



DGPA JSPA Combat Camera Photo ISD01-8869 by Sgt. Dennis Mah

A CF-18 fighter from 425 Tactical Fighter Squadron arriving at CFB Greenwood after an air patrol off the Atlantic coast, October 2001.

AEROSPACE POWER AND LEADERSHIP PERSPECTIVES

By Colonel Brett Cairns

Within a national security context, a nation must be capable of doing at least two things. First, it must demonstrate the capability and resolve to enforce its sovereignty in peacetime. Second, it must retain the capability and will to defend itself should the need arise. Armed forces contribute to the enforcement of national sovereignty in peacetime, but their fundamental and most demanding national security role is to be ready to defend their nation should the need arise. To do so effectively, they need land, sea and aerospace forces that are organized, trained and equipped for combat operations. Of the three, aerospace power is, perhaps, the least well understood by those who participate in national security decision making.

It has often been said that how people view a specific situation is simply a matter of perspective, and that the views held by people are often a reflection of their background, education and experience. It has also been said that to get the most out of any capability, one must fully understand what it has to offer, what its limitations are, and when and how it should be used to best effect. Aerospace power is a capability that requires this detailed understanding to employ it to best effect.

Each of Canada's services uses aerospace power to accomplish their missions, but they do so against a different backdrop. As General Maurice Baril, former Chief of the Defence Staff, said during his 1997 testimony to the Standing Committee on National Defence and Veterans Affairs (SCONDVA): "We are a unified force, but...each service, army, navy, and air force, has a distinctly different role, culture, and tradition."

Given the distinctly different aspects of Canada's three services it is not unreasonable to expect their leaders to hold very different views on issues such as the application of aerospace power. The United States Air Force Chief of Staff expressed this in the February 2000 USAF Air Force Doctrine Document 2:

This nation has one Air Force. There are other services with air arms, and they are magnificent air arms, who focus on certain things in support of our national capabilities, but it is your Air Force that is charged with the full spectrum of capabilities. We are asked to pro-

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vide for the nation air and space power, starting with science and technology; research and development; testing and evaluating; fielding, employing and sustaining air and space forces. We have no other tasks. That is our only job. It is not a diversion for us. We do it full time — all the time.

This description of the United States Air Force follows after a century of global debate on aerospace power and air force organizations. Even as the 20th

pendent, integrated (joint and/or combined) or supporting (of surface-based) operations at all levels (strategic, operational and tactical) at the same time. Third, aerospace power can be used to great effect when applied wisely and correctly, at the right place and time, and for the right reasons.

Two equally fundamental lessons emerged about air forces. First, only the air force is occupied with controlling and exploiting the aerospace environment through the generation and application of aerospace

power as its primary focus. Second, to be effective and ready when needed, an air force must be combat-capable and maintained in an appropriate state of readiness.

Another important lesson concerned both aerospace power and air forces. Throughout the past century, many have argued that only those who truly understand all facets of aerospace power are able to provide the best advice on how to use it wisely, correctly and effectively. History has shown, on many occasions, that leaders from independent air force organizations who have had airborne leadership experience and specialized training in a wide range of aerospace operations at the tactical, operational, and strategic levels were generally best able to exploit the flexibility and capabilities of aerospace power. It also demonstrated that aerospace operations are generally most effective when placed

under these commanders. In many cases, the air force leaders approached things from a different perspective than those of their surface and sub-surface experienced counterparts.

It took many years for these lessons to gain recognition in Canada. The considerable turmoil brought about by the many changes to Canada's Air Force organizations between 1914 and 2000 contributed to aerospace power lessons having to be regularly re-identified, re-learned and re-applied. By the end of the 20th century, however, there was a renewed emphasis within the Air Force on capturing and documenting the lessons that have been proven over time. As Canada's Air Force entered the 21st century, further reductions and organizational changes were being contemplated for budgetary reasons. It remains to be seen, therefore, whether or not the Air Force will have the resources to implement the most important experience-based, time-proven lessons of the past.

To understand these lessons, it is important to understand the aerospace environment and the aerospace 'platforms' that are used to deliver aerospace power. It is also important to understand aerospace leadership perspectives and terms. Aerospace leadership is a term that will be used to describe the application of leadership by air force leaders. Airborne leader-



A Griffon helicopter belonging to 430 Tactical Helicopter Squadron flying a routine air patrol in the Canadian area of responsibility in Bosnia, November 2001.

century came to a close, significantly differing perspectives continued to be offered on the value of aerospace power. After the 1991 Gulf War, some argued that aerospace power had won the war. Others argued that the Gulf War was an anomaly and that aerospace power remained an adjunct of land and sea power. Yet others argued that air power became an equal partner of land and sea power and that it performed a critical enabling function that led to victory.

LESSONS FROM THE PAST

As aerospace technology matured and evolved, so did the application of aerospace power. This, in turn, led to an increasing awareness of its importance to national security. Much of the increased awareness stemmed from the different, and often unique, aerospace power perspectives proffered by leaders from independent air force organizations.

Three fundamental lessons emerged over time. First, aerospace power is fundamentally different from land and sea power because of the environment through which it is derived and because of the aerospace platforms that have been designed to deliver it. Second, the inherent flexibility of aerospace power is unparalleled in the surface-based environments because it can be applied sequentially or simultaneously through inde-

ship is a term that will be used to describe the application of aerospace leadership while actually operating in the aerospace environment. For air force leaders, what follows will be a statement of the obvious, but others may find it illuminating.

THE AEROSPACE ENVIRONMENT

The gaseous fluid that extends throughout the atmosphere into space diminishes in density and composition with altitude without a distinctive dividing line between the atmosphere and space. Doctrinally, the atmosphere and space are considered to represent a single indivisible entity — the aerospace environment — with unique characteristics and properties. It has one boundary (the Earth's surface) and unlimited elevation. These characteristics afford a three-dimension spatial perspective that is unparalleled in the other two environments. Its properties support the development of aerospace platforms with speed, reach and manoeuvrability advantages over the other environments. A virtually unimpeded freedom of movement (except for significant weather) means greater mobility, and greater mobility combined with greater speed affords better responsiveness. These advantages also afford an unparalleled freedom of action that is not constrained by geographical barriers.

Of the three environments, the aerospace environment is, perhaps, the most sensitive to technological developments. Since aerospace power is derived from the use of platforms that exploit the aerospace environment for military purposes, technology is a key determinant of the characteristics of aerospace platforms and the power that they are designed to deliver. Aerospace power characteristics are only limited in degree by technology. As technology develops, so will our ability to more fully exploit the fundamental advantages that the aerospace environment has over the surface-based environments. For example, aerospace platforms can currently operate over a much larger area in far less time at much greater speed than surface or sub-surface based platforms.

Contemporary aerospace platforms are flexible (the ability to adapt to new circumstances) and versatile (an aptitude for various tasks). They are flexible because they can be diverted to new tasks while airborne, or reconfigured for new tasks while on the ground. They are versatile because they can be configured to carry out different tasks on the same mission. For example, fighters can be configured for air-to-air and air-to-surface missions, and transport aircraft can be configured for air-to-air refueling and cargo/passenger airlift. An understanding of these two

important characteristics was not always evident in the past, given how aerospace power platforms were given 'tactical' and 'strategic' labels. These labels should be reserved for aerospace power objectives, and not applied to platforms, since many contemporary platforms could be employed in operations at more than one level.

AEROSPACE LEADERSHIP

The optimum use of this technology in combat to achieve tactical objectives requires a high level of individual technical skill and tactical competence by airborne leaders. The orchestration of aerospace power at the operational level requires a detailed understanding of how best to exploit the strengths and minimize the weakness of the technology being employed. In both cases, a high level of technical understanding of



A CP-140 Aurora from 405 Maritime Patrol and Training Squadron serving with the Long-Range Patrol Detachment in the Arabian Sea, December 2001.

the capabilities and limitations of various aerospace platforms and their weapons systems is needed to employ them to best effect. Such an understanding can be gained through first-hand experience while operating in the aerospace environment. It can also be imparted through advice by specialized staff. However, knowing when to accept or reject the advice, especially when conflicting, may prove difficult for those without a foundation of first-hand experience on which to base the decision.

Those with airborne leadership experience will know what effect the aerospace environment can have on individual aerospace platforms. As well, they will understand the effect of the environment on the operational employment of individual weapon systems, individual platforms and their systems, and the orchestration and employment of large force packages. For example, some aircraft and weapons systems are more operationally limited in certain weather conditions than others. In addition, even though it may be possible to

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fly individual aircraft in certain weather conditions, it may not be possible to fly them together effectively as large force packages.

There is, of course, much more to the effective application of aerospace power than aerospace power platforms. The effective integration of a variety of aerospace systems with the platforms, weapons, bases, logistics and supporting infrastructure are all essential and interdependent elements. Large numbers of personnel are required to generate aerospace power, but only a small percentage of air force personnel (aircrew) actually conduct aerospace operations and engage opposing forces. This is different from the army where large numbers of personnel come into close contact with opposing forces, and the navy where all personnel on a ship — operations and

experience gained by actually operating in the aerospace environment. Airborne operational experience and airborne leadership provides the tactical foundation from which to build a comprehensive understanding of the aerospace environment, platforms and aerospace power. Airborne leadership qualifications are bestowed based on demonstrated airborne operational competence and not by virtue of rank or position. Some air force leaders will have airborne leadership experience and some will not. Those with the experience may develop different perspectives on aerospace power issues than those without.

Airborne leadership perspectives are derived from within 'crewed' and 'single-seat' environments. A crewed environment may consist of a pilot, co-pilot, navigator, weapon systems officer, flight engineer and other sensor personnel working together to accomplish a mission. They will normally be responsible to a mission crew commander who may or may not be the pilot of the aircraft. In a single-seat environment, individual pilots will normally work together in 'packages' of aircraft under control of one or more flight leads. In both circumstances, teamwork and effective airborne leadership are constants requisite to effectively execute the mission.

As in most military operations, airborne leaders rely on instinct, intuition, judgement and common sense to execute tactical operations effectively. However, they also rely on airborne competence, the ability to develop a rapid 'air picture' — the ability to make split second decisions and give unambiguous direction under rapidly changing and often difficult circumstances (such as bad

weather and when communications and sensor systems may be jammed or degraded). On a combat mission, immediate reactions to commands, trust and unquestioned loyalty are often essential for mission effectiveness. The lack of any of these could result in the loss of life in aerospace combat.

Aerospace leadership decision-making on the ground is normally not as time constrained. There is usually time for a leader in a headquarters to solicit expert advice from a variety of highly specialized staff before having to make a decision. Occasionally, contradictory advice will be received from the staff on a very important issue (for example, whether to fly sweep or escort as the most effective means to protect forces on vital missions that could affect the course of the war). When this occurs, the air commander must be prepared to step in and make a decision, knowing full well, for example, that it is possible for an incorrect tactical decision to have significant adverse consequences on the overall air campaign. First-hand knowledge and experi-



DGPA JSPA Photo ISD01-9594a by MCpl Brian Walsh

A Sea King helicopter coming in for a landing aboard HMCS *Preserver* during the voyage to the Arabian Sea for Operation "Apollo", October 2001.

support — become engaged. Air force personnel, other than aircrew, would only become engaged by opposing aerospace forces if their ground installations were attacked.

People can be both an advantage and a limitation because of factors such as their level of training and education, knowledge, proficiency, competence, motivation and ability to cope with stress. People can achieve extremely high levels of performance, but they can also reach a breaking point with catastrophic results. Effective leadership, exercised at all levels within an air force, is often the key determinant of effective aerospace operations. Ultimately, however, aerospace power is dependent upon the people who operate, command, control and sustain the platforms — the aerospace leaders.

A general understanding of aerospace power concepts can be derived academically and through association with aerospace operations. However, there is no substitute for the first-hand spatial and temporal experi-

ence, at both the operational and tactical levels, will help prepare aerospace commanders for these decision-making eventualities.

AIRMINDEDNESS

The perspective that an air commander brings to the planning and execution of aerospace operations stems from an ability to think of aerospace power in four dimensions. This ability, known as situational awareness (SA), is normally developed through years of operational experience at the tactical level. SA is the term used by aircrew to describe the ability to interpret limited and even contradictory information rapidly, from a variety of sources, in a highly fluid and rapidly changing four-dimensional (three spatial and one temporal) environment in order to form an accurate air picture. It involves dealing effectively with the unique distance-time relationships associated with aerospace platforms. However, as fundamental as this ability is to effective aerospace operations, all tactical airborne leaders do not develop it to the same degree.

Air commanders with airborne operational experience normally think of aerospace power and the application of force from a functional, rather than geographical perspective. They do not divide up the battlefield into operating areas as do surface forces. Instead, they see the entire theatre as a single operating area, subject to the application of force as small as a single target or target set. As well, they typically classify targets by the effect their destruction would have on the adversary, instead of where the targets are physically located. This approach normally leads to more general and global thought processes that could favour strategic solutions over tactical ones. It could also place aerospace leaders at odds with their surface-based counterparts who tend to want aerospace power that they can see in action in direct support of their forces versus aerospace power used to attain higher-level objectives. The more global approach by air commanders has been termed 'airmindedness'.

APPLICATION OF AEROSPACE POWER

There is more, of course, to the effective employment of aerospace power than being familiar with the aerospace environment, aerospace power platforms, and aerospace leadership perspectives and terminology. Knowing how aerospace power can be applied, and what constitutes a combat-capable air force, is also important.

Aerospace power can be applied directly or indirectly. It can be applied directly without force (such

as the Berlin airlift operation) or through a show of force. It can also be applied directly through four functional aerospace operations (aerospace control, force application, aerospace support to maritime operations, and aerospace support to land operations). It can be supported and sustained through what will be termed supporting aerospace operations and ground support operations.

Aerospace control is a primary operational function of a combat-capable air force. Aerospace forces aim to take control of the aerospace environment in order to acquire the freedom of action requisite to the successful completion of friendly missions, while denying the same freedom of action to opposing forces. Aerospace control comprises a continuum of operations that includes air sovereignty operations in peacetime, air enforcement (also referred to as air policing or air siege) operations during times of tension, and air superiority operations dur-



Airfield ambulance equipment gets a check at the base used by the Canadian Tactical Airlift Detachment deployed on Operation "Apollo". In the background is a C-130 Hercules.

ing conflict. During combat operations, the concept of securing the environment is described by the United States Air Force as "freedom from attack, freedom to maneuver, and freedom to attack". The concept is also referred to as 'Counter-Aerospace Operations'. Aerospace control missions can be offensive (surface attack, suppression of enemy air defences and sweep) or defensive (combat air patrol, air intercept and escort) during times of tension or conflict. Offensive missions aim to neutralize opposing aerospace forces as close to their source as possible, while defensive missions are aimed at neutralizing opposing aerospace forces that threaten friendly forces and/or installations.

Force application is another primary operational function of a combat-capable air force. It refers to the theatre-level tasked application of air-to-surface targeting aimed at achieving theatre-level objec-

tives. Force application missions include strategic attack and air interdiction. These missions are normally tasked to air forces, but aerospace forces organic to, and controlled by, surface-based forces could also be tasked with force application operations at the theatre level.

Combat-capable air forces could also provide direct support to land and maritime operations. When tasked at the theatre level, these missions have traditionally been termed Close Air Support and Tactical Air Support to Maritime Operations. When tasked below the theatre

While air force leaders understand the importance and precedence of each of the functional areas just described, history has shown that others do not. In this regard, it is important to distinguish between air forces and aerospace power. Air forces are responsible for aerospace control and force application operations as a primary focus. During combat operations, if aerospace superiority is not achieved and maintained by the air force, enemy air forces could retain sufficient freedom of action to threaten friendly surface-based forces. Therefore, surface-based commanders have a stake in whether or not aerospace superiority exists, and its achievement may necessitate the diversion of aerospace forces away from the direct support of friendly surface forces. Surface-based commanders need to understand that air forces do not exist only to support surface-based operations, although their aerospace power can be applied in a supporting manner just as readily as surface-based forces can be used to support air force operations.

AEROSPACE POWER

Aerospace power has several other characteristics that need to be understood in order to apply it effectively. First, it is, by nature, an offensive capability. Even when defending against it, aerospace power is applied offensively. Offensive action retains the initiative and element of surprise.

Defensive action against aerospace power is normally more difficult to concentrate in space and time, and the most that can be gained is a stalemate. Offensive action is required to win. One cannot defend everywhere at once, so the focus should be concentrated around vital areas. Second, it should be employed under the centralized control of a single air commander to ensure unity and economy of effort. Third, aerospace effort, especially when assets are limited, should not be fragmented. Aerospace forces should be organized into large enough groupings to retain flexibility and avoid fragility. Smaller units generally tend to be less flexible. They also tend to be more susceptible to the effects of a single loss.

Clearly, there are many factors that need to be considered when establishing aerospace power objectives. Clearly articulated objectives are necessary to ensure that aerospace power is used wisely and to best effect. Once objectives are established, the planning and execution of aerospace operations can be quite complex. The planning phase normally involves the formulation of aerospace strategies, plans and orders. The execution phase usually involves tasking, monitoring, controlling, assessing and adjusting aerospace operations. Aerospace power objectives establish what needs to be done, and tactical level commanders are normally given the latitude to determine how it is done.

level, the support could come from air forces organic to surface-based forces. Examples could include maritime helicopters supporting naval units and land aviation helicopters supporting army units.

Some combat-capable air forces could also conduct a wide variety of supporting aerospace operations. They include air transport, air-to-air refueling, combat search and rescue, electronic warfare, airborne early warning and control, airborne command, control and communications, intelligence support operations (surveillance and reconnaissance) and special operations.

Ground support operations employ the majority of air force personnel. These involve operations support (aerospace support activities and ground support activities) and logistics support (administration, finance services and technical services). Aerospace support activities include aerospace engineering and maintenance, environmental, intelligence, command post, air traffic control and ground intercept control. Ground support activities include air defence, ground defence, NBCW, airfield engineering and support, and crash fire rescue. Administration and finance activities include financial, personnel, medical and dental services. Technical services activities include construction engineering, electro-mechanical engineering, supply, transport, telecommunications and food services.



A C-130 Hercules on the tarmac at a Canadian air base.

DND Photo by Mike Reyno

AEROSPACE POWER AND NATIONAL SECURITY

How then does all of this apply to national security? Have we learned anything from all of these lessons? More importantly, have we applied what we have learned? The 1994 Canadian White Paper on Defence states that:

The Government has concluded that the maintenance of multi-purpose, combat-capable forces is in the national interest. It is only through the maintenance of such forces that Canada will be able to retain the necessary degree of flexibility and freedom of action when it comes to the defence of its interests and the projection of its values abroad. We must maintain a prudent level of military force to deal with challenges to our sovereignty in peacetime, and retain the capability to generate forces capable of contributing to the defence of our nation should the need arise.

Many contemporary aerospace power platforms are multi-role (the capability to configure aircraft to perform more than one type of mission) and multi-mission (the capability to perform more than one type of mission on the same mission) capable. This multi-purpose capability is resident in all of Canada's combat-capable platforms.

The CF-18 is Canada's only fighter aircraft. It constitutes the primary combat capability of the Air Force and is Canada's only means of exercising active control over unwanted activities in domestic and international airspace through aerospace control operations. It is Canada's only airborne means of enforcing both elements of air sovereignty (air surveillance and control) in peacetime. As well, it can be employed in force application operations such as strategic attack and air interdiction. It can also be tasked to provide support to land and maritime operations.

The Aurora is Canada's only long-range patrol aircraft. It constitutes the primary long-range land and sea surveillance platform of the Air Force. It is used primarily to provide support to the Navy in its surface and sub-surface roles, but could also be used to support land operations. As well, it is one of two Canadian airborne platforms used to contribute to the enforcement of Canada's maritime sovereignty in peacetime.

The Sea King is Canada's only maritime helicopter. It is used primarily to provide support to maritime forces while embarked on naval ships. It can be employed on missions such as sub-surface missions aimed at detecting, locating and attacking submarines, surface missions aimed at detecting surface vessels, and for the transport of personnel and equipment. It too is used in the enforcement of Canada's maritime sovereignty in peacetime.

The Griffon is Canada's only land aviation helicopter. It is used primarily to provide support to land forces. It entered service as a Utility Tactical

Transport Helicopter. Its combat power missions could include reconnaissance and surveillance. Its combat support missions could include the direction and control of indirect fires, the airlift of equipment and supplies, and communications assistance. Its combat service support missions could include medical evacuation and logistics support.

Each of the above aircraft provides flexibility and freedom of action to the government when it comes to the defence of Canadian interests and projection of our values abroad. All are also required for the Air Force to maintain the capability to execute its doctrinal functions. The CF-18 is used to maintain its aerospace control and force application capabilities. The Aurora and maritime helicopter are used to provide direct support to maritime operations. The Griffon is used to provide direct support to land operations. The CF-18 is used to conduct air sovereignty missions, and the Aurora is used to conduct maritime sovereignty missions. Both helicopters could be used in support of maritime and territorial sovereignty.

When discussing the minimum level of aerospace power that should be maintained in peacetime, contemporary discussions tend to focus on the concept of a core or minimum capability. Proponents of this concept argue that, should it be required, the core capability could be developed into a much more robust capability. They add that Canada was able to do it in the past during the magnificent build up of air power during the Second World War. Could we do it again should the need arise? Would there be any impediments at a future time that did not exist in the past? Would the dramatically increased technological complexity of contemporary aerospace platforms have a bearing on how fast they could be produced if required? Would our increased dependency on off-shore manufacturers for parts and components make a difference? Would the significantly more complex and lengthy training required to operate, maintain and support contemporary high technology platforms make any difference? Would recruiting and retention problems have any bearing?

Canada's Air Force entered the 21st century with a renewed emphasis on capturing and applying time-proven aerospace power lessons. At the same time, however, the Air Force continues to face severe budgetary pressures, personnel shortages and demands to reduce equipment. A *Jane's Defence Weekly* article (31 January 2001) discussed plans for Canada's 21st century combat-capable Air Force. It refers to the 285 aircraft that will be left in inventory as a "minimum force structure". Of the 285, there will be 80 CF-18 fighters, 16 Aurora long-range patrol aircraft, 28 new maritime helicopters, and 75 Griffon utility helicopters.

As a technology-centered service, will Canada's Air Force be able to capitalize on the technological development that will undoubtedly occur in the 21st century? The 20th century drew to a close with concepts being investigated such as space planes, trans-atmospheric vehicles and air breathing hypersonic vehicles. The

aerospace environment presents technological challenges for the future development of a single platform that could operate within, and beyond, the atmosphere. If such a platform, capable of sustained operations throughout the aerospace environment, is developed in the early part of this century, will it be affordable?

Maintaining a combat-capable air force is expensive. Some argue against maintaining capabilities in peacetime because they either believe they are too expensive, or that it is unlikely they will need them. Would these same people also argue against maintaining life insurance or a fire hall in a small town with a limited budget for the same reasons? If a catastrophe occurs and a person is without insurance, the cost is normally

measured in terms of one's lifestyle. When a nation is without insurance, the cost is normally measured in human life and freedom. Will Canada have enough aerospace power insurance as it progresses through the 21st century?

Will Canada's Air Force be robust enough to enforce the aerospace element of Canadian sovereignty, defend Canada's interests and project its values abroad when called upon? Perhaps more importantly, will it be ready to strike in an emergency?



DND Photo APD02 5000-74 by Cpl Lou Penney

Canadian troops in Kandahar, Afghanistan, celebrate as Canada wins gold in hockey at the 2002 Winter Olympics.