overall mission and popular support. Events such as these are the battlefield equivalent of an own goal and must be avoided.

CENTRES OF GRAVITY

Generally speaking, CGs are categorized as follows:

a. **Leadership.** The purpose of war is to compel an adversary to act in accordance with friendly will. Thus, adversarial national command authorities and military-strategic leadership are attractive and natural targets. The other CG targets discussed in this paragraph will indirectly affect an adversary's leadership, but the individual leaders and their C2 systems may also be subjected to direct lethal, psychological, and/or electronic attacks. These operations could be called strategic counter-C2 operations. The effect desired from a strategic counter-C2 operation could be strategic paralysis, with the purpose of giving the opponent a sense of futility and isolation.

b. **Production** consists of two related sub-categories:

(1) **Industry.** Counter-industry operations are conducted against an adversary's key industries. The prosecution of the right target complex will eventually affect an adversary's ability to wage war. In an industrialized society, attractive strategic targets could include facilities supporting the generation/distribution of electrical current, oil production, and oil refineries.

(2) **Economy.** Counter-economy operations are closely related to counter-industry operations but are conducted for the desired effect of causing a collapse of an adversary's economy. With the increased dependence in industrialized countries on information technology for the conduct of all economic transactions, the offensive application of all the facets of command and control warfare make it an attractive target option.

c. **Transportation.** Strategic targeting of an adversary's vital transportation centres and transport means, both civilian and military, may have a decisive effect on their overall ability to wage war.

d. **Civilian population.** International humanitarian law prohibits attacking or threatening violence against civilians and civilian property. However, the opinion of the civilian population can have an impact upon the will of adversary forces and, therefore, remains a key CG. Information operations, which conform to the

provisions of international law, may be directed towards civilians within adversary territory. Air power has the ability to support these types of operations.

e. **Military.** Strategic counter-military operations are conducted against those adversarial military forces and weapons systems, which, if used, have the ability to achieve strategic effect and pose a direct threat towards our own strategic CG. Since a country's CG defines its strength and will, such a threat automatically gives counter-military operations a high priority. For example, strategic counter-military operations can be directed against weapons of mass destruction for the purpose of destroying an ability to use these weapons.[49]

SUMMARY

The goal of air attack operations is to achieve the JTFC's intent and desired end state by dominating the surface battlespace from the air. Aerospace forces are particularly well suited to the counter-surface mission in that the characteristics of aerospace power (speed, range, surprise, manoeuvrability, flexibility, and lethality) provide significant advantages over surface-based forces. Effective counter-surface operations demand a high degree of friendly control of the air.

Air attack operations may be integrated (through direct support to a surface formation or component) or independent (directed against a joint prioritized target). The intent of any counter-surface Shape mission is to find, fix, delay, disrupt, or destroy adversarial forces on or under the surface; these missions can take place in the land or maritime domains. Missions conducted in direct support of a surface force require close cooperation, detailed planning, and integrated C2 systems and processes. While the ACC retains overall control of aerospace assets, tactical control must rest with the supported commander if successful integration is to be achieved. Counter-surface missions are intelligence intensive and require high-fidelity targeting. They also require the support of air combat enablers such as C2, AAR, EW, and ISR assets. Air attack operations include counter-sea and support to maritime forces, counter-land and support to land forces, SAO, and strategic attack.

The aim of counter-sea operations is to attain and maintain a desired degree of maritime superiority by finding, fixing, delaying, disrupting, or destroying adversary forces in the maritime domain and to prevent an opponent from doing the same. Aircraft tasked with counter-sea missions may be organic to a naval force or attached from a land-based aerodrome.

49 K. Noedskov, "Systematizing Effect Based Air Operations," *Air&Space Power Journal – Chronicles Online Journal*, May 24, 2000, http://www.airpower.maxwell.af.mil/airchronicles/cc/noedskov.html (accessed August 20, 2013).

Missions may occur in close proximity to a maritime force or be focused on areas of open ocean, maritime lines of communications, or strategic chokepoints (such as the Strait of Hormuz). Counter-sea operations conducted close to land in the littoral are complicated by the presence of land-based weapons systems, higher concentrations of civil traffic (both air and maritime), and the defensive advantages that coastal waters and topography can provide an adversary. These operations are particularly complex, requiring robust joint doctrine and the close synchronization of TTP. The three counter-sea missions are ASUW, AAW, and ASW.

The aim of counter-land operations is to employ aerospace Shape capabilities against land targets to achieve the JTFC's strategic, operational, or tactical intent. Counter-land operations enable friendly manoeuvre and freedom to attack while denying an adversary the same. Aerospace forces offer the advantage of targeting adversarial surface forces across the full depth of the battlefield, generally unconstrained by battlespace boundaries and topographical limitations that can hamper land force manoeuvre and sensors. Aerospace operations can be conducted across the battlespace from the close battle to the deep battle and into an adversary's rear areas. Aerospace power is fundamental to the success of the land battle, and when true integration of aerospace and land capabilities is achieved, mission success follows. The four counter-land missions are AI, aerial fire support, tactical security, and direction and control of fire.

Special air operations and support to SOF include aspects of both the counter-sea and counter-land missions. Specialized training in SOF techniques and procedures will normally be required, and operations of this sort may be limited to specific aerospace units using unique equipment. Execution requires clandestine manoeuvre and high precision and occurs in environments of lower-level control of the air and higher level of risk. Nevertheless, additional aircraft in a direct support role, but not certified as organic SAO qualified, may be offered and accepted to augment the airlift, fire support, and ISR capabilities of a special operations force. The Shape SOA missions are specialized air mobility / personnel recovery operations, aerial fire support, and overwatch (armed/unarmed).

Strategic attacks are aimed at an adversary's CGs, and targets are carefully chosen, not for their tactical value but for the potential strategic effect of the attack. Strategic attacks weaken the adversary's ability or will to engage in conflict or continue an action. Strategic attacks can be carried out by any platform, and targets can include any facility, person, or platform deemed to yield the strategic effect desired. Precision strike is the sole mission within the Shape aerospace strategic attack role.

CHAPTER 4

AEROSPACE INFORMATION OPERATIONS

Photo: US Army

INTRODUCTION

> *To win one hundred victories in one hundred battles is not the acme of skill. To subdue the enemy without fighting is the acme of skill.*[1]
>
> – Sun Tzu

Although info ops[2] is considered a relatively new military discipline spawned by the present information age, in reality, the only thing that is new is the *breadth* of the evolving capabilities. Within Canadian history, aspects of this discipline can be observed as early as the Battle of Detroit in August 1812, a victory won by conquering "the mind of the enemy commander, not the bodies of his troops."[3] As demonstrated in Vignette 10, terminology for some aspects of info ops had not yet been coined; however, the tenets and power of info ops have been practiced since the dawn of warfare.

Vignette 10: The Battle of Detroit. The War of 1812 is often described by historians as a formative chapter in the eventual establishment of Canada as a nation. The collective rallying of disparate pre-nation Canadians (British, French, native, and even former Americans living in Upper Canada) against an offensive US force is still reflective of Canada's non-offensive but, once evoked, fiercely defensive mindset.

Under the leadership of British Major General Isaac Brock, a carefully synchronized campaign utilizing the then unnamed concepts of signals intelligence (SIGINT), military deception, psychological operations (PSYOPS), and operational security (OPSEC) was brilliantly waged against a numerically superior adversarial force.

Critical to any information operations campaign, Brock started by developing a strong understanding of the mindset of his adversary: US Brigadier General William Hull. Through covertly intercepted communiqués, Brock searched for and ultimately discovered a key psychological weakness: a deep fear of native "Indian savages." Leveraging this information for maximum effect, Brock took siege of Detroit and implemented his next information operations tool: deception. He dressed many of his militia forces in borrowed distinctive redcoats of British regulars and instructed that night fires were to be lit individually (vice the common practice of one per five soldiers); giving the day and night impression of a large British force.

1 See "Art of War: Quotes by Sun Tzu," http://suntzuart.com/sun-tzu-quotes (accessed August 20, 2013).

2 As mentioned previously, where the terms "information operations" or "info ops" are used they should be understood as referring to joint info ops. The aerospace contribution to joint info ops is described within this chapter as the aerospace info ops capability.

3 The full quote: "The real target in war is the mind of the enemy commander, not the body of his troops." See B. H. Liddle Hart, *Thoughts on War* (Staplehurst, UK: Spellmount, 1998).

Bolstering this deception, his allied chief, Tecumseh, repeatedly cycled his moderate number of warriors through gaps in the forest that observers within Fort Detroit would have mistaken, and reported, as a huge "savage" force. These deception-based actions neatly reinforced a letter that Brock's staff had crafted much earlier with the intent that it be "captured" by their adversary. A paragraph in this deliberately administrative-sounding letter mentioned that 5,000 native warriors should be enough support to the amassed British forces already facing Detroit. Shifting his information tactics to psychological warfare, Brock gently encouraged his allied warriors to circle Fort Detroit in a screaming and blood-thirsty fashion. Against this backdrop, Brock played his decisive information operations card; he sent a letter to Hull which basically stated that the number of natives who had joined with his forces would be beyond his control once the battle started. Faced with the horrifying imagery of 5000 "savages" unleashed upon his fort, Brigadier General Hull simply surrendered.

If Brock's men, allies, or countrymen had uttered words or taken visible actions that had funneled back to the defenders of Detroit, disproving any significant part of the information campaign, Brock would have surely lost the battle. Effective OPSEC, throughout the operation, was essential to its success. Ultimately, Brock's approximately 1330 troops (600 natives, 330 British regulars, and 400 militia) suffered zero casualties; Hull's troops suffered seven deaths (due to artillery bombardment) and approximately 2500 were captured.

In addition to the booty that was stripped from Detroit, Brock's actions emboldened pre-nation Canadians and demoralized the Americans at a time when US political leadership commonly and dismissively considered Canada as "for the taking." Had Brock entered into a classic war of attrition, history books would have surely recorded his resounding defeat vice the rout of Detroit through his brilliant implementation of information operations principles.[4]

Information superiority can be critical to the outcome of a military conflict. Military actions are designed to generate effects across the domains. Operating within the physical, moral, and informational domains, info ops shape the electromagnetic, psychological, conative (will), cognitive (understanding), information, and cyber sub-domains to support friendly intentions and goals, while degrading or denying an adversary's freedom of action to operate in kind. When combined with current electromagnetic and other technological advances, it is easy to appreciate the expanded potential of modern info ops. To maximize this potential and avoid mutual interference, operational planners must ensure that info ops activities are coordinated and synchronized with fires and manoeuvre. Additionally, military members at all levels must be cognizant of the effects, be they intended or unintended, of their actions and how they shape the battlespace.

4 For more see Historica Canada, "Capture of Detroit, War of 1812," *The Canadian Encyclopedia*, http://www.thecanadianencyclopedia.com/articles/capture-of-detroit-war-of-1812 (accessed August 20, 2013).

For example, the overflight of a village by an armed fighter en route to an operating area is no longer simply a transit; it can become a means of sending a message to one's adversaries, allies, and civilian populations about one's intent, means, and will. Information is a key operational factor when planning and conducting military operations.

DEFINITION

Several definitions of info ops exist among allied nations, but the ideas behind most concepts are similar in context and purpose. For the CF, info ops is defined as "coordinated actions to create desired effects on the will, understanding and capability of adversaries, potential adversaries and other approved parties in support of overall objectives by affecting their information and information-based processes and systems, while exploiting and protecting one's own."[5] While these actions are constrained by Western values and by legal frameworks, it must be understood that adversarial info ops are often unconstrained and, as a result, potentially even more damaging if not countered. Info ops are designed, synchronized, and implemented in support of the JTFC's overarching campaign objectives.

This chapter is intended to highlight the importance of info ops in modern warfare and to identify some of the ways aerospace forces can be brought to bear. From recent experiences in Afghanistan and elsewhere, the strategic impact of aerospace operations from an info ops perspective is obvious. Unfortunately, it has often been the negative impact that is most evident. For this reason in particular, it is critical that RCAF personnel understand the overarching principles of info ops that must guide and govern future aerospace operations.

It is important to understand what separates info ops from other psychological warfighting strategies. An old term often associated with info ops, and in particular with PSYOPS, is propaganda. Although the aim of propaganda may be similar to info ops, it consciously uses falsehoods to produce its effects. PSYOPS by Western powers use selected truths to achieve their objectives. The RCAF recognizes that the short-term gain of a lie, once discovered, causes a long-term and unacceptable degradation of future PSYOPS products.

5 B-GL-300-001/FP-001, *Land Operations* (January 1, 2008), 5-44. Note that *Land Operations* specifies that NATO Allied Joint Publication (AJP) 3.10, *Allied Joint Doctrine for Information Operations*, November 2009, http://info.publicintelligence.net/NATO-IO.pdf (accessed August 20, 2013) was used as a reference for this definition.

PRINCIPLES OF INFORMATION OPERATIONS

To build, manage, and maximize info ops, the following six principles must be observed:

a. **Support the JTFC's objectives.** When the RCAF is tasked to lead or support a broad GC initiative or specific CF operation, the JTFC and their staff will promulgate strategic mission objectives. The resulting aerospace info ops objectives must be clearly traceable and synchronized to support these mission objectives.

b. **Execution in the pre, active, and post phases.** Early, broad, and persistent shaping through info ops will provide significant long-term operational dividends.

c. **Persistent focus on "effect," not "performance."** The equivalent to a kinetic battle damage assessment (BDA) is inherently difficult to determine. An undue focus on measures of performance (e.g., numbers of leaflets dropped, jamming conducted, motherboards fried, signals intercepted, wells dug, and communiqués released) instead of measures of effectiveness (e.g., observed changes in an adversary's behaviour) must be avoided in an effective info ops campaign. Info ops is fundamentally about coordinated influencing and observable change in neutral and adversarial targets; this is the only metric of info ops significance.

d. **Synchronization with influencing entities of all elements, agencies, and allies.** Simplistically, info ops can be described as synergistic cooperation between non-kinetic practitioners. However, due to the potential breadth of the synchronization effort, in practice, info ops is neither simple nor strictly non-kinetic. Formal and informal synchronization mechanisms between own military, own government, allied forces, and non-governmental organizations (NGO) must be established and maintained. As a general rule: the broader the synchronization effort, the greater the info ops effect.

e. **Deep understanding of the target audience.** To effectively influence the minds and subsequent behaviours of a target audience, it is necessary to understand the social, cultural, and religious motivational precepts which guide their actions. To avoid personal biases and errant hypotheses, it can be critical to garner understanding and background information from academics, anthropologists, and religious leaders. Info ops, and in particular, PSYOPS, are most effective when both emotive hearts and cognitive minds are targeted for influence.

f. **Monitor, assess, and adjust.** Change within the hearts and minds of a target audience is often a slow process and can only be quantified with assessed changes in behaviour. It can be difficult to assign definitive cause-effect to individual info-ops-based efforts. The establishment of a baseline and cyclical monitoring of the target audience's frame of mind (e.g., motivation, outlook, allegiances, and fanaticism) and actions (e.g., war-fighting, work habits, recreation activities, and religious adherences) is critical. This framework will afford info ops practitioners the ability to gauge shifts in target audience psychological state, a precursor to change in behaviour. This collection and assessment process must leverage the combined potential of all available intelligence, polling, open-source, and informal sources. As info ops milestones are achieved, emphasis will adjust to, and ideally lead, the progressive phases of the mission.

Photo: US Air Force

CORE INFORMATION OPERATIONS ACTIVITY AREAS[6]

Current info ops doctrine groups operations into three core activity areas: counter-command activities (CCA),[7] influence activities (IA), and information-protection activities (IPA). While IPA must take place at all times, IA and CCA may or may not be planned as part of an operation. Each activity area has a unique focus:

6 This section was adapted from NATO AJP 3.10, 1-7.

7 CCA is also used to refer to close combat attack, discussed previously in Chapter 3.

a. **Counter-command activity**. Information activities that focus on countering command functions and capabilities, by affecting the data and information that support an adversary's use of information in command and control; intelligence, surveillance and target acquisition; and weapon systems (e.g., CNO and EW/EA/jamming).

b. **Influence activity**. Information activities that focus on changing, influencing, or reinforcing perceptions and attitudes of adversaries and other approved parties (e.g., PSYOPS, EW/spoofing, and PA).

c. **Information-protection activity**. Information activities that focus on preserving and protecting freedom of manoeuvre in the informational domain by defending the data and information that supports one's own decision makers and decision-making processes (e.g., OPSEC and frequency-agile radios).

Figure 4-1 illustrates the thematic construct of info ops. For the sake of clarity, arrows only point to the primary intended effect of each activity area; however, it is essential to understand that activities conducted under CCA, IA, or IPA commonly have second-order effects. For example, conducting a CNA to destroy an adversary's communication node may be primarily executed as a CCA. As a second-order effect, this action will also degrade the adversary's situational awareness, hence their understanding. If the CNA activity is also coordinated with friendly SIGINT assets, the adversary may commit exploitable OPSEC breaches. Collectively, these second-order effects support IPA initiatives. Conversely, if the attack on the communications node was done without coordination, it may negatively impact important friendly intelligence-gathering efforts.

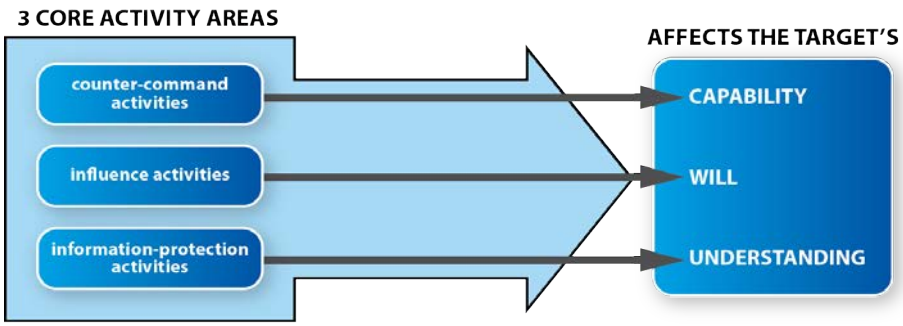

Figure 4-1. Construct of information operations

COMPONENTS OF INFORMATION OPERATIONS[8]

Info ops ensure that appropriate tools, techniques, and capabilities are coordinated, de-conflicted, and synchronized to achieve desired effects in the target domains. In some instances, these efforts can result in specific aerospace missions, but in general, they form an inherent part of the overarching operational planning process. It must be understood that any military activity can be leveraged towards an info ops objective. While not exhaustive, the following are examples of military capabilities that commonly contribute to info ops initiatives:

a. **Psychological operations**. The primary purpose of PSYOPS is to influence the perceptions, attitudes, and behaviours of selected individuals or groups to achieve operational objectives. This is generally accomplished through the use of highly selective messages. Common mediums to disperse this messaging include: face-to-face, print, audio, audio-visual, and novelty products. PSYOPS exerts direct control over content, dissemination, and audience and will not intentionally use commercial media organizations to transmit its messaging. Aerospace assets can support the dissemination of PSYOPS messaging through radio broadcasting and leaflet drops. PYSOPS is often confused with public affairs (PA), but very clear distinctions between the two exist. The PA officer's primary aim is to *inform* neutral and friendly audiences via media outlets, while the PSYOPS officer's primary aim is to *influence* neutral and adversary targets.

b. **Military deception** involves measures designed to mislead adversaries through manipulation, distortion, or falsification. Deception is a complex art which demands good OPSEC, significant compartmentalized planning, and a sound understanding of an adversary's way of thinking. In operations, it can contribute directly to the achievement of surprise and indirectly to security and economy of effort. Within a deception plan, both information and traditional physical means and methods (such as feints, camouflage, and decoys) can be applied. Info ops planners must be involved in deception planning to ensure that deception objectives and other information activities are mutually supportive. Aerospace forces—owing to their range, speed, prowess, and flexibility—are exceptionally well suited for deception objectives.

8 This section was also adapted from NATO AJP 3.10, 1-8 to 1-13.

Vignette 11: Deception during the Normandy invasion. The beginning of the end to Nazism was decisively ushered in with the Normandy landings on 6 June 1944. Less well known are the full complement of deception activities that helped establish this triumphant beachhead. A brilliant case in-point was the phantom naval invasion force that was orchestrated by Royal Air Force 218 Squadron; a unit that included numerous Commonwealth aircrew.

Generally relegated to coastal mining roles due to their slow and nearly obsolete Short Stirling Mk III aircraft, 218 Squadron, nonetheless, honed a precise kinetic skill set that would be leveraged for an even more important non-kinetic deception: one that would save the lives of thousands of naval and army personnel. Critical to the success of the D-Day landings was the requirement to have Nazi forces convinced that the expected Allied invasion forces were arriving at a different location; a deception made difficult by the need to emulate a huge water-borne invasion force. With only days to brief, equip, train, and execute, 218 Squadron achieved this feat through a carefully orchestrated use of chaff, a fairly new deception tool referred to as "window" in this era.

At 2339Z on 5 Jun 1944, with Australian Flight Lieutenant Chaplin at the controls, the first of eight Shorts Stirlings lumbered into the air and aimed for a location in the English Channel well north of Normandy. Once in position, the aircrew commenced choreographed drops of 12 chaff bundles along an 18-mile-long (29-km) front in the strait. With precise navigation and under the cloak of night, these aircraft flew successive paths that progressively moved towards the French coastal area of Bolougne, which, when viewed by Nazi radar, gave the impression that a vast armada was sailing towards them at 7 knots (13 km per hour). Ultimately, the enemy forces mistook this low-level cloud of chaff for a genuine threat and engaged it with long-range guns, search lights, and fast attack E-boats, a combination of resources and command focus drawn away from the imminent real invasion force, 150 miles (241 km) to the south. When the last Short Stirlings touched down at Royal Air Force Station Woolfox Lodge at 0512 Zulu on 6 June 1944, the real Normandy invasion was well underway. 218 Squadron could be very proud of its masterfully executed effort to deceive the Nazi High Command, an effort that clearly contributed significantly to the end of the Second World War.[9]

c. **Operations security** is a process focused on the protection of select unclassified information and/or observable activities that, in isolation or cumulatively, could expose friendly dispositions, capabilities, or intentions to the adversary. OPSEC is often confused with the protection of classified information, but this is an inaccurate use of the term. It is assumed/accepted that all branches of DND have well-established protocols for protecting classified information and that the process of obtaining security clearances informs and directs individuals on the proper application of these

9 For more on this event see Mary Barbier, *D-Day Deception: Operation Fortitude and the Normandy Invasion* (Mechanicsburg, PA: Stackpole Books, 2009).

protocols. In the case of unclassified information, no such control measures exist, hence the evolution of OPSEC. In accordance with its name, OPSEC is an operations-centric activity which demands that all personnel remain vigilant in their handling of select unclassified information (e.g., flight plans, metrological briefs, Defence Wide Area Network emails, Facebook accounts, etc.). As an informal OPSEC mindset, personnel must treat all unclassified information, throughout its lifecycle, as though their mishandling of it would result in its provision to an adversary. As a formal and proactive process, OPSEC seeks to identify critical friendly-force information, analyse threats and vulnerabilities, assess risks, and then apply countermeasures.

Vignette 12: Within the cauldron of Vietnam, the birth of a dragon. In the art of war, commanders intuitively understand the need to protect their strategic plans. Indeed, Sun Tzu neatly summarized this important facet of warfare in approximately 500 BC with the quote: "Let your plans be dark and as impenetrable as night."[10] While secrecy of classified information has been an established military requirement for an eon, lesser understood is the associated need to protect unclassified operational data that can, when combined with other information, reveal a combatant commander's intent, sometimes with debilitating results. This lesson was firmly learned by USAF during the Vietnam War, through a top secret investigative operation known as PURPLE DRAGON. It was through this covert yet holistic study that the understanding, structure, and term operations security (OPSEC) was born.

After the Viet Cong (VC) attacked the US air base at Pleiku on 7 February 1965, destroying or damaging 25 aircraft, USAF embarked on a dramatic response designed to "bomb them back to the Stone Age."[11] Within a week, the first wave of Operation ROLLING THUNDER, consisting of 160 US and allied aircraft, began a relentless bombing campaign. By June 1965, these already impressive Air Force efforts were joined by the carpet-bombing power of B-52s flying from Guam and other distant aerodromes under the operational codename *Arc Light*. However, by December 1966, initial optimism for this mammoth USAF effort turned to concern when BDA and interrogations of captives revealed minimal destruction of adversary capacity and continuing high morale of adversary troops. Something was wrong, something was broken, something had to be done; that something was Operation PURPLE DRAGON.

Although early suspicions focused on possible intelligence leaks, based on National Security Agency (NSA) SIGINT reporting that confirmed prior knowledge by the VC of USAF targets and timings, the focus gradually shifted to the realization that it

10 See "Art of War: Quotes by Sun Tzu," http://suntzuart.com/sun-tzu-quotes (accessed August 20, 2013).

11 For more see Nick Cullather, "Bomb Them Back to the Stone Age: An Etymology," George Mason University's History News Network, http://hnn.us/articles/30347.html (accessed August 20, 2013).

was unsecure unclassified information that was the main culprit. Through the study of International Civil Aviation Organization (ICAO) flight plans and other associated unclassified traffic, the VC, with some assistance from China, were able to derive good estimates of when to take deep shelter in advance of each bombing wave; a tactic which nullified the bombing campaign. Subsequent adjustments in USAF's handling of unclassified operational information provided a significant increase in the lethality of future bombing efforts, underscoring the symbiotic relationship between info ops activities and kinetic action.

Ultimately, the once top-secret Operation PURPLE DRAGON morphed into the first formal OPSEC programme that was subsequently embraced by other US military and government departments. OPSEC was considered so broadly applicable and key to national security that on 22 January 1988, President Ronald Reagan signed a directive decreeing that "each Executive department and agency assigned … sensitive activities shall establish a formal OPSEC program … ."[12] The criticality of a structured and deliberate OPSEC programme, that fundamentally views friendly actions from the vantage point of an engaged predator at the fence, is now acknowledged and practiced by all modern militaries.[13]

Photo: US Navy

12 See Naval Postgraduate School Center for Homeland Defense and Security, "National Security Decision Directive 298: National Operations Security Program," *Homeland Security Digital Library* (Washington, DC: January 22, 1988), 2, http://www.hsdl.org/?view&did=463214 (accessed August 20, 2013).

13 For more, see National Security Agency Central Security Service, "Purple Dragon: The Origin and Development of the United States OPSEC Program," Volume 2, series VI (Center for Cryptologic History, 1993), http://www.nsa.gov/public_info/_files/cryptologic_histories/purple_dragon.pdf (accessed August 20, 2013).

d. **Electronic warfare** is defined as "military action to exploit the electromagnetic spectrum encompassing interception and identification of electromagnetic emissions, the employment of electromagnetic energy and directed energy to reduce or prevent hostile use of the electromagnetic spectrum, and actions to ensure its effective use by friendly forces."[14] EW is sub-divided into electronic warfare support (ES), electronic protection (EP), and electronic attack. ES involves searching for, intercepting, identifying, and locating or localizing sources of intentional and unintentional radiated electromagnetic energy for the purpose of immediate threat recognition, targeting, planning, and the conduct of future operations. SIGINT as well as measurement and signature intelligence (MASINT) are products of ES activities. EP involves passive and active means taken to protect personnel, facilities, and equipment from any effects of friendly or enemy employment of EW. And EA involves the use of electromagnetic energy, directed energy, or anti-radiation weapons to attack personnel, facilities, or equipment, with the intent of degrading, neutralizing, or destroying enemy combat capability. With the ever-expanding use of and dependence on the electromagnetic spectrum to wage warfare, EW's battlefield role is only destined to grow. EW has the potential to seize and maintain friendly command of critical portions of the electromagnetic domain. EW provides important shaping options to the commander. However, if these tools are improperly synchronized with joint and coalition partners, their uncoordinated employment against adversarial targets can result in mutual interference. Additionally, even if some EW operations, such as jamming, are judiciously timed and executed, they can produce negative second-order effects such as lost opportunities to gain important SIGINT. Consideration of short-term gains garnered via various EW tools must be weighed against the second-order ramifications of their use.

e. **Computer network operations** address the three major divisions of the cyber battlespace: CNA, computer network exploitation (CNE), and computer network defence (CND). These roughly align with the three thematic constructs of info ops (i.e., CNA supports CCA, CNE supports CCA and IA, and CND supports IPA). Due to

14 EW is presented here as a component of info ops and of the Shape sub-function, but in some ways this approach can be limiting. The integral role that EW plays in the overall application of combat power and in the protection of those platforms so engaged goes beyond the bounds of info ops, forming a fundamental element of each of the RCAF functions. The information and definitions presented here are taken from B-GA-403-002/FP-001, *Aerospace Electronic Warfare Doctrine*. A more detailed examination of aerospace EW can be found therein.

the clandestine nature of CNO, interaction and synchronization with other aspects of info ops can be challenging; however, CNO's inherent scope and reach can play a significant role in theatres which are dependent upon networked resources.

f. **Civil-military cooperation (CIMIC)** is an important influence tool. Interaction with local governments, indigenous populations, and NGOs can provide a unique perspective on the influence potential of proposed projects. Within asymmetric warfare situations, regions that are initially won by conventional war-fighting tactics might best be held, in the long-term, through sage delivery of humanitarian efforts, facilitated by CIMIC, to win and/or maintain the hearts and minds of the local populace. Overall, from the perspective of info ops, CIMIC activities must not be confused with altruistic aid. They represent an outreach opportunity to indirectly measure the mood of a region, move neutral populations towards friendly-supporting status, maintain the support of a friendly sector, and, on a larger scale, through tangible deeds, garner and maintain domestic and international support.

g. **Public affairs** officers are often part of the commander's personal staff, in recognition of the criticality of media operations and the need for timely advice. They are responsible for the planning, writing, and release of trustworthy themes and messages in support of evolving operations. Occasionally, the duties of PA can also be reactive to issues, such as an adversary's propaganda. When they deal with these adversary-focused issues, their responsibilities may seem to overlap those of PSYOPS officers; however, clear distinctions do exist. Essentially, the PA officer's primary aim is to *inform* neutral and friendly audiences via media outlets while the PSYOPS officer's primary aim is to *influence* neutral and adversarial targets. Ultimately, PA and PSYOPS officers are both responsible for communicating mutually supportive aspects of the commander's messages, and this dictates that close interaction between these groups is essential.

h. **Presence, posture, and profile (PPP).** The impact that the mere presence of aerospace assets may have on perceptions can be significant. Deploying even limited capability to the right place at the right time can add substantial credibility to messages being delivered through other channels and provide a major contribution to deterrence. The use-of-force continuum demonstrates that simply possessing a capability and making its presence known is a use of force in and of itself.

i. **Key leader engagement (KLE).** Commanders typically use emails, messages, and letters to succinctly convey their requirements; however, these mediums lack the extra communicative dimensions inherent in face-to-face engagements. During direct discourse, particularly in non-Western regions, non-verbal cues and cultural adherences can have more impact than actual spoken words. Therefore, when commanders are scheduled to meet with important personnel, who function outside the military reporting chain but whose actions could impact an operation, these meetings are best managed through a formalized KLE process. The cornerstone of the KLE process is ensuring commanders are forearmed with cultural insight, informational leverage, pre-defined key themes, problematic issues to avoid, and the desired effect to be achieved.

These components of info ops are grouped among the three principal info ops activity areas in the following manner:

a. **Counter-command activity (CCA)**: EW and CNO (exploitation and attack);

b. **Influence activity (IA)**: PSYOPS, military deception, EW, CNO (exploitation), CIMIC, PA, PPP, and KLE; and

c. **Information-protection activity (IPA)**: military deception, OPSEC, and CNO (defence).

AEROSPACE INFORMATION OPERATIONS

While RCAF personnel can participate in the whole range of info ops activities, the areas where aerospace assets can shape the info ops battlespace are more limited. As a result, the focus of aerospace information operations is placed on a subset of the total number of components listed in the preceding section; namely PSYOPS, military deception, EW, and PPP. Figure 4-2 groups these components into two aerospace info ops roles: influence operations (which encompass PSYOPS, military deception, and PPP) and electronic warfare. The missions within each role are also identified and, in certain instances, serve to highlight the overlap between aerospace info ops and other aerospace capabilities.[15]

15 Aerospace CNO capabilities are under development in some countries but are not discussed here due to the lack of a fielded unclassified system. As these capabilities emerge, CNO may be reconsidered and become an additional role within the aerospace info ops capability.

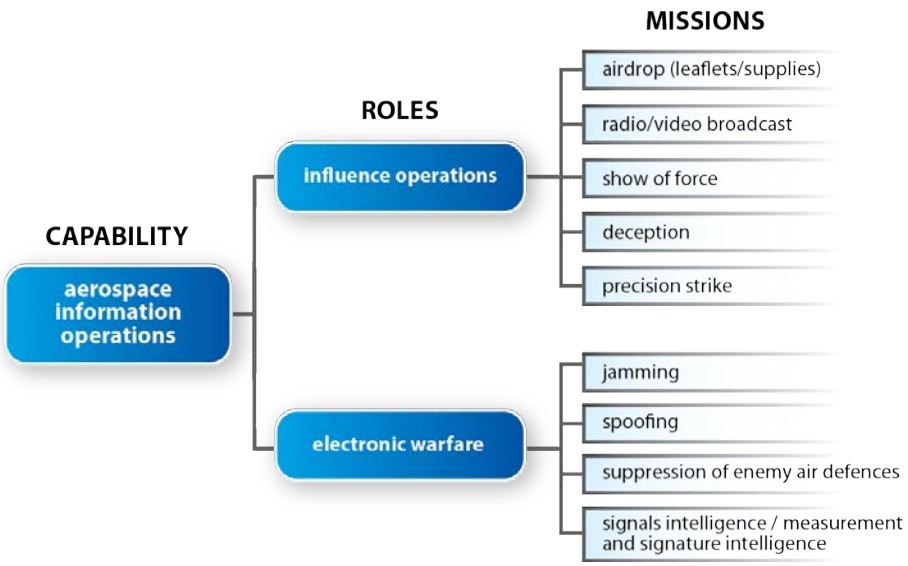

Figure 4-2. The aerospace information operations capability

The aerospace info ops missions can be conducted by a variety of platforms, not all of which are specialized or dedicated to info ops. Show-of-force missions are a good example where almost any platform can be used. EW missions require specialized equipment, and current EW-capable platforms possess a wide range of capabilities, from modern EW suites focused mainly on self-protection and signal intercept, to full-blown jamming systems. The CP140 Aurora Block III is equipped with a very advanced EW suite that will provide the CF with significant aerospace info ops capabilities. The EA-18G Growler, currently operated solely by USAF, is an excellent example of an aircraft specifically equipped for the jamming mission. Radio and video broadcast also requires specialized equipment and an aircraft with a lot of transmitting power. The EC-130J Commando Solo is so-equipped and is one of the few platforms whose primary function is aerospace info ops. Integrating these platforms effectively within a joint and coalition operation is a key priority for the JTFC.

SUMMARY

The use of info ops to wage combat is well documented throughout the history of warfare. Indeed, history provides many brilliant examples of cunning deception and psychological manipulation. However, with the advent of digital technology, info ops have expanded to provide the combatant commander with even more levers with which to exert non-kinetic influence, particularly within cyberspace and the electromagnetic spectrum. Unfortunately, some aspects of these new technologies can be inexpensively and effectively used by unfriendly state and non-state actors against technologically superior friendly forces. This reality dictates that CF personnel must be leaders in information-based warfare while remaining defensively vigilant.

Info ops is a planning and coordinating function which integrates and synchronizes information-related capabilities to create desired physical, moral, and informational effects in the operational battlespace. To maximize its potential, info ops must be considered and fully integrated from the earliest stages of planning and executed through all phases of a mission. If successful, info ops has the potential to reduce, if not eliminate, the requirement for the use of force. As such, info ops should be viewed as a critical force multiplier.

The aerospace contributions to info ops are limited to a small subset of the available component tools, namely: PSYOPS, military deception, EW, and PPP. Within the aerospace info ops capability, these components are divided between the two aerospace roles of influence operations and EW.

As technologies and warfare theories continue to evolve, info ops will have an increasing impact on military operations. Therefore, it is incumbent on all RCAF personnel, from commander to airmen/airwomen, to understand how their actions can impact, either positively or negatively, an info ops objective within an overarching mission plan.

CHAPTER 5

COMMAND AND CONTROL

CF Photo: Sgt Matthew McGregor

INTRODUCTION

Effective aerospace operations require a command and control framework and processes that are dynamic and adaptable to the specific needs of aerospace operations. Although variations may exist in the C2 of aerospace assets within a nation, alliance, or coalition, key fundamentals will remain and guide the delivery of kinetic and non-kinetic effects during aerospace Shape activities at home and abroad. This chapter is not intended to delve deeply into all aspects of domestic and expeditionary aerospace C2 but, rather, will focus on those aspects directly linked to Shape. The overarching RCAF C2 structure, definitions, and processes are found in B-GA-401-000/FP-001, *Canadian Forces Aerospace Command Doctrine*.

COMMAND AND CONTROL IN THE AEROSPACE DOMAIN

Past and recent conflicts have clearly demonstrated that to best accomplish the mission, aerospace forces must be coordinated and directed at the operational level by a single air commander. This individual is normally referred to as the air component commander[1] who, having a theatre-wide perspective, has the authority to assign available forces to best achieve assigned objectives. The ACC is responsible to the joint task force commander (JTFC)[2] for the control—to include planning, direction, prioritization, allocation, synchronization, integration, and deconfliction—of aerospace assets within the joint environment. Normally, the ACC will also be nominated by the JTFC as the theatre airspace control authority (ACA) and air defence commander (ADC). These command appointments ensure that the management and use of the theatre aerospace domain are fully coordinated.

In the Canadian context, Commander 1 Canadian Air Division is designated as the JFACC, exercising the duties and responsibilities of an ACC as the senior air advisor to the designated force employment (FE) commander.[3] For each given mission or exercise, whether domestic or deployed, a command structure comprising appropriate subordinate RCAF commanders can be established.[4] The JFACC will often delegate duties and responsibilities for specifically assigned aerospace assets to one of these commanders in order to provide better overall support to the supported commander.

1 The term "air component commander" can be adapted for different command situations. In a joint environment, the ACC becomes a joint force air component commander (JFACC). In a multi-national operation, a combined force air component commander (CFACC) or combined/joint force air component commander (C/JFACC) can be designated. In all cases, these commanders have, at a minimum, the same responsibilities as an ACC.

2 In the Canadian context "JTFC" refers to an FE commander or their designated JTFC (e.g., Commander JTF North).

3 These include but are not limited to Commander NORAD, Commander Joint Operations Command (CJOC) and Commander Special Operations Forces Command (CANSOFCOM).

4 Examples of possible command structures are detailed in B-GA-401-000/FP-001, *Canadian Forces Aerospace Command Doctrine.*

An ACC will be supported by a staff ranging in numbers and capabilities from those assigned to a full-fledged aerospace operations centre (AOC)[5] comprising core elements such as strategy, combat plans, combat/current operations, ISR, and air mobility to a mission-specific current-operations cell. A wide variety of factors will determine requirements, including the overarching C2 structure, whether the operation is joint or combined, and the number and variety of assigned aerospace assets.

The RCAF has established a single Combined Aerospace Operations Centre (CAOC), which embodies the philosophy of centralized control and decentralized execution for the delivery of aerospace effects.[6] The CAOC team produces operational- and tactical-level direction and guidance on behalf of the JFACC in the form of the air operations directive (AOD), airspace control order (ACO), air tasking order, special instructions (SI), and other products necessary for the control, tasking, coordination, synchronization, and deconfliction of aerospace effects. The CAOC will support the efforts of a delegated ACC to varying degrees depending on the specific mission. For a deployed ACC on international operations, there will normally be an allied air C2 structure that performs the core aerospace operations centre functions, and the involvement of the RCAF CAOC will be minimal. By contrast, the CAOC will be heavily involved where an ACC is assigned to support a JTFC in Canada; this has as much to do with economy of effort as it does with effective C2.

The dynamic nature of aerospace C2 requires the establishment of support facilities with active sensors, data feeds, and communication links that allow control to be exercised over a given portion of airspace. When linked into a broader network, these facilities, often supplemented by airborne assets, help provide a common operating picture which is used by the commander to render dynamic aerospace management decisions and provide mission-critical control of aerospace assets for threat response, integration of fires and effects, and safe separation of aircraft. The complexity of this network is determined by the requirements of the operation and the desired level of control and can range from procedural arrangements with regular voice reporting to complete radar coverage of an area and live-video downlinks.

5 The generic term "air operations centre" is superseded in the Canadian context by a specific organization known as the "aerospace operations centre," with the same abbreviation.

6 Additional details on the Canadian Combined Aerospace Operations Centre (CAOC) concept of operations can be obtained in 1 Canadian Air Division, Canadian NORAD Region Headquarters, *Combined Aerospace Operations Centre: Operating Instructions, Volume 3: Concept of Operations* (October 1, 2009), http://winnipeg.mil.ca/cms/Libraries/CAOC_OI_Vol_1_2_3_Annexes/CAOC_OI_Vol_3_FINAL_1_Oct_09.sflb.ashx (accessed August 20, 2013).

APPORTIONMENT AND ALLOCATION IN JOINT OPERATIONS

Assigning aerospace forces to operations is a shared responsibility between the JTFC and the component commanders (CC).[7] Aerospace capability is apportioned, allocated, tasked, and retasked based upon priorities set by the joint and supported commanders. The JTFC sets the theatre priorities and articulates intent and desired end state in the form of a joint coordination order (JCO). The JTFC also assigns missions to their subordinate CCs. The component commanders (land [LCC], maritime [MCC] and special operations [SOCC]) carry out their estimates and then request aerospace (among other) resources to support their mission objectives.

The ACC will articulate the total available aerospace Shape capabilities to the JTFC. This takes into account all support and operational factors and represents 100 per cent of the available air effort for the day. The JTFC will then apportion aerospace capability (often expressed as a percentage of total effort) to their component commanders based upon the theatre priorities and their assigned tasks and aerospace requests. The respective CC will then be allocated aerospace support based on their missions and objectives.

In the case of support to the land component, for example, the LCC will determine and declare their main effort and priorities and will then allocate aerospace support (based on the JTFC apportionment) to their subordinate manoeuvre elements requesting and desiring aerospace support. The ACC will then assign tasks through the air planning staff and air tasking order cycle; aerospace assets will be tasked to support specific operations, objectives, and/or surface manoeuvre elements. Aerospace units will then undertake detailed planning and liaison with supported units.

This process does not normally apply to either tactical aviation or MH assets where there will be little to no detailed involvement by the ACC's air planning staff in the development of missions. These assets generally operate under the OPCON of the supported commanders and, as such, receive their detailed direction from the land or maritime planning staffs.

Inside a certain time frame (varying by theatre) any changes to the pre-planned and tasked aerospace support become immediate requests. Aerospace assets may be re-allocated by the ACC first, based upon theatre priorities set by the JTFC, and then on mission priorities established by the supported CC.

7 There are four standard force components: the air component, land component, maritime component, and special operations task force. Other components may be established depending on the demands of the mission.

AIR BATTLE RHYTHM AND AIR TASKING CYCLE

The JFACC (or assigned ACC) plans and executes aerospace operations based on JTFC guidance and objectives. As such, every phase of a campaign will see changes to the level and focus of the JFACC activities. Early in any air campaign, the JFACC will ensure that aerospace forces acquire and maintain the required freedom of action before looking to fully support the target nominations of other CCs. To accomplish this, the JFACC must initially focus targeting activities so as to achieve the desired level of control of the air, ideally gaining air supremacy or air superiority. This normally involves OCA operations aimed at destroying, degrading, or disrupting adversary aircraft and missile threats. In an allied context, aerospace assets and weapons systems owned by the other components may also be tasked to support the JFACC in establishing and maintaining the required level of control of the air. As a joint campaign progresses, the JPTL will show a shift in targeting priorities as reflected in the JTFC joint air apportionment decisions contained within the JCO.

CF Photo

As the subject matter expert on air operations, the ACC contributes to the JCO by providing the JTFC with a draft air plan, including recommendations on air asset apportionment and targeting. After the JTFC approves these recommendations and the JCO is released, the JFACC will publish an AOD which provides the intermediate level of detail required by air planners to service missions, tasks, and targets in accordance with JTFC guidance. The AOD may be published weekly or on a more frequent basis, even daily, if required. The eventual final products prepared by ACC planners are the ATO, the ACO, and SI. These products provide the tasking and supporting information required by aerospace forces of all components to plan air missions and tasks, enabling the efficient and coordinated use of all assets and airspace to accomplish JTFC objectives.

As previously mentioned, the AOD translates higher-level guidance into the tactical-level instructions required for mission accomplishment. While the JCO contains overall apportionment recommendations based on a thorough strategy-to-task analysis, the AOD provides further detail and normally contains the following:

a. JTFC direction, guidance and apportionment decisions. Apportionment (see example in Figure 5-1) can be expressed in terms of geographic area, percentage, priority, or weight of effort. The scope of apportionment guidance would include activities such as DCA, OCA, CAS, AI, and ASUW. Note that apportionment normally only applies to multi-role aircraft, as single-role aircraft will be automatically assigned their only role;

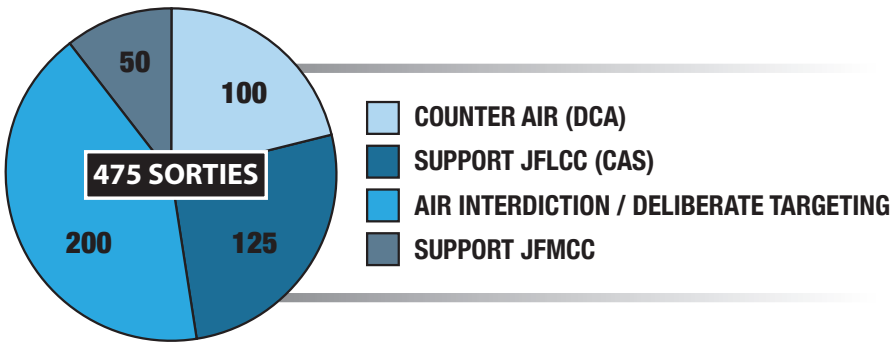

Figure 5-1. Example of apportionment

b. air campaign priorities and objectives;

c. guidance on the desired effects to be achieved in the AOD period;

d. list of available aerospace resources available, broken down daily if the AOD period covers multiple days. This is often referred to as the resource allocation (RESALOC);

e. deliberate and dynamic targeting guidance including JFACC targeting priorities;

f. command and control guidance; and

g. operational assessment to include data collection priorities.

The air tasking cycle provides a repetitive process for the planning, coordination, allocation, and tasking of aerospace missions in support of JTFC and ACC objectives. A relatively short cycle has the advantages of being able to accommodate a changing tactical situation and requests from other CCs as well as focus targeting efforts on supporting operational requirements. As depicted in Figure 5-2, the JFACC air tasking cycle is comprised of six interrelated steps: objectives, effects and guidance; target development and weaponeering; capabilities analysis (allocation of assets); ATO production and dissemination; execution planning and force execution; and assessment. Each step includes and is influenced by joint targeting activities. Close liaison and early coordination between ACC planners and any supported components are critical to the overall efficiency and effectiveness of the air campaign.

CF Photo: MCpl Robert Bottrill

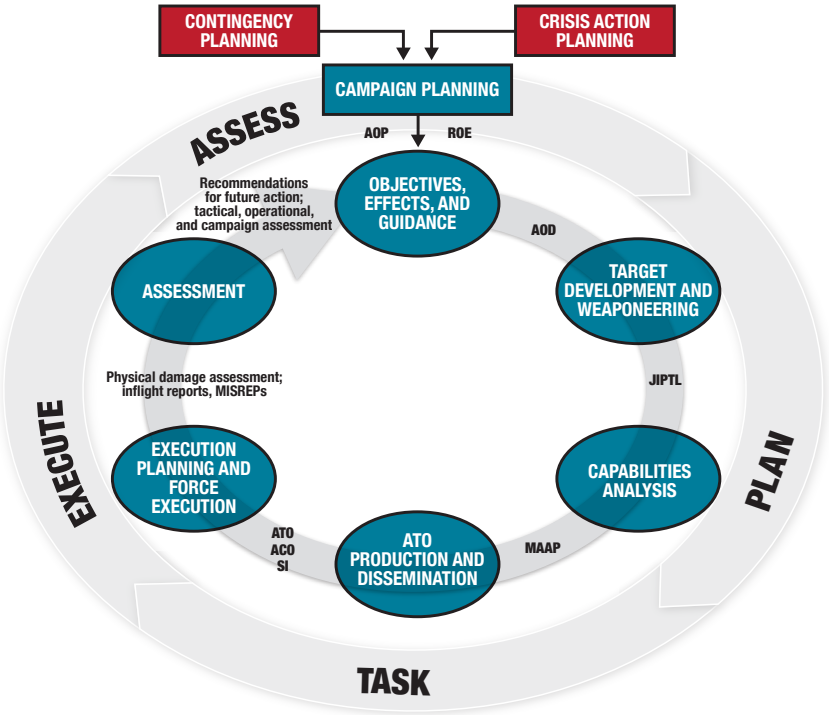

Figure 5-2. Air tasking cycle[8]

The air tasking cycle begins with a JFACC staff review of JFACC objectives, apportionment and targeting guidance (all are in the AOD), and an assessment of the results (positive or negative) of previous aerospace activities. Specific targets drawn from the ACC's prioritized target list (PTL)[9] are then matched with all the capabilities/forces made available to the JFACC for the given ATO day. The full joint cycle from JTFC guidance to the end of ATO execution is normally 72 hours, with planning beginning 48 hours prior to the ATO execution period of 24 hours. At any given time, there will be three ATOs in various stages of maturity: the ATO in progress, the ATO nearing planning completion, and the ATO about to start planning. The described ATO production cycle can be tailored depending on the operational situation. For example, the standard 72-hour cycle could be shortened to 48 hours or less to allow for better targeting flexibility in a rapidly evolving campaign. Equally, the cycle can be extended, as depicted in Figure 5-3. Note that an ATO can

8 JIPTL is considered synonymous with JPTL. In NATO context, the use of the term MAAP is shifting to a more inclusive MAOP—master air operations plan. Within the RCAF CAOC, MAAP is defined as master air action plan.

9 A PTL is a target list derived from the JPTL that allocates prioritized targets to individual components. Each CC, therefore, has and maintains its own PTL.

(and should) include air missions operating under the OPCON of other component commanders; this provides crucial visibility to assist with overall coordination and deconfliction within the theatre of operations.[10]

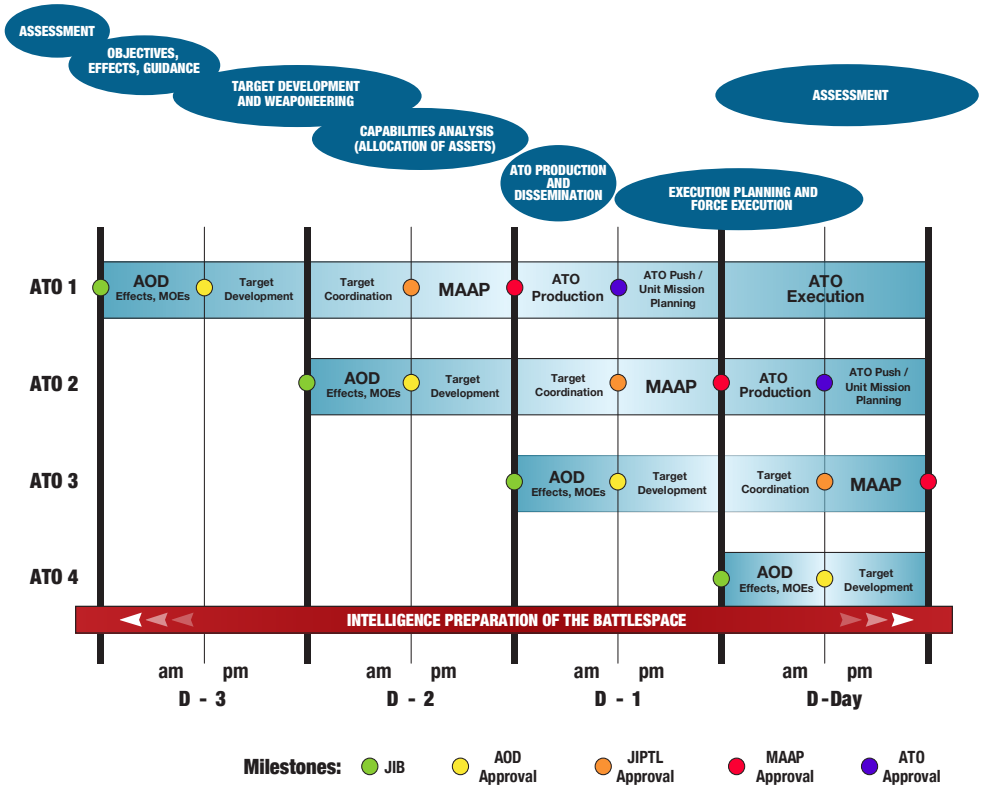

Figure 5-3. Daily ATO battle rhythm (example is a 96-hour cycle)[11]

During operations (including both routine domestic and international operations) the RCAF CAOC employs a cycle that differs somewhat from that described above. The production of the joint air operations plan (JAOP), AOD, master air action plan (MAAP), ACO, and ATO follow a different timeline that varies from quarterly to weekly. For specific missions and exercises the JFACC will modify the CAOC battle rhythm (see Figure 5-3) and apply an air tasking cycle that meets the operational requirements of the supported FE commander.

10 For example, the MCC may have OPCON of assigned maritime helicopter forces or the LCC may have OPCON of assigned tactical aviation forces. It is important that these missions be coordinated into a single ATO, produced by the JFACC and the supporting CAOC. In order to not unduly limit tactical freedom, the mission details for these ATO entries will often include only aircraft type, callsign, IFF code, and general timeframe information. The same methodology is used for aircraft assuming ready-launch procedures.

11 USAF AFDD 2-1.9, *Targeting*, 8 June 2006, Figure 2.4, 28, http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA454614 (accessed August 20, 2013).

As mentioned earlier in the apportionment and allocation discussion regarding tactical aviation or MH assets, there remains a requirement for the respective staffs to ensure that the ATO is as accurate as possible, but in the case of these assets in particular, the available information may well be limited to aircraft type, call sign and identification, friend or foe (IFF) code as well as the general time frame of the mission. In these cases, the ATO is as much an overall situational awareness tool as it is a tasking mechanism, aimed at enhancing airspace coordination and safety between airborne aerospace users.

Canadian aerospace assets, once deployed on international operations, will normally contribute to and be tasked via an entirely separate ATO process and cycle under the OPCON of a combined joint task force / combined joint force air component commander (CJFACC).

AEROSPACE TARGETING

Airmen and airwomen have arguably moved faster than others in the military to adopt effects-based concepts, principally in the form of effects-based targeting. This stems partly from a different perspective which predisposes them to view the entire battlespace functionally, as opposed to geographically. This functional perspective sees the battlespace as a whole, closer to the viewpoint of the JTFC than a surface force commander, who generally fights the war in a clearly delineated area, with boundaries separating one area from that of other surface commanders. As a natural extension of this perspective, airmen and airwomen often question how actions in one part of the battlespace are linked with, and affected by, actions elsewhere. For instance, they have been more inclined to see the possibility of operational and strategic outcomes as the result of individual tactical actions, and strategic attack is a prime example of tactical actions leading to strategic outcomes.

A target is any object or behaviour of an adversary designated for engagement by friendly forces. A target may be engaged in a variety of ways and either kinetically or non-kinetically. The targeting process identifies targets, analyses their applicability and vulnerabilities, and then matches Shape capabilities to the desired effects for the target. Targeting can be conducted deliberately through a well-defined joint targeting cycle or dynamically in the face of short-notice or rapidly changing circumstances. Dynamic targeting, in particular, has benefited significantly from recent technological advances, enabling commanders to respond more quickly and efficiently while exerting an unprecedented degree of control over effects.

DELIBERATE TARGETING

The joint targeting cycle is a crucial element of the air tasking cycle. It is an iterative process involving intelligence collection and assessment; target nomination, development and prioritization; collateral damage estimation (CDE); ROE/legal/political litmus tests; and post-attack BDA. Potential targets are identified, developed, and then nominated to a joint targeting working group (JTWG) that rigorously reviews each nomination for its applicability, legality, and payoff. Those nominated targets approved by the JTWG are then passed upward and reviewed/authorized by the JTFC. Targets approved by the JTFC are then added to the JPTL and apportioned to a CC for inclusion into that CC's PTL and eventual prosecution. Both the JPTL and CC PTLs are living documents with targets being added/deleted almost daily. Targets prosecuted are not normally removed from these lists until the desired level of effect has been confirmed by intelligence means (suitable BDA, etc.).

ACC staff have clearly defined roles and responsibilities within the joint targeting cycle. Specifically within an air component, the guidance, apportionment, and targeting (GAT) cell (a component of the combat plans division) is responsible for:

a. screening and selecting targets for development that meet the objectives of the JTFC and the JFACC;

b. prioritizing those targets and identifying the desired effects to be achieved;

c. quantifying expected results of lethal and non-lethal weapons employed against those targets (weaponeering). All presented targets will include aim points, munitions and fusing information as well as CDE;

d. collating these target nominations and presenting them to the JTWG; and

e. refining the JTFC approved JPTL targets into the ACC's PTL.

With the current PTL in hand, the JFACC's GAT team considers which targets best meet JTFC and ACC guidance and intent for the following ATO cycle. Accordingly, on a daily basis, GAT staff will provide these targets and a list of available air assets to members of the MAAP branch who then assemble the ATO/ACO/SI based on the established ACC battle rhythm and guidance contained in the AOD. All targets listed in an ATO are considered deliberate targets, as they have been planned and scheduled.

DYNAMIC TARGETING

Dynamic targets are those targets that were not detected, located, or selected for action in time to be included in an ATO (i.e., dynamic targets are those handled "on the fly" by the CAOC). While the timeline associated with dynamic targeting is compressed when compared to that of deliberate targeting, compression does not imply reduced rigour or the omission of steps. Ultimately, dynamic targets are still targets; their nomination, development, execution, and assessment still takes place within the larger framework of the targeting and tasking cycles.

Closely associated with dynamic targets are time sensitive targets (TSTs), which are those targets requiring immediate response once detected or located because they pose a danger to friendly forces or they are highly lucrative fleeting targets of opportunity.

Dynamic targets have one thing in common: they are time-sensitive to some degree and/or have increased priority due to changing circumstances within the battlespace. Some targeting windows of opportunity will be fleeting and thus require near-immediate prosecution if the targets are to be prosecuted at all. The effective and timely prosecution of dynamic targets requires stringent procedures in order to act quickly upon the receipt of intelligence and achieve a targeting solution. Recent operations demonstrate that this compressed decision cycle is best handled through a specialized sub-process known as the dynamic targeting procedure; a process[12] which usually takes place within the CAOC.

Seen from the larger air tasking cycle perspective, dynamic targeting takes place within steps five (execution planning and force execution) and six (assessment). It represents the targeting portion of the execution phase of effects-based operations. Throughout a dynamic targeting evolution, it is essential that commanders and CAOC personnel maintain focus on the overarching JTFC objectives and desired effects, as it is easy to become too focused on tactical-level details. Execution must avoid the blind servicing of target sets; targeting must always be guided by strategy, anticipating and adjusting to an adversary's actions.

Dynamic targeting missions can be planned into the ATO cycle for those areas where dynamic targeting opportunities are highly likely. A good fixed-wing example is the armed reconnaissance task,[13] where fighter aircraft or armed UAs are tasked to a defined area at a certain time to prosecute targets of

12 The dynamic targeting process utilizes a six-step process: find, fix, track, target, engage, and assess (F2T2EA). For additional information on targeting see AJP-3.9, *Allied Joint Doctrine for Joint Targeting* or NATO Allied Command Operations Directive (AD) 80-70, *Joint Synchronisation and Targeting in ACO*, 2009.

13 As discussed in Chapter 3, armed reconnaissance is a subordinate task to the AI mission.

opportunity. Interdiction attack is essentially the same mission type, utilizing rotary-wing aircraft either autonomously or in close coordination with CAOC staff utilizing the dynamic targeting procedure previously discussed. Fixed-wing assets often require final authorization for engagement, while rotary-wing assets often operate autonomously and may already have sufficient authority via their delegated ROE to permit engagement.

Dynamic targets can be categorized as follows:[14]

a. JTFC-approved TST. The JTFC is ultimately responsible for TST prosecution but normally relies upon the CCs for conducting TST operations;

b. targets that are considered crucial for success of friendly objectives but which are not JTFC-approved TSTs. These are referred to as high pay-off targets;

c. targets scheduled to be struck on the current ATO, but which have changed status in some way (changed timings or apportionment of assets/weapons); and

d. other targets that emerge during execution that friendly commanders deem worthy of targeting, prosecution of which will not divert resources from higher priority targets.

CF Photo: MCpl Robert Bottrill

14 Each of the four categories of targets specified above is prosecuted via the same dynamic targeting process; they differ only in relative priority.

INTELLIGENCE, SURVEILLANCE AND RECONNAISSANCE AND THE JOINT TARGETING CYCLE

Aerospace ISR operations contribute significantly to the joint targeting cycle. This is true in terms of the ever-increasing ability to provide accurate and timely intelligence information to targeting staff and also in terms of the NRT oversight that ISR capabilities afford commanders. The current trend, dominated by the requirement to minimize collateral damage, is that each kinetic mission is normally preceded by a series of ISR missions that serve to refine the target and establish local patterns of life. This is particularly true when targets in urban areas are being considered for attack and when a mix of adversarial combatants and civilians on the ground is expected. This highlights the newfound importance of ISR assets. In recent experience, commanders have found that there are never enough of these critical platforms, and as a result, their tasking and assignment authority is held at a high level within the joint task force (JTF). Currently, the RCAF tasks ISR assets through an operations-driven process. Some of the CF's allies, including the United States, are leaning towards a more intelligence-driven process, but experience gained in Afghanistan indicates that this approach may be too tactically restrictive, reducing overall responsiveness. The key takeaways for the purposes of this manual are that aerospace ISR assets are critical force enablers and that demand for their services will almost always exceed availability. As a result, these assets must be closely managed and focused on key JTFC priorities and objectives. Aerospace ISR platforms include the CU-170 Heron, CP140 Aurora Block II, CH146 Griffon INGRESS, General Dynamics Avenger, E-3D Sentry, Nimrod R1, and the Sentinel R1.

As mentioned in Chapter 1, ISR missions that prepare the battlespace belong primarily to the aerospace Sense function. Blending of the Sense and Shape functions occurs when the platform conducting the Shape mission is itself equipped with ISR sensors or where it is supported by an ISR asset in real or near real-time. This can occur on a planned basis or dynamically in reaction to a target of opportunity.

An example of this overlap during a planned mission would be an attack on a critical industrial site. The local pattern of life will be established well in advance in order to time the attack to minimize collateral damage (Sense). ISR support will then also be required just prior to the attack in order to enable the commander to provide the final attack authorization (Shape). Post-attack, ISR assets would then loiter or be tasked to conduct a BDA in order to determine follow-on/re-attack requirements (Sense and/or Shape). A SCAR task in this case could provide a more robust C2 interface to coordinate multiple aircraft, detect (and possibly attack) targets,

neutralize enemy air defences, and provide BDA. These missions involve ISR-equipped assets providing NRT targeting information and coordination to airborne strike packages. They can also involve the embedding of subject matter expert liaison officers on the ISR aircraft, whose duties can range from simply providing advice to assuming a role similar to that of a FAC(A)/JTAC role.[15] These individuals[16] have demonstrated their worth in strengthening and simplifying the commander-sensor-shooter link and have helped underscore the benefits of manned ISR assets in dynamic situations.

An example of a purely dynamic situation would be that of an advancing ground unit coming into contact and requesting aerial fire support. A mix of armed UA and CAS fighters would be tasked to the area to provide overwatch, locate, and ultimately engage an adversary's positions. A maritime example of a dynamic situation would be an LRPA tasked with barrier operations in front of a surface force locating and tracking an adversarial submarine. Depending on ROE and the level of threat this submarine posed to the force, the MCC could release the aircraft to engage the submarine.

Additional detail regarding aerospace targeting information, definitions, and processes can be found in the following publications: Canadian Forces Joint Publication 3-9 (CFJP 3-9), *Joint Targeting*;[17] NATO Allied Joint Publication 3.9 (AJP-3.9), *Allied Joint Doctrine for Joint Targeting*; and NATO Allied Command Operations Directive (AD) 80-70, *Joint Targeting and Synchronization in ACO*.

Vignette 13: Not Since WWII. Operation MOBILE was the CF participation in Operation UNIFIED PROTECTOR (OUP), the UN-authorized, NATO-led effort to impose an arms embargo and a no-fly zone on Libya to protect civilians and civilian-populated areas. Task Force Libeccio was the air component of Op MOBILE and comprised the task force HQ based in Naples, Italy; the air component coordination element based in Poggio-Renatico, Italy; and the Sicily Air Wing based out of two locations in Sicily, Italy. The Sicily Air Wing was made up of four air operations flights and two close support flights: a CP140 flight based at Sigonella, Sicily, and a CF188 flight, a CC 150T flight, a CC130J flight, an operational support flight and a mission support flight, all based at Trapani-Birgi, Sicily. A mission over Libya on 5 October 2011 provided an opportunity to have Canadian aircraft engaged in every phase of a mission.

15 The FAC(A) and/or JTAC label applies only when operating in close proximity to friendly forces. SCAR tasks occur deeper into adversary territory where coordination with friendly ground forces is not a consideration.

16 The individual that is responsible for directing all aircraft in the specified area for the associated SCAR mission may be referred to as the SCAR coordinator (SCAR-C).

17 CFJP 3-9 was still in study draft form at the time this publication was promulgated.

During the last month of operations over Libya, Gaddafi's forces had retrograded into his last remaining strongholds, including Sirte, Al Fuqaha, and Bani Walid. On this particular day, the combined force air component commander (CFACC) ordered a concerted effort to reduce the fighting effectiveness of Gaddafi's forces in the Bani Walid area. Predator UAVs were not available due to high winds at their base in Sigonella, so the Canadian CP140 was approved to surge to two sorties to cover the requirement for ISR support. The CP140 crews had only very recently been approved to conduct the strike coordination and reconnaissance – coordinator (SCAR-C) mission. Earlier on during OUP, the aircraft was employed solely in support of the maritime force compiling the RMP in the embargo zone. After demonstrating a combination of unique capabilities and a superior ISR data product, that Aurora's role was expanded to coastal patrols that allowed the crew to capture inland imagery of Libya's coastline, highways, command and control centres, and then finally to missions directly over Libyan territory. While conducting these missions, Aurora crews also carried out other critical functions such as providing a visible presence along the coast and conducting broadcasts addressed to the Libyan people.

The SCAR-C mission was used extensively during the Libyan campaign, with long endurance ISR platforms such as UAs and LRPA including USN P-3s, French Atlantiques, and Canadian CP140s providing ISR coverage prior to and during the strike missions. For the most part, the fighters had a fairly short duration on station, and the ISR aircraft were able to confirm targets, conduct pattern of life assessments to ensure no civilians were in the target area, and then guide the fighters to their targets. The addition of a UK fires support team to the CP140 crew, to act as the JTAC, significantly increased the overall effectiveness and capability of the aircraft. The role of this team was to provide positive identification of the target, conduct the collateral damage estimates, and communicate directly with the fighter aircraft attacking the target. Their presence on-board the aircraft shortened the commander-sensor-shooter link, improving the overall situational awareness of all involved personnel, and minimizing delays in engaging the targets.

At the commencement of the 5 Oct mission, the CP140s were conducting ISR over Bani Walid. Canadian CF188s took off from Trapani-Birgi Airfield, refueled from their CC150T Airbus tanker, and made their way to the target area. They were then guided onto their targets by the CP140 crew, striking successfully with joint direct attack munitions (JDAMs), an all-weather "smart" bomb. Over the course of the mission, a total of 14 OUP fighters struck several targets with excellent effect. This mission demonstrated for the first time since WWII that the RCAF could bring the whole package to the fight. At the commander's update briefing the next morning, the CFACC thanked the Canadian team for their support, for providing the necessary eyes on target, and for the overall success of the mission.[18]

18 Information provided by Brigadier-General Derek Joyce, Commander Task Force Libbecio, and by Captain Jill Strelieff, Sicily Air Wing Public Affairs Officer.

SUMMARY

A robust and dynamic aerospace C2 capability allows the commander to retain firm control of aerospace forces while enabling dynamic employment, tasking, and retasking of aerospace capabilities to meet the competing needs of the supported commanders. Aerospace C2 operates under the fundamentals of centralized control and decentralized execution and is structured accordingly. Aerospace operations require sufficient flexibility to respond to rapidly emerging and dynamic changes to the battlespace. To achieve this flexibility, aerospace commanders operate within a cycle known as the air tasking cycle.

The air tasking cycle enables centralized control of theatre aerospace assets. It generally follows a standard format regardless of the theatre or specific operation but can be adjusted to accommodate the special and distinct needs of every operation. The cycle has six steps: objectives, effects and guidance; target development and weaponeering; capabilities analysis (allocation of assets); ATO production and dissemination; execution planning and force execution; and assessment. Decentralized execution is enabled by establishing flexible procedural rules for transit to and from operating areas and directives governing tactical operations within designated airspace (captured within the ACO). These procedures are promulgated to all aerospace users and operators via theatre aerospace control orders and special instructions.

Aerospace targeting can be conducted deliberately or dynamically. Deliberate targets are those targets planned, scheduled, and embedded within the ATO. Dynamic targets are those targets detected, located, or selected too late to be included into the normal air tasking cycle. While dynamic targeting is normally a reactive mission generated to address a specific pop-up target, dynamic targeting missions can also be included into an ATO (i.e., a SCAR task).

Targets are nominated, refined, and considered through a series of staff efforts in order to ensure that they meet JTFC objectives and intent. Current advances in ISR capabilities are allowing targeting to become more dynamic and responsive, while at the same time improving command oversight in a targeting environment that is very unforgiving of collateral damage.

GLOSSARY

The definitions contained in this glossary are derived from a number of sources. Where this publication is the source of a definition, no source is indicated. Definitions taken from other sources are indicated in parentheses at the end of each term, utilizing the following abbreviations:

a. AFTP – Air Force Terminology Panel; and

b. *DTB – Defence Terminology Bank*, http://terminology.mil.ca/term-eng.asp.

Act
The operational function that integrates manoeuvre, firepower and information operations to achieve the desired effects. (*DTB* record 26165)

aerospace control
The implementation and coordination of the procedures governing airspace planning and organization in order to minimize risk and allow for the efficient and flexible use of airspace. (*DTB* record 3422)
Note: aerospace control is synonymous with airspace control.

aerospace warning
A warning based on the detection, assessment and validation of an impending or actual intrusion into an airspace of interest by aircraft, missiles or spacecraft. (*DTB* record 44191)

air component commander (ACC)
A designated, operational-level commander responsible for making recommendations to a supported commander on the proper employment of assigned, allocated, attached and/or made available forces; planning and coordinating aerospace operations; assigning missions and tasks; and accomplishing such missions as may be directed by the supported commander. (*DTB* record 34079)

air defence
All measures designed to nullify or reduce the effectiveness of hostile air action. (*DTB* record 48)

air domain
All areas, entities and activities related to, or affecting, the air environment.
Note: The air domain includes infrastructure, people, cargo, aircraft and other conveyances. (*DTB* record 41193)

air interdiction (AI)
Air operations conducted to divert, disrupt, delay, degrade or destroy an adversary's military potential before it can be brought to bear effectively and at such distance that detailed integration of each air mission with the fire and manoeuvre of friendly forces is not required. (*DTB* record 3343, modified)

air sovereignty operations
All military measures conducted across the spectrum of conflict to control sovereign airspace. Such an operation does not need to have aircraft airborne. The airspace is being controlled, not protected. (*DTB* record 44195)

air superiority
That degree of dominance in the air battle of one force over another which permits the conduct of operations by the former and its related land, sea and air forces at a given time and place without prohibitive interference by the opposing force. (*DTB* record 3364)

air supremacy
That degree of air superiority wherein the opposing air force is incapable of effective interference. (*DTB* record 3366)

air surveillance operation
An operation conducted to monitor designated airspace by detecting and tracking operations or intrusions. (*DTB* record 44196)

air tasking order (ATO)
A document issued by an aerospace operations centre under the authority of the air component commander directing subordinate air forces to execute aerospace missions.
Note: An air tasking order is authoritative and is the product of the air planning process. It is valid for a prescribed period and provides sufficient tactical detail for subordinate commanders to execute missions. (*DTB* record 30607, modified)

airspace control authority (ACA)
The commander designated to assume overall responsibility for the operation of the airspace control system in their assigned area. (*DTB* record 19471, modified)

anti-air warfare (AAW)
Measures taken to defend a maritime force against attacks by airborne weapons launched from aircraft, ships, submarines and land-based sites.
Note: In the air force, AAW is synonymous with counter-air operations. (*DTB* record 18987)

area defence
In air defence, deployment of units or sub-units to provide an effective degree of protection over specified area. (*DTB* record 24098)

area of operations (AOO)
A geographical area, within an area of responsibility, assigned to a subordinate commander within which that commander has the authority to plan and conduct tactical operations. (*DTB* record 3528)

area of responsibility (AOR)
The geographical area assigned to an operational-level commander within which that commander has the authority to plan and conduct military operations. (*DTB* record 34612)

battle damage assessment (BDA)
The assessment of effects resulting from the application of military action, either lethal or non-lethal, against a military objective. (*DTB* record 26988)

battlespace
The environment, factors and conditions that must be understood to apply combat power, protect a force or complete a mission successfully. Note: It includes the land, maritime, air and space environments; the enemy and friendly forces present therein; facilities; terrestrial and space weather; health hazards; terrain; the electromagnetic spectrum; and the information environment in the joint operations area and other areas of interest. (*DTB* record 35045)

close air support (CAS)
Air action against hostile targets which are in close proximity to friendly forces and which require detailed integration of each air mission with the fire and movement of those forces. (*DTB* record 23335)

close combat attack (CCA)
A coordinated attack by armed aviation against targets that are in close proximity to friendly forces. (*DTB* record 34045)

collateral damage (CD)
Inadvertent casualties and destruction in civilian areas caused by military operations. (*DTB* record 26989)

combat air patrol (CAP)
An aircraft patrol provided over an objective area, the force protected, the critical area of a combat zone, or in an air defence area, for the purpose of intercepting and destroying hostile aircraft before they reach their targets. (*DTB* record 256)

command and control (C2)
The exercise of authority and direction by a commander over assigned, allocated and attached forces in the accomplishment of a mission. (*DTB* record 5950)

common operating picture (COP)
An interactive and shared visual representation of operational information gathered from various sources. (*DTB* record 41401)

computer network attack (CNA)
Action taken to disrupt, deny, degrade or destroy information resident in a computer and/or computer network, or the computer and/or computer network itself.
Note: A computer network attack is a type of cyber attack.
(*DTB* record 26982)

control of the air
The level of influence over the aeropsace domain exerted by friendly forces relative to the aerospace capabilities of the adversary.

counter-insurgency (COIN)
Those military, paramilitary, political, economic, psychological, and civic actions taken to defeat insurgency. (*DTB* record 3941, modified)

cyber domain
The sphere of activity that uses information technology to produce effects. (AFTP proposed definition)

domain
A sphere of activity, influence or knowledge related to a specific physical or conceptual property.
Note: In joint doctrine, the domains are physical, moral and informational. (*DTB* record 44221)

electromagnetic domain
The sphere of activity that uses the electromagnetic spectrum to produce effects.

electronic attack (EA)
Use of electromagnetic energy for offensive purposes. (*DTB* record 30833)

electronic warfare (EW)
Military action to exploit the electromagnetic spectrum encompassing: the search for, interception and identification of electromagnetic emissions, the employment of electromagnetic energy, including directed energy, to reduce or prevent hostile use of the electromagnetic spectrum, and actions to ensure its effective use by friendly forces. (*DTB* record 4164)

fighter engagement zone (FEZ)
The part of the air defence area neither by the missile engagement zone nor by the low level engagement zone and in which fighters have freedom of action to identify and, if necessary, engage other aircraft.
(*DTB* record 33499)

fires
Actions that seek to produce a first order physical effect against a target's capabilities.
Note: They include lethal and non-lethal means. (*DTB* record 33777)

force application
The use of military force to achieve an effect.
Note: Military force can be kinetic or non-kinetic.
(AFTP proposed definition)

force enabler
A capability provided to a force that is essential to mission accomplishment. (*DTB* record 37304)

force multiplier
A capability provided to a force that enhances the probability of success in mission accomplishment. (*DTB* record 37306)

force protection (FP)
All measures and means to minimize the vulnerability of personnel, facilities, equipment and operations to any threat and in all situations, to preserve freedom of action and the operational effectiveness of the force. (*DTB* record 23554)

forward air controller (FAC)
A qualified individual who, from a forward position on the ground or in the air, directs the action of combat aircraft engaged in close air support of land forces. (*DTB* record 552)
Note: The term joint terminal attack controller (JTAC) is used synonymously with FAC and refers in general terms to the person performing the same duties. ABFAC (airborne FAC) is an aircrew member who controls close air support missions from an airborne position while operating an aircraft.

information domain
The sphere of activity where unprocessed data is processed, manipulated, used or communicated to produce a desired effect. (AFTP proposed definition)

information operations (info ops)
Coordinated actions to create desired effects on the will, understanding and capability of individuals and groups, in support of overall objectives by affecting their information, information-based processes and systems, while exploiting and protecting one's own. (*DTB* record 31721)

informational domain
The sphere in which the information and cyber domains exist to produce desired effects.

intelligence, surveillance and reconnaissance (ISR)
An activity that synchronizes and integrates the planning and operation of all collection capabilities with processing and dissemination of the resulting information to the right person, at the right time, in the right format, in support of current and future operations. (*DTB* pending)

maritime domain
All areas, entities and related activities on, under or adjacent to a sea, an ocean or other navigable waterway.
Note: The maritime domain includes infrastructure, people, cargo, vessels and other conveyances. (*DTB* record 43601)

missile engagement zone (MEZ)
The defined airspace where missile systems have normally the priority to engage various targets. (*DTB* record 890)

moral domain
The sphere in which people interact on a psychological, ethical and/or cognitive level. (*DTB* record 41423)

Move
The function that exploits global reach and speed of aerospace power to rapidly deploy and position personnel and materiel to achieve desired effects. (*DTB* record 37252)

near real time (NRT)
Pertaining to the timeliness of data or information which has been delayed by the time required for electronic communication and automatic data processing. This implies that there are no significant delays. (*DTB* record 22876)

non-permissive environment
An environment in which friendly forces anticipate obstructions to, or interference with, operations. (*DTB* record 43595)

offensive counter-air operation (OCA)
An operation mounted to destroy, disrupt or limit adversary air power as close to its source as possible. (*DTB* record 4956, modified)

operational command (OPCOM)
The authority granted to a commander to assign missions or tasks to subordinate commanders, to deploy units, to reassign forces, and to retain or delegate operational and/or tactical control as the commander deems necessary.

Note: It does not include responsibility for administration. (*DTB* record 19477)

operational control (OPCON)
The authority delegated to a commander to direct forces assigned so that the commander may accomplish specific missions or tasks which are usually limited by function, time, or location; to deploy units concerned, and to retain or assign tactical control of those units. It does not include authority to assign separate employment of components of the units concerned. Neither does it, of itself, include administrative or logistic control. (*DTB* record 1056)

operational planning process (OPP)
A coordinated staff process used by a commander to determine the best method of accomplishing assigned tasks and to direct the action necessary to accomplish the mission. (*DTB* pending)

permissive environment
An environment in which friendly forces anticipate no obstructions to, or interference with, operations.

Note: A permissive environment does not necessarily imply absence of threat. (*DTB* record 43594)

physical domain
The sphere in which people live and work. (*DTB* record 41433)

rules of engagement (ROE)
Directives issued by competent military authority which specify the circumstances and limitations under which forces will initiate and/or continue combat engagement with other forces encountered.
(*DTB* record 5285)

Shape
The function that optimizes agile manoeuvre and integrated information operations in the delivery of kinetic and non-kinetic aerospace power to achieve desired effects. (*DTB* record 37254)

special operations forces
Military units of an army, navy and air force which are designated for special operations, and are organized, trained and equipped specially to conduct such operations. (*DTB* record 33206)

suppression of enemy air defences (SEAD)
That activity which neutralizes, temporarily degrades or destroys adversary air defences by a destructive and/or disruptive means. (*DTB* record 5469, modified)

tactical air control party (TACP)
A subordinate operational component of a tactical air control system designed to provide air liaison to land forces and for the control of aircraft. (*DTB* record 1429)

tactical command (TACOM)
The authority delegated to a commander to assign tasks to forces under [the commander's] command for the accomplishment of the mission assigned by higher authority. (*DTB* record 5491)

tactical control (TACON)
The detailed and, usually, local direction and control of movements or manoeuvres necessary to accomplish missions or tasks assigned. (*DTB* record 5493)

unmanned aerial system (UAS)
A system that includes the necessary equipment, network, and personnel to operate an unmanned aerial vehicle. (*DTB* record 44145)

unmanned aircraft (UA) / unmanned aerial vehicle (UAV)
A powered, aerial vehicle that does not carry a human operator, uses aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expendable or recoverable, and can carry a lethal or non-lethal payload. Ballistic or semi-ballistic vehicles, cruise missiles, and artillery projectiles are not considered unmanned aerial vehicles. (*DTB* record 44144)

LIST OF ABBREVIATIONS

A/A	air-to-air
AAA	anti-aircraft artillery
AAR	air-to-air refuelling
AAW	anti-air warfare
ABFAC	airborne forward air controller
ACC	air component commander
ACO	airspace control order
AD	air defence
AI	air interdiction
AOC	aerospace operations centre
AOD	air operations directive
AOP	air operations plan
ARM	anti-radiation missile
A/S	air-to-surface
AS	associated support
ASUW	antisurface warfare
ASW	antisubmarine warfare
ATO	air tasking order
BDA	battle damage assessment
C2	command and control
CA	Canadian Army
CANSOFCOM	Canadian Special Operations Forces Command
CAOC	Combined Aerospace Operations Centre
CAP	combat air patrol
CAS	close air support
CC	component commanders
CCA	close combat attack
CCA	counter-command activity

CDE	collateral damage estimation
CF	Canadian Forces
CFACC	combined force air component commander
CIMIC	civil-military cooperation
CJFACC	combined joint force air component commander
CNA	computer network attack
CND	computer network defence
CNE	computer network exploitation
CNO	computer network operations
CO	commanding officer
CG	centre of gravity
CT	counterterrorism
DCA	defensive counter-air operation
DS	direct support
DTB	*Defence Terminology Bank*
EA	electronic attack
EO/IR	electro-optical/infrared
EP	electronic protection
ES	electronic warfare support
ESM	electronic warfare support measures
EW	electronic warfare
FAC	forward air controller
FAC(A)	forward air controller (airborne)
FAOR	fighter area of operations/responsibility
FE	force employment
G3 Avn	G3 aviation
GAT	guidance, apportionment and targeting

GBAD	ground-based air defence
GC	Government of Canada
GWT	Griffon weapons team
HQ	headquarters
HVAA	high-value air asset
IA	influence activity
IADS	integrated air defence system
IAF	Israeli Air Force
IJN	Imperial Japanese Navy
info ops	information operations (CF and NATO terminology)
IO	information operations (US terminology)
IPA	information-protection activity
ISR	intelligence, surveillance and reconnaissance
JCO	joint coordination order
JFACC	joint force air component commander
JFLCC	joint force land component commander
JIB	joint integration board
JIPTL	joint integrated prioritized target list
JPTL	joint prioritized target list
JTAC	joint terminal attack controller
JTFC	joint task force commander
JTWG	joint targeting working group
KLE	key leader engagement
km	kilometre

LCC	land component commander
LRPA	long-range patrol aircraft
MAAP	master air action plan
MCC	maritime component commander
MH	maritime helicopter
MISREP	mission report
NATO	North Atlantic Treaty Organization
NGO	non-governmental organization
NORAD	North American Aerospace Defence Command
NRT	near real time
OCA	offensive counter-air operation
OPCON	operational control
ops	operations
OPSEC	operational security
OTC	officer in tactical command
OUP	Operation UNIFIED PROTECTOR
PA	public affairs
PAVN	People's Army of Vietnam
PPP	presence, posture and profile
PSYOPS	psychological operations
PTL	prioritized target list
RCAF	Royal Canadian Air Force
RCN	Royal Canadian Navy
RMP	recognized maritime picture
ROE	rules of engagement

SAM	surface-to-air missile
SAO	special air operations
SCAR	strike coordination and reconnaissance
SCAR-C	strike coordination and reconnaissance – coordinator
SEAD	suppression of enemy air defence
SI	special instructions
SIGINT	signals intelligence
SOATU	special operations air task unit
SOF	special operations force
TACOM	tactical command
TACON	tactical control
TACP	tactical air control party
TACS	theatre air control system
TASMO	tactical air support for maritime operations
TIC	troops in contact
TST	time sensitive target
TTP	tactics, techniques and procedures
UA	unmanned aircraft (also known as UAV – unmanned aerial vehicle and UAS – unmanned aerial system)
UK	United Kingdom
US	United States
USAF	United States Air Force
USN	United States Navy
VC	Viet Cong
W/KIA	wounded / killed in action
WME	weapons of mass effect
WWII	Second World War
XINT	on-call (air) interdiction

REFERENCES

1 Canadian Air Division, Canadian NORAD Region Headquarters, *Combined Aerospace Operations Centre: Operating Instructions, Volume 3: Concept of Operations*, October 2009.

1 Canadian Air Division Orders, Volume 1, 1-617, "Mission Management Codes," 2003.

A-GA-007-000/AF-008, *Air Force Vectors*, 2012.

B-GA-400-000/FP-000, *Canadian Forces Aerospace Doctrine*, 2nd ed., December 2010.

B-GA-401-000/FP-001, *Canadian Forces Aerospace Command Doctrine*, March 2012.

B-GA-402-000/FP-001, *Canadian Forces Aerospace Sense Doctrine*, August 2012.

B-GA-403-002/FP-001, *Canadian Forces Aerospace Electronic Warfare Doctrine*, March 2011.

B-GA-404-000/FP-001, *Canadian Forces Aerospace Move Doctrine*, November 2011.

B-GA-405-000/FP-001, *Canadian Forces Aerospace Shield Doctrine*, February 2012.

B-GA-405-001/FP-001, *Aerospace Force Protection Doctrine*, August 2008.

B-GA-440-000/AF-000, *Tactical Helicopter Operations,* Change 1, February 1999.

B-GA-442-001/FP-001, *Tactical Aviation Tactics, Techniques and Procedures,* Change 5, June 2010.

B-GJ-005-000/FP-001, Canadian Forces Joint Publication (CFJP) 01, *Canadian Military Doctrine*, September 2011.

B-GL-300-001/FP-00, *Land Operations*, January 2008.

Canada, Department of National Defence, *Project LAMINAR STRIKE – Canada's Air Force: Post Op ATHENA*, 2011.

Canadian Forces Joint Doctrine Note 03/08, *Close Air Support*, March 2008.

Canadian Special Operations Forces Command, *An Overview*, 2008.

Department of National Defence, *Canada First* Defence Strategy, June 2008.

Directorate of Maritime Strategy, *Leadmark – The Navy's Strategy for 2020,* June 2001.

Echevarria, Antulio J. *Clausewitz's Center of Gravity: Changing Our Warfighting Doctrine – Again!* Carlyle, PA: Strategic Studies Institute, September 2002.

Horn, Bernd. "Complexity Squared: Operating in the Future Battlespace." *Canadian Military Journal* 4, no. 3, 2003.

NATO Allied Joint Publication (AJP)-3.3(A), *Allied Joint Doctrine for Air and Space Operations,* November 2009.

NATO AJP-3.3.3, *Air-Maritime Co-ordination*, April 2005.

NATO AJP-3.5, *Allied Joint Doctrine for Special Operations,* January 2009.

NATO AJP 3-9, *Allied Joint Doctrine for Joint Targeting*, May 2008.

NATO AJP-3.10, *Allied Joint Doctrine for Information Operations*, November 2009.

NATO Allied Command Operations Directive (AD) 80-70, *Joint Synchronisation and Targeting in ACO*, 2009.

NATO ATP-49(F), *Use of Helicopters in Land Operations Doctrine,* October 2012.

NATO Special Operations Headquarters (NSHQ) 80-004, *Special Air Warfare Manual,* March 2012.

Noedskov, K. "Systematizing Effect Based Operations." Air & Space Power Journal Chronicles Online, 24 May 2000.

United States Air Force (USAF). "Counterair Operations," in *Air Force Doctrine Document* (AFDD) 3-01, October 2008.

US Department of Defense Joint Publication (DoD JP) 3-09.3, *Close Air Support*, July 2009.

US Air Force Doctrine Document (AFDD) 2-1.9, *Targeting*, 8 June 2006.

Warden, John A. "The Enemy as a System." *Airpower Journal* 9, no. 1, 1995.

ADDITIONAL READING

Barbier, Mary. *D-Day Deception: Operation Fortitude and the Normandy Invasion*. Mechanicsburg, PA: Stackpole Books, 2009.

Chun, Clayton. *The Doolittle Raid 1942: America's First Strike Back at Japan*. Oxford: Osprey Publishing, 2006.

Dupuy, T. N., and P. Martell. *Flawed Victory: The Arab-Israeli Conflict and the 1982 War in Lebanon.* Fairfax, VA: Hero Books, 1986.

Evans, Richard. "Immoral Rearmament." *The New York Review of Books*, 54, no. 20, 2007.

Fleming, Peter. *Operation Sea Lion.* London: Macmillan, 2002.

Historica Canada. "Capture of Detroit, War of 1812." *The Canadian Encyclopedia*. http://www.thecanadianencyclopedia.com/articles/capture-of-detroit-war-of-1812 (accessed August 20, 2013).

Liddle Hart, B. H. *Thoughts on War*. Staplehurst, UK: Spellmount, 1998.

Lambeth, B. S. *The Transformation of American Air Power*. Ithaca, NY: Cornell University Press, 2000.

Moore, Harold G., and J. Galloway. *We Were Soldiers Once ... and Young: la Drang–The Battle That Changed the War in Vietnam*. San Francisco: Presidio Press, 2004.

National Security Agency Central Security Service. "Purple Dragon: The Origin and Development of the United States OPSEC Program," Volume 2. Center for Cryptologic History, 1993.

NATO AJP-3.3.1(B), *Allied Joint Doctrine for Counter-Air*, July 2010.

NATO AJP-3.3.2(A), *Allied Joint Doctrine for Close Air Support and Air Interdiction*, September 2009.

Naval Postgraduate School Center for Homeland Defense and Security. *Homeland Security Digital Library*. Washington, DC. https://www.hsdl.org/ (accessed August 20, 2013).

Symonds, C. L. *The Battle of Midway*. Oxford: Oxford University Press, 2011.

United Kingdom (UK) British Army Field Manual, Vol. 1, part 13, *Air-Land Integration*, December 2009.

UK Interim Joint Warfare Publication 3-30, *Joint Air Operations*, October 2003.

UK Joint Warfare Publication 3-36, *Joint Air Defence*, July 2003.

UK Royal Air Force Air Warfare Centre AP 3002, *Air and Space Warfare, Second Edition*, November 2009.

United States (US) Department of Defense (DOD) JP 3-30, *Command and Control for Joint Air Operations*, January 2010.

US Air Force Doctrine Document (AFDD) 201, *Air Warfare*, January 2000.

US AFDD 2-1.1, *Counter-Air Operations*, October 2008.

US AFDD 2-1.3, *Counter-Land Operations*, September 2006.

US DoD JP 3-09, *Joint Fire Support*, June 2010.

US DoD JP 3-52, *Joint Airspace Control*, May 2010.