PATHFINDER

COLLECTION – VOLUME 5

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Edited by

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Air Power Development Centre
CANBERRA

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ISSN 1836-7712

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Layout and design by Graeme Smith

Published and distributed by:

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Cover image: 'RAAF Kittyhawk Squadron at Milne Bay, August-September 1942' by William Dargie (1969). Oil on canvas, 154 x 275.3 cm, Australian War Memorial (ART27628).
Sir William Dargie CBE (1912-2003) was one of Australia's most famous painters. During World War II he was an official war artist, and as a result of this appointment more than 500 of his paintings, drawings and sketches are in the War Memorial in Canberra. His portraits won him the Archibald Prize a record eight times—he was reputedly digging a trench at Tobruk, Libya, in 1942 when informed he had won the first time. For his painting of the Kittyhawk unit at Milne Bay, Dargie consulted with RAAF veterans to recreate details of the fighting there, but he made clear to the War Memorial's director that he made no attempt to include in his painting actual portraits of real participants in the battle. Even so, aircrew who saw the picture took the standing figure at right to be Squadron Leader Les Jackson, the Commanding Officer of No 75 Squadron.

Foreword

While continuing the established practice of producing two Pathfinders each month, the RAAF Air Power Development Centre (APDC) periodically collects and publishes a number of Pathfinders organised into two general categories; air power topics, and historical discussions. This is the fifth such volume of collected Pathfinders that APDC has produced and it reflects a cross-section of themes and ideas developed and explored throughout the past eighteen months.

The general theme explored in the air power Pathfinder category is that of 'Facets of Air Power'. This reflects our interest in bringing key elements of air power doctrine to public discussion ahead of the publication and release of the sixth edition of AAP 1000-D—*The Air Power Manual* in early 2013. Included in the air power category, alongside discussions of key air power roles, are several Pathfinders treating the subjects of Space Power and Cyberspace. Clearly the cyber domain is emerging as a critical and consequential area of security concern and the significance of this is not lost on the RAAF. Likewise, although space has been vital to Air Force operations for decades, it still presents considerable intellectual and operational challenges, especially in regards to the weaponisation and regulation of activities in the space domain.

The historic category represents a collection of Air Force experiences, and some concise yet informative analysis of these experiences. This collection highlights several important facets of Australia's historic and contemporary security circumstance, most notably the enduring significance of our maritime security context and the use of air power as a coercive instrument across a spread of conflict scenarios. All of these papers provide fertile ground in which to cultivate a deeper and more considered understanding of the employment of air power for national security. We trust you will enjoy and benefit from these Pathfinders. This volume is a somewhat eclectic collection that covers a considerable range of issues that are relevant and important to the RAAF at present. It is also hoped that this volume

will prove to be of interest and use to others outside of the RAAF. As a collection they admirably contribute to the broader international air power discourse and discussion.

I commend this volume to you.

Group Captain Mark Hinchcliffe
Director
Air Power Development Centre

The Air Power Development Centre

The Air Power Development Centre, formerly the Aerospace Centre, was established by the RAAF in August 1989, at the direction of the Chief of Air Force. Its function is to promote a greater understanding of the proper application of air and space power within the Australian Defence Force and in the wider community. This is being achieved through a variety of methods, including development and revision of indigenous doctrine, the incorporation of that doctrine into all levels of RAAF training, and increasing the level of air and space power awareness across the broadest possible spectrum. Comment on this publication or inquiry on any other air power related topic is welcome and should be forwarded to:

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AIR POWER

Air power will not make a land force potent, but without air power a land force will never be potent.

Air Marshal Geoff Brown, AO
Chief of Air Force

The Issue of Space Debris

Key Points

- *Orbital debris poses a significant threat to space systems.*
- *Earth orbits are becoming increasingly congested.*
- *Space situational awareness is essential for a space-enabled force.*

Although Australia has only limited military space assets, access to space-based systems is critical to the operational efficiency of the ADF. In fact, almost 50 per cent of the capabilities identified within the Defence Capability Plan have a first-order dependence on space for communications; intelligence, surveillance and reconaissance; meteorology and position, navigation and timing information. In other words, the ADF is very heavily reliant on the products and services derived from space-based systems, necessitating a clear understanding of the challenges of operating in space.

One of the major hazards of military flying is the danger of ingesting/striking a foreign object that would cause unwanted damage that could be lethal. While a number of remedial measures have reduced this risk, collisions with other flying objects still constitute a grave danger to flying activities. In the 21st Century, Air Force's operating environment includes space and operations in space also have the inherent risk associated with collision and debris damage.

There are numerous objects orbiting the Earth. The most common are functioning and non-functioning satellites ranging in mass from 1 kg for a microsatellite to about 1154 kg for a US Defense Meteorological satellite. There are also the platforms that are used to insert these satellites into orbit after separation from the launch vehicle, which remain in orbit long after their purpose is served. Depending upon the height of the orbit, the launch vehicle itself can remain in orbit for a short time after the release of the payload and platform.

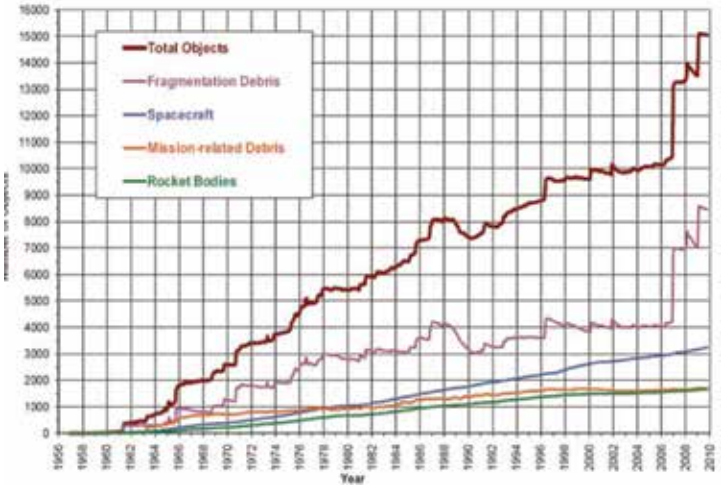
Then there is the detritus—the orbital junk—from the launch process, which includes parts that separate from the launch vehicle or satellite for whatever reason. Common debris includes nose-cone shrouds, hatch covers, outer skins ruptured by solar thermal changes, and spilt engine coolant and unused rocket fuel. But by far the most unpredictable and

dangerous are the bits and pieces left over from satellite collisions. This debris in turn can lead to further collisions and the creation of new fragments.

Even Australia has contributed to the space debris problem. Australian space activities have left a spent rocket booster, used to launch Optus B2 in 1992, and five decommissioned geostationary telecommunications satellites that remain in a graveyard orbit.

There are also natural objects found in Earth's orbit like meteors, disintegrating comets and asteroidal particles captured by Earth's gravity, which can remain in orbit from a few hours to centuries, depending upon their individual kinetic energy.

This orbital debris, in combination with the shear volume of space that needs to be monitored, the small size of many of these objects, and the speed at which they travel, pose a significant threat to satellites and a daunting challenge for those responsible for managing space capabilities. For example, objects in stable Earth orbits are typically travelling at speeds of about 28 000 km per hour, in low-Earth orbit (~800 km altitude) to 11 000 km per hour in the geostationary belt (~36 000 km altitude). At these speeds, even a collision with a fleck of paint can severely damage a satellite.



Growth trend in space objects

Because of the threat that orbital debris poses to satellites, the US Air Force Space Command (AFSPC) has developed a dedicated global network of sensors to track objects in Earth orbit, which includes satellites and debris that are 10 cm or greater in size. A large number of smaller objects are also known to exist in orbit but are too small to be tracked by this system. The tracked objects are recorded in a 'space catalogue' that was started in 1957 following the launch of the Russian Sputnik I.

AFSPC uses the space catalogue to produce an unclassified weekly Space Situation Report (SRR). For example, on 8 November 2010, the SSR listed 37 207 resident space objects in Earth orbit of which only 2949 are functioning satellites.

A major contributor to space debris are satellites that have exceeded their original design specifications and continue to function and those that remain in orbit after completion of their missions instead of re-entering the Earth's atmosphere as originally planned. For example, the US Vanguard 1 test satellite launched in 1958 with mission expiry in 1964, is not expected to de-orbit for another 240 years.

Some of the objects that are now considered space debris were deliberately inserted into orbit. Between 1961 and 1963, the US military inserted into orbit millions of 1.787 cm copper needles, code-named the 'Westford Needles', in an attempt to create a radio-reflective ring around the Earth. This ring was to be used to reflect radio signals and relay messages in the event of communications satellites being disabled during a nuclear war.

Why is there so much concern about space debris? With the increase in the volume of space debris there is an increased likelihood of a collision. While collisions between even small space objects would be a problem, it becomes far more significant when two large bodies collide. For example, a collision involving an 8-tonne rocket booster and a 5-tonne decommissioned satellite could potentially create thousands of new fragments, resulting in scenario called a 'Kessler Syndrome'. In this scenario, the density of objects already in low Earth orbit is so high that collision fragments could cascade—each subsequent collision generating further debris, which increase the possibility of further collisions. The worst-case result could be unusable Earth orbits and transits to outer space becoming extremely hazardous for hundreds of years.

Asteroids also pose a risk to both orbiting objects and the Earth itself. Asteroids range in size from the largest, *Ceres*, with a diameter of about 1000 km, to ones that are the size of small boulders. The vast majority of all interplanetary material that reaches the Earth's surface originates as fragments resulting from colliding asteroids. Although the Earth is bombarded with more than 100 tonnes of dust and sand-size particles daily, NASA estimates an average interval of about 100 years for asteroids larger than about 50 m to reach the Earth's surface.

The increasing congestion in space demonstrates the importance of having adequate counter measures and processes in place to reduce the risk of damage to systems that are vital for the effective functioning of modern military forces. Improved space situational awareness as well as the ability to predict risks of collisions and, where feasible, take precautionary measures to protect space capabilities is a critical requirement for a force that is reliant on space-based systems.

Weapons in Space

I do not say that we should or will go unprotected against the hostile misuse of space any more than we go unprotected against the hostile use of land or sea, but I do say that space can be explored and mastered without feeding the fires of war, without repeating the mistakes that man has made in extending his writ around this globe of ours.

John F Kennedy 'Moon Speech,' 1962

Key points

- *Traditional weapons are not effective in the space environment.*
- *Physical destruction of a space asset can introduce space debris with the risk of long-lasting collateral damage to other current and future space systems.*
- *Disabling the supporting ground infrastructure and space communication links may be a cost-effective way to neutralise space-based capabilities without creating increased space debris.*

In the past few decades the security of individual nations and international collectives has become increasingly dependent on space power. As a result, some space-faring nations have commenced 'weaponising' space, which has heightened international concern. The ADF Glossary defines a 'weapon' as 'an offensive or defensive instrument of combat used to destroy, injure, defeat or threaten an enemy'. In space operations, this takes on a different dynamic to the conventional understanding of a weapon. For example, a mission expired satellite, with reserve fuel available for manoeuvring, could be used as a weapon even though it does not carry a weapon on board—a concept similar to flying a commercial aircraft into a building!

Today, effective military operations are dependent on space based capabilities for the purposes of activities such as the monitoring of air, land and maritime environments; satellite broadcasting and communications; and global navigation support systems to name a few. However, the effectiveness of these capabilities is dependent on the availability of a space asset in an appropriate orbit to provide

the necessary sensor coverage over the required area of interest and to communicate with aligned ground stations. In turn, this has led to increasing competition between nations to inhabit these optimum orbits. The optimum orbit is to be found above the Kármán line at 100 km above the Earth, which is generally accepted to be the point at which outer space starts. This height is the practical lower limit for spacecraft to stay in orbit to overcome the gravitational pull of the Earth.

Consequently, it is not surprising that space-faring nations are developing technologies, and the associated tactics to ensure that they have unhindered access to space-based capabilities. The recent testing by China of an anti-satellite missile is an example of such developments.

In weaponising space, the unique environmental properties of near-Earth orbit directly affect the performance and effectiveness of traditional heat and blast or fragmentation weapons. Blast and flame effects are almost ineffective without air, and traditional air weapons require significant modifications to be effective in space. The challenges here are further exacerbated by the difficulties in getting a warhead into space in the first place, not to mention the tracking and fixing of targets travelling at orbital speeds of 28 000 km/h or more. The resultant fragmentation from the warhead and subsequent damage to the target can cause unwanted space debris and associated collateral damage (see *Pathfinder #146*, p .3). Add to this the consideration that the deliberate creation of space debris through the destruction of a satellite which could affect other satellites could be considered a hostile act, contrary to international agreements.

An alternative approach to using an explosive warhead is to neutralise the effectiveness of an orbiting satellite by the deliberate manoeuvring of an existing spacecraft so that it obstructs the surveillance sensors or communications signals of the satellite, or casts a shadow over the solar power panels of the satellite. Therefore, it does not necessarily take a direct collision—which avoids the space debris issue—to raise tensions among space-faring nations. Perhaps the most effective weapons to be used in space are non-conventional ones such as those which apply electronic or cyber attack capabilities, ionising radiation from an electromagnetic pulse apparatus or directed-energy weapons from lasers or microwaves. These could put space-based systems out of operation without physically destroying them—a 'soft-

kill' option. However, pulse, laser and microwave weapons are still in the experimental stages of development and are currently prohibitively expensive.

The cost-effectiveness of developing and operating these sophisticated weapons in space is also an important consideration in determining their military value. Placing a weapon in orbit can be as complex and expensive as conducting a manned space mission. To detect and identify a target, launch a spacecraft, manoeuvre it into an orbital rendezvous and deliver a weapon that impacts only the target without any collateral damage is an extremely difficult operation.

Given the cost associated with developing such capabilities and the attendant operational difficulties, it may be easier and more cost-effective to engage the ground station or the communications links for mission control or 'hack' the onboard data of a space-based system rather than the orbiting satellite itself. In the event that attack on the space-based component of the system is the only option, directed energy weapons and/or electronic and cyber attack may be the only viable alternative.

There are a number of United Nations (UN) treaties that govern the use of space and ban the testing and deployment of space objects carrying weapons of mass destruction. The UN has sought to control the use of space and prevent the placement of weapons in space to keep the space environment openly available for current and future generations. Australia is a signatory to most of these treaties.

International efforts are underway to ensure free and open use of space. However, the military significance of space-based systems point towards the 'weaponisation' of space increasingly becoming a tempting option. All space-faring nations and their allies must be aware of the implications of such actions and institute defensive measures and redundancies to ensure space system availability to friendly forces. The other side of the coin is that all nations must abide by the UN treaties that govern the use of space to ensure that space remains free of weapons. Ideally, space should remain what it is: a peaceful vacuum.

What is Cyberspace? Examining its Components

Key points

- *Cyberspace is a virtual domain similar, but discretely different, to the physical domains of air, sea, land and space.*
- *Cyberspace has four distinct components—Information, Physical Systems, Cognitive Actions, and People.*
- *People and their manipulation of information are central to conducting operations in cyberspace.*

The ability to operate in Cyberspace is becoming a key component of national security. The *Defence White Paper 2009* places considerable importance in the ADF developing a cyber capability. As the RAAF introduces an increasingly network-enabled force, it is critical to understand cyberspace, its relationship to air power and its potential impact on operations. This requires knowledge of its components, nature and purpose.

There is increasing recognition that cyberspace is another domain in military operations. The cyberspace domain has similarities to the traditional environmental domains of land, sea, air, and space, which are interactive and require cross-domain planning. Although these considerations also apply to cyberspace, it is distinctly different from the other domains. Cyberspace is a largely intangible domain and is not physically identifiable in the natural world while the other domains are clearly recognisable. It is essentially a networked terrain that has no geographic boundaries. Further, it is largely owned and operated by private sector entities, many of them multinational corporations. Since it is not constrained by boundaries, cyberspace can act independently through and/or influence all other domains as depicted at right.

Very broadly, cyberspace is the collection of computing devices connected by networks in which electronic information is stored and utilised, and communication takes place. The US Air Force, in their doctrine document 3-12, defines cyberspace as, 'a global domain within

the information environment consisting of the interdependent network of information technology infrastructures, including the Internet, telecommunications networks, computer systems, and embedded processors and controllers'. A useful way of understanding cyberspace is by articulating operations within it, which can be described as the processing, manipulation and exploitation of information and its interaction with people. Information and people are central to cyberspace. Cyberspace consists of four components: information, physical systems, cognitive actions and people. These components function in a closed loop that feed back information retrieved in cyberspace to the people requesting it.

The creation, capture, storage and processing of information is central to the domain. Information in cyberspace takes many forms; it is the shared music and videos, the stored records of businesses, and all of the pages in the world-wide web. It is online books and photographs, as well as information about information (meta-data). It is information created and retrieved when other information is looked for using online search engines.

The character of information in cyberspace (or more colloquially 'on the net') has changed greatly since computers first started working with data sets. Data was processed by isolated computers well before the capability of interconnection was developed and stored in card decks, tapes, and later disks. Initially, data was normally static, stored and retrieved as needed. Massive archives of static information still exist, such as corporate transaction records that are now stored in 'data warehouses' and 'mined' for further information. But increasingly, information is created dynamically on demand, blurring the boundaries between storage and computation. Information is now becoming more of a personal experience, instead of a communal one. Issues of ownership, authenticity and dependability are all becoming critical challenges as more and more information moves 'online'.

The nature of cyberspace, its strengths and its limitations, derive more from the decisions made at the cognitive level rather than through the operation of physical systems. The decisions that shape the Internet arise at this higher layer, where the nature of the Internet is defined. The design of the Internet results in a cyberspace that is built out of components and provides services designed so that they can be composed and combined to form more complex services. Low

level services include program execution environments, mechanisms for data transport and standards for data formats. From these are built applications, such as word processors, databases or webpages. By combining these, more complex services emerge. For example, by combining a database with the Web, dynamic content generation and active Web objects are created. In addition, social networking services that are themselves platforms for further application development can be generated. A unique characteristic of cyberspace is the continuous and rapid evolution of new capabilities and services, based on the creation and combination of new logical constructs, all operating on top of the physical foundations.

The physical components of cyberspace are its foundation and comprise the physical devices/systems that create it. Cyberspace is a space of interconnected computing devices, so its foundations are computers and servers, supercomputers and grids, sensors, transducers, and the Internet as well as other supporting networks and communications links. Communications may occur over wires, fibre, radio transmission, or by the physical transport of the computing and storage devices from place to place. The physical component is perhaps the easiest to grasp since it is tangible and provides a geographic sense of location as physical devices such as routers or data centres exist in a place.

The most important aspect of cyberspace is the technological interconnection of people. People are not merely passive users of cyberspace, they define and shape its character by the ways they choose to use it and the decisions they make within it. People and their individual characters, which could vary with a number of factors, are an important influence on the nature of cyberspace. The unique nature of people means that each individual cyberspace user will have an individual experience. Essentially cyberspace is an expanding spiral of constantly changing decisions and information, brought about by the interaction of its four components.

When the nature of cyberspace, and the position of different countries with respect to their place and power in cyberspace is contemplated, it must be recognised that people are as important a component of cyberspace (or more so), than are wires and protocols.

The *Defence White Paper 2009* identifies cyberspace as a capability development domain for Australia's national security. Operations in

cyberspace pose growing challenges but also provide opportunities for the RAAF and air power to contribute to and enhance national security. This requires a clear understanding of cyberspace as a domain, which is distinctly different to the conventional environmental domains. The cyberspace domain is relatively new and is largely a virtual landscape that is difficult to comprehend as opposed to physical domains. Understanding cyberspace in its basic construct of four components is essential to understanding it as a domain. It will also assist in developing more effective ways to exploit it in generating and applying air power and protecting our own capabilities from adversary cyber threats.

What is Cyberspace? Examining its Characteristics

Key Points

- *Four suggested characteristics of the cyberspace domain are inter-connectivity, virtuality, expansion and ambiguity.*
- *These characteristics create challenges for doctrine, policy and capability development.*
- *Understanding these characteristics is essential to fully expoit the domain for the optimum employment of air power.*

A characteristic is a distinctive attribute that derives from the inherent nature of a domain. There are a number of characteristics of the cyber domain, further examination of which is valuable to better understand the nature and complexity of the domain. As with any new technology, the domain may develop its own terminology to convey specific meanings. Some of the suggested cyber domain characteristics are—inter-connectivity, virtuality, expansion and ambiguity.

The Oxford dictionary defines **inter** as: *a prefix meaning between or among* and **Connectivity** as – *the characteristic of, or suitability for, being connected, to make connections*.

Cyberspace comprises of interconnected physical systems that have a host of connections within the physical domain. The physical systems may differ in detail, but they share the common feature that they are the foundation for the next physical system connected to them. The air domain is a physical entity and air power relies on individual systems such as platforms, bases, logistics and personnel to function as a system of systems. In contrast, the cyber domain itself is a system of systems due to the inter-connectivity of a multitude of physical systems.

It is this inter-connectivity that defines cyberspace and has allowed applications like *Facebook* to grow to have over 700 million users in a short span of time. This aspect of the cyber domain makes it intricate, complex to define and difficult to understand. This is compounded by

cross jurisdictional boundaries and attribution difficulties that provide challenging doctrinal, legal and operational implications.

Individuals or corporations may have ownership of some physical systems and interconnections but there is no ownership of cyberspace as a collective. This is a quality shared with the space domain noting that entry into the cyber domain is obtained at a significantly lower cost and sophistication than into space. Users of cyberspace exploit low-entry costs, widely available resources and a minimal required investment to influence the domain.

The Oxford dictionary defines **virtuality** as: *not physically existing, but made by software to appear to do so from the point of view of the user; an artificial world created by interactive computer technology.* Although cyberspace has physical systems, not all of it exists in a physical state as some connections are wireless and utilise parts of the electromagnetic spectrum. In essence, it is much easier to see and sense in the other domains. The unbounded and virtual nature of cyberspace allows action through it, but not physical movement within it. In the cyber domain no physical movement takes place and only information is transferred.

While the word virtual may be used as a simple synonym for computerised, it usually implies that somehow virtual objects are figments of imagination, somehow less real. In the context of cyberspace, virtual means 'seems to be'. The programmable nature of cyberspace makes it possible for a single person to have enormous social or physical effect through software that allows him/her to act virtually, i.e. to appear to exist in multiple places. One individual can, in essence, clone himself in the form of a program or agent and act globally as the many computer viruses in circulation demonstrate.

The Oxford dictionary defines **expansion** as: *enlargement of scale; anything spread out; to increase in size or effect.* As highlighted by the Cyber Spiral Concept in *Pathfinder #153* (p. 11), information in the cyber domain is expanding and evolving as every action initiated by a cyberspace user makes subtle changes to the domain for the next user. There is an increasing demand for information from the domain, requiring the physical systems and technology underpinning it to expand and evolve. Changes in cyberspace are driven in large part by private industry research and development. The interdependency

and innovation of civilian economic markets and communications industries have a direct impact on cyber security.

Further, the domain itself is growing and evolving as information technology and the market expand and develop. This shapes many aspects of cyberspace and drives towards a system that allows for rapid innovation. To achieve this, one of the internet's fundamental goals was assurance of connection and ability to access or deliver data, not security. This philosophy is expansive by nature and results in cyberspace being continuously redefined by the nature of its users' actions. This significantly contrasts with the fixed, physical nature of the air, land and sea domains.

The Oxford dictionary defines **ambiguity** as: *doubtfulness or uncertainty of meaning, unclear, indefinite.* A combination of the interconnectivity, virtuality and expansion characteristics makes cyberspace an inherently ambiguous and a complex structure that is abstruse—difficult to understand—in nature. Ambiguity is unique to cyberspace and highlights the difficulty in understanding its ever changing and perplexing nature. This may be due, in part, also to the vast amount of information available in cyberspace. It is estimated there are over five million terabytes of information accessible on the internet and that in 2010 approximately 107 trillion emails were sent. The scale of storage, amount of data and usage of the domain creates intricate, undefined and challenging legal implications for actions within it, thereby increasing its ambiguity.

Little appears to have been discussed about the inherent characteristics of the domain. The above characteristics are presented to describe the domain and to increase awareness of its unique nature. Knowledge of the cyber components and an understanding of these characteristics allow a deeper appreciation of how the domain can be fully exploited. Transposing well-known concepts from physical domains like deterrence, where attribution is known, to cyberspace, where attribution is frequently indeterminate, creates many challenges for doctrine, policy and capability development. This is highlighted when there is limited understanding of cyberspace.

The potential impact of the domain is far-reaching, the possibilities unbounded. Similar to nuclear weapons that could bring about the application of catastrophic force, attacks in cyberspace can also create enormous destructive effects. But unlike nuclear war,

cyberspace attacks do not require the resources of a nation-state, they can be committed by a single person with a computer and an internet connection anywhere in the world.

What is Airmindedness?

Key Points

- *Airmindedness is not a new concept and dates back to the 1930s.*
- *Airmindedness is the instinctive ability to use the air domain as a single entity to create the desired effects.*
- *From an air force perspective, airmindedness is a critical component of professional mastery.*

The effectiveness of an air force is directly dependent on the professional mastery of its personnel, which is much more than the ability to operate sophisticated technology. By virtue of the inherent three dimensional nature of air warfare, professional airmen have a unique perspective—fundamentally different to that of a soldier or sailor—regarding the concept, characteristics and conduct of warfare. Further, since air power is a dynamic entity, it requires a nuanced understanding to capture all aspects of its employment, which could be termed 'airmindedness'. Therefore, from an air force perspective, a critical ingredient of professional mastery is the need to be air-minded. So what is airmindedness?

Airmindedness is not a new concept. In fact, the term itself dates back to the 1930s when early air power theories were being developed. Broadly, it meant the need to have a deeper understanding of the third dimension in order to utilise it to achieve national objectives. Airmindedness should not be confused with air power doctrine and theory or air force strategies. It is an intangible quality that binds airmen together in a common understanding of the utilisation of the air domain to further national interests.

All professions have their own perspectives regarding events—past, unfolding and future—that reflect their particular institutional point of view. This is also the case with airmen, who view history, contemporary conflict scenarios and evolving and future security imperatives through a unique lens. The uniqueness of the lens through which airmen view events is resident in the understanding of the primary tenets of the employment of air power and influenced by collective experience. Air forces and air power are perceived in different

ways by outside agencies and other Services. It would be correct to say that none of these views would be an all encompassing, holistic view of an air force, because the peculiarities of the agency making the assessment would influence its judgement. In fact, it would not be far from the truth to state that such appreciations are almost always only two-dimensional. Air power is a multi-dimensional entity, making air forces multi-dimensional organisations. This is the strength of air forces and an understanding of the nuances of this multi-dimensionality is at the core of airmindedness.

Airmindedness is essentially an explicit appreciation of the potential of air power across all levels of its application, from the strategic to the tactical. This has to be supplemented by an inherent understanding of the ability of air power to create strategic effects, even through minimal involvement and tactical actions, tempered with the forces' experience in applying force. Airmindedness, therefore, cannot be imbibed purely through training; it is the product of personal perception, education and involvement in air activities in both peace and war.

Airmindedness is the instinctive ability to use the air domain as a single entity to create the necessary effects that either independently or as part of a joint task force contributes to campaign objectives and national security. Ideally, this is what independent air forces must be able to accomplish. Land forces optimise their air arms to provide organic mobility, fire support to tactical battles and operational or tactical level intelligence, surveillance and reconaissance (ISR). Similarly, naval aviation is primarily meant to protect the fleet from attacks from, above or beneath the surface by acting as an extension of the mother ship. In contrast, air forces by virtue of their three-dimensional perspective, are able to contribute directly to ground and maritime operations while simultaneously conducting theatre-wide, independent, strategic operations. In a cyclical manner, such operations further enhance an airman's airmindedness and are in turn optimised by the airmindedness of airmen at all levels.

At the strategic level, airmindedness is an essential criteria to ensure that the national security planning process is cognisant of the contribution that air forces can make in terms of deterrence, stabilisation and when necessary the lethal application of force. The precise, discriminate and proportional application of lethal force is

unique to air power and cannot be easily replicated. An appreciation of this holistic capability is based on a broad ability to be air-minded. At the operational and tactical level, it requires an airman with adequate knowledge of air force capabilities to ensure that its contribution to the joint campaign is well enmeshed in the overall plan and appropriately employed.

Airmindedness is critical to understanding the decisive roles of air power and their optimised application. Operation *Allied Force* conducted by NATO forces in Serbia and Kosovo in 1999 is an example. This operation was primarily reliant on air power for its success, which has led to a debate regarding the 'decisiveness' of air power. Irrespective of the tactical level debate, airmen must appreciate that in this operation air power was effective as a military, diplomatic, economic and informational instrument of power that achieved the desired strategic objectives. Such an appreciation will no doubt influence the future application of air power and can only come with being air-minded.

Recent operations in Afghanistan and Iraq have reinforced the effectiveness of air forces when employed with sufficient understanding of the evolving conflict situation. Air power has carried out extreme long range strikes, provided close air support and ISR, improved the effectiveness of numerically limited ground forces by increasing their virtual mass, and delivered humanitarian aid. At times these disparate activities have been carried out simultaneously. Further, the combination of air power and Special Forces has created its own asymmetric effects within the battlespace which an inherently asymmetric adversary is unable to counter. It is the agility of thought in airmen, nurtured through being air-minded, that has permitted these innovative applications of air power.

By virtue of the multi-dimensionality of air forces, airmen think differently and, therefore, are more likely to find alternative solutions to problems. Technical dexterity is an essential component of air power, but only when it is focused with professional mastery will it produce the synergy needed to be effective. Professional mastery in an air power context involves airmen being air-minded to understand the multi-dimensional aspects of the air domain and the nuances in the generation, delivery and sustainment of air power.

Asymmetry in Warfare

Key Points

- *Asymmetric threats and challenges are enduring aspects of warfare and are fundamental to the conduct of irregular wars.*
- *Asymmetry can be applied through either technology or the cognitive domain.*
- *Air power often provides a technological asymmetry that can be exploited in countering irregular forces.*

Asymmetric threats have been central to recent security debates around the world. The events of the last decade are evidence of a distinct rise in asymmetric threats to stability. Therefore, there is value in examining exactly what is meant by asymmetric threats. At the outset it should be noted that asymmetric threats are an enduring aspect of warfare and not a new phenomenon.

Contemporary literature is replete with references to asymmetric warfare, asymmetric challenges, asymmetric threats and asymmetric tactics. However, the term asymmetry is used to indicate a very broad spectrum of activities in conflict.

The Macquarie Dictionary defines **asymmetric** as 'not symmetrical; without symmetry'. Symmetry is defined as 'the correspondence, in size, form, an arrangement, or parts on opposite sides of a plane, line or point; regularity of form or arrangement with reference to corresponding parts.' US joint doctrine provides an explanation as applicable to warfare as, 'symmetric engagements [are] battles between similar forces where superior correlation of forces and technological advantage are important to ensure victory and minimize losses'. It also states, 'Asymmetric engagements are battles between dissimilar forces'. The US doctrinal explanation implies that asymmetry is largely applicable at the operational level.

Asymmetry is a principle characteristic of irregular warfare. Irregular groups, such as the Taliban in Afghanistan, use asymmetry to avoid the strengths of an opposing conventional force while exploiting its potential vulnerabilities. These asymmetric actions involve the selective use of weapons and tactics to constrain regular military

operations and to counter and defeat an adversary who is numerically and/or technologically superior.

Technological asymmetry is pronounced when a major power is in conflict with a relatively smaller power or an irregular adversary. For example, in the Matabele War (Africa) in 1893-94, in one engagement 50 soldiers of the British colonial forces fought off 5000 local warriors with just four Maxim guns. This was pure technological asymmetry. Asymmetry can also be a product of the cognitive domain. For example, in order to neutralise the superiority of a conventional force, irregular adversaries regularly employ asymmetric tactics. This is highly evident in how irregular forces such as the Taliban have opposed international forces in recent operations in Afghanistan.

Asymmetry was accepted as part of warfare by Sun Tzu around 250 BC. He observed that one engages in battle with the orthodox and 'gains victory through the unorthodox'. Throughout history there have been many examples of 'lesser' adversaries employing asymmetry to compensate for obvious mismatch in their capabilities compared to their opponents. The long history of warfare on the American frontier is but one example, with the Apache Wars in the second half of the 19th century a particular case in point. In the Second South African War (1899-1902), the adoption of guerilla tactics by Boer commandos was a direct and deliberate response to an inability to match the British Army in conventional operations. By this means the Boer defenders, who never exceeded 45 000 at any time, succeeded in resisting an opposing force half a million strong for two and a half years.

The employment of British air power in Iraq during the 1920s to control the local population is a classic example of the use of conventional forces in an asymmetric manner. In modern times, asymmetric tactics have been even more evident. The use of RAAF Lincoln bombers in Malaya to quell a Communist uprising is a good example of the employment of technological asymmetry. On the other hand, the Viet Cong tactics in the Vietnam War is an example of the use of conceptual asymmetry to counter western technological superiority.

The 11 September 2011 attacks on the World Trade Centre and the Pentagon are classic and tangible examples of asymmetry. The scale of destruction of these attacks has raised fears of irregular groups carrying out even more devastating asymmetric attacks using nuclear, biological or chemical weapons of mass destruction.

The Western concept of operations in current conflicts, such as in Afghanistan, is a demonstration of the asymmetric application of air power in combating an irregular adversary. The combination of intelligence, surveillance and reconnaissance (ISR), precision strike, control of the air and air mobility exploiting air power's inherent characteristics of reach, speed, perspective and flexibility provides the coalition forces in Afghanistan with distinct advantages. Air power's ISR capabilities create a particularly strong and effective asymmetric advantage in irregular warfare. Similarly, air mobility provides rapid manoeuvrability that permits the engagement of a ground-based adversary's vulnerabilities at a time and place of one's own choosing. It is no surprise that the Taliban considers air power as a great threat as evidenced by a Taliban Commander's statement: *'Tanks and armour are not a big deal ... The planes are the killers, I can handle anything but the jet fighters.'* Likewise, the Taliban's effective information operations plan developed to discredit allied air power by highlighting collateral damage incidents could be interpreted as a key psychological asymmetric measure to combat the allied air power and technological superiority.

While the current Western experience is associated with operations in Iraq and Afghanistan, other instances of the use of asymmetry in conflict can be identified. For example, the Liberation Tigers of Tamil Eelam demonstrated considerable innovative thought in employing aircraft to strike Sri Lankan military and government infrastructure between 2007 and 2009. Similarly, Ivory Coast military forces sought technological asymmetry by the use of mercenary controlled Israeli Remotely Piloted Aircraft for pre-strike ISR and Belorussian Su-25 for the actual strike missions against internal rebels in 2004.

Few could argue with US Secretary of Defense Gates' statement that 'we can expect that asymmetric warfare will be the mainstay of the contemporary battlefield for some time'. Non-national and trans-national groups are now becoming major players in conflict and the operating environment is becoming increasingly complex and ambiguous. The battlespace is increasingly beyond the borders of a nation-state; indeed, it is increasingly non-physical. The operating environment has become characterised by greater numbers of irregular adversaries seeking increasingly asymmetric advantages. In reality,

however, this is no different to the challenges that previous military forces have faced in all wars. Asymmetry in warfare is, after all, an enduring aspect.

Air Power and Coercive Diplomacy

Key Points

- *Coercive diplomacy is often used in international relations when traditional diplomacy has not achieved the desired results.*
- *Diplomatic coercion seeks to apply only limited force, giving the adversary the ability to choose to alter their behaviour while the damage is limited.*
- *Air power is often the instrument of first choice of coercion, but should not be considered a tool to be used in isolation.*

Diplomacy can be broadly defined as the government level interaction that occurs between official representatives of different states. It is employed in international relations in an effort to maintain amicable relations between countries. When disagreements or points of contention arise between states, 'soft power', in the form of persuasive diplomatic overtures, is generally the first mechanism to be employed in an attempt to achieve a satisfactory resolution.

If subtle diplomatic initiatives do not achieve the desired results, however, recourse to coercion may be considered necessary. To coerce is to achieve compliance by intimidation or appeal to authority, and as a last resort, to compel by threat of force. Coercive diplomacy can thus be considered a tool of 'hard power' and is defined as an attempt to change an entity's behaviour, from an undesired to a desired state, by the threatened use of force. Past experiences, however, demonstrate that the demarcation between the threat of force and the actual application of force is not easily discernable. The actual use of force is initially discrete and increased incrementally, with the scalability and reversibility of the application of force being the key factor to success. Coercive diplomacy gives the adversary the choice between continuing with their current course of action and facing increased application of force as punishment, or complying with the coercer's demands, and having the threat of force removed.

Hard power, applied through military force, is usually the last tool in a range of available options, and is not readily sanctioned or easily

enacted. The use of military force is never without contention, as recent UN Security Council debates over the prospects of international intervention in Libya and Syria attest.

The link between coercive diplomacy and air power may not be readily apparent, but increasingly air power is regarded as an optimal form of engagement in the military sense for two primary reasons. First, it does not normally necessitate a foreign presence in the target country, and the risk of casualties to the coercing force is minimal. Second, the inherent flexibility of air power gives it the ability to scale up or down the responses while continuing to generate the desired effects with precision and discrimination.

For an adversary to be successfully compelled to change their course of action (for example, their invasion of a neighbouring state), or be dissuaded from a contemplated undesirable action (such as the killing of the citizens of that state), they must be convinced that the coercer's threatened use of force is credible. Credibility will be determined both by a demonstrated ability to carry out the threatened action, and critically the intent and will to do so. Without both the clarity of the coercer's intent and an appreciation of the coercer's capability, the adversary may perceive little risk and may not comply with the coercer's demands. Air power has the ability to provide the most vital and credible component of coercive diplomacy: a demonstrated and scalable strike capability.

Contemporary military operations are subject to a number of constraints. Primary amongst these is the need for legitimacy, which can only be achieved through international consensus. Air operations, with their ability to apply precise, proportional and discriminatory force, often provide a more politically palatable option than ground operations that are viewed as less discriminate and more invasive. Avoidance of unintended civilian casualties and damage to civilian infrastructure has become a key tenet in contemporary military endeavours, and precision air power can play a key role in minimising 'collateral damage'.

The international intervention in Libya between March and October 2011 provides the most recent example of an attempt to coerce a leader to alter his undesirable behaviour (in this case the persecution of Libyan citizens), primarily through the use of air power. The NATO intervention was ultimately successful in protecting civilians—

as called for under UN Security Council Resolution 1973—but cannot truly be considered a case of successful coercion, as Muammar Qaddafi did not comply with the UN's demands. Qaddafi did not call on his military and supporters to desist from the oppression and slaughter of Libyan civilians, and the intervention ended with his capture and death at the hands of the Libyan rebels—in other words, regime change. The NATO intervention could only be cited as a success for coercive diplomacy if Qaddafi had chosen to stop his actions while he still had the power to continue to resist the air operations.

A more successful example of the use of air power in a coercive role was the NATO campaign in Kosovo in 1999; where Slobodan Milošević eventually capitulated and was brought to the negotiating table and eventually to the International Criminal Court. However, labelling it as a success is not without contention, as it illustrated the limits of air power in coercive application through its inability to prevent the genocide of Kosovar Albanians taking place on the ground.

The success of coercive air operations in the Balkans in the 1990s resulted in an expectation of the ability of air power to ensure fast and bloodless results. More recent operations, however, have demonstrated that this expectation may be overly optimistic. An air campaign may successfully cause the aggressor to desist from their undesirable behaviour, for fear of further consequences, but this does not necessarily imply that their motivation has changed, nor prevent subsequent undesirable behaviour.

The success of a coercive air campaign on its own may not guarantee a satisfactory end-state to a conflict. The air campaign is normally only one element in the overall military strategy, which may include simultaneous activities such as surface actions or threat of the use of ground forces or the imposition of no-fly zones to deny the adversary access to territory. In addition, concurrent initiatives such as the imposition of economic sanctions and continued diplomatic engagement may also contribute to the conflict's resolution.

There is no single framework or template that can be prescriptively followed to ensure the success of coercive diplomacy, as each situation will have unique circumstances that require a tailored approach. However, irrespective of the mechanism employed, the effect sought is for the adversary to comply with the requested action rather than risk further consequences, including military defeat.

Air power can play a decisive role in diplomatic coercion, but it must be recognised as one of a set of tools to be applied within a broader spectrum of strategy. Similarly, coercive diplomacy itself is but one element of a spectrum of strategies that strives to resolve international issues.

The Air Campaign and the Joint Task Force

Key Points

- *The joint task force is established to harmonise the activities of two or more components in order to achieve a common set of military objectives.*
- *The air campaign is the conduct of air operations to meet JTF objectives.*
- *Air and amphibious elements will form integral parts of future Australian JTFs.*

The security of Australia's national interests rely on gaining and maintaining the freedom to manoeuvre our air, land and maritime forces in places and at times of our choosing and restricting adversaries from doing the same. Through the application of air power, the air campaign provides the joint force with the speed, flexibility, responsiveness, reach and perspective needed to ensure Australia's security.

The ADF is normally employed as a joint task force (JTF) to achieve military objectives through the application or threat of force in support of national policy. JTFs may be called upon to deter or defeat attacks on Australia or its interests, contribute to stability and security in the South Pacific and East Timor, contribute to military contingencies in the Asia-Pacific region, and/or contribute to military contingencies in support of global security.

This range of responsibilities may require a number of JTFs operating in different areas, or theatres, concurrently.

Air power is most effective in meeting the joint force commander's objectives when applied through the conduct of an air campaign. An air campaign can be required to support multiple JTFs; however, the conduct of each air operation is tailored to meet specific joint objectives. In effect the air campaign is the planning, coordination and execution of air component activities within the joint campaign.

The air campaign is the integrated application of the RAAF's air power to create effects that are harmonised with the actions and

effects of the other joint force components to achieve joint campaign objectives. Air campaign planning is synchronised with the land and maritime components' plans to develop an air strategy that identifies air objectives required to achieve the desired joint force outcomes (ends), the effects and tasks to achieve these objectives (ways), and the resources required to conduct the tasks (means).

JTFs vary in size and shape with the force structure determined by the type and scale of conflict. Thus, the character of an air campaign is shaped by the nature of the operation, and thereby the degree to which air power's enduring roles of control of the air, strike, intelligence, surveillance and reconaissance (ISR), and air mobility contribute to the joint campaign.

While no one aspect of the air campaign stands alone, history has consistently demonstrated control of the air is usually essential to gain sea control, undertake land and air manoeuvre, and conduct air activities. However, Australian forces have not been challenged from the air in recent history, leading to an assumption of air superiority leading to operational complacency.

Air power is inherently offensive and is most effective when employed to defeat hostile forces in their bases, in staging areas, or in transit. Striking enemy forces as far away as possible from our own allows room to manoeuvre and achieve JTF objectives.

The air campaign seeks to establish the necessary degree of control of the air through offensive or defensive activities prior to the onset of major land or maritime actions. This is a prerequisite to allow the required freedom of operations to the joint force and could create decisive effects in a dynamic operational environment.

Control of the air can provide a major asymmetrical advantage in most forms of conflict. As evidenced during recent Libyan operations, a well resourced conventional force can be defeated by a small rebel army that has dominant air power on its side.

Alongside control of the air, the air campaign provides JTFs with the ability to reduce an adversary's ability to fight, through air strikes on centres of gravity away form the battlefield or against enemy forces that directly threaten friendly actions.

Success or failure of the JTF can rest on the ability to get the right information and intelligence, to the right people, in the right format, at the right time. Airborne ISR provided through the air campaign can

enable the JTF to operate against an adversary with a definitive decision advantage.

Deploying and sustaining any joint force is a major undertaking in itself, and air mobility, delivered through the air campaign, underpins the manoeuvre capability of the JTF.

Australia's force projection capabilities have been enhanced with the introduction into service of the Landing Ship Dock HMAS *Choules*, and will significant expand with the induction of Landing Helicopter Docks (LHD) HMAS *Canberra* and *Adelaide* in 2014-16. These amphibious ships will have the capacity to deploy and sustain land forces via organic air mobility (helicopters) and landing craft. This enhanced amphibious capability will allow the projection of combat teams (220 personnel), up to a medium-weight battle group (2200 personnel), and their armour, fire support, logistics and battlefield rotary-wing assets. In recent years HMAS *Tobruk*, *Manoora*, and *Kanimbla* have formed the mainstay of Australia's amphibious capability, but the introduction of the LHDs raises our force projection capabilities to a whole new level.

Like the air campaign, the amphibious capability provides the expeditionary force commander with more than a means to move land and mobility elements from one location to another. It provides the mechanism for logistic resupply, command and control, and medical facilities.

The ability to project this power must, in turn, come with the ability to protect it. The Air Warfare Destroyer will provide localised air and sea defence for the modestly protected LHDs. However, in areas that are anything less than permissive, a more robust layered approach to defence may require submarines, frigates, mine counter measures and various ground based ISR and strike aircraft. These assets together may form only a part of a JTF.

The deployment of combat teams as a JTF is not new, but Australia's capacity to project these teams as an integrated element from the sea is a new capability. Thus, the *amphibiousity* of this element of the joint force brings new challenges for an integrated approach to joint operations.

Australia projects military power through the deployment of joint task forces; the air campaign is the JTF's means of delivering the right type of air power, at the right time, at the right place to achieve

the right effect. Like air power, the amphibious element also cannot be considered in isolation; rather it has to be viewed as an essential element of the overall military capability of the JTF.

Air power and Australia's Amphibious Capability

Key Points

- *Air power will have two major contributing roles in Australia's future amphibious capability; force protection and force projection.*
- *Current Australian airfields will enable extensive force projection of air power but securing appropriate forward airfields may be required.*
- *While Air Force's current roles and missions will largely go unchanged, capacity will be a key element in determining the level of air power's contribution to an amphibious task group.*

The introduction into service of the Navy's Landing Helicopter Docks (LHDs), alongside the generation of an Army battle group capable of mounting operations off these amphibious platforms, will fundamentally change Australia's force projection capability. As Chief of Army, Lieutenant General David Morrison said recently, 'it is a capability we have not been able to field since the end of the Second World War'. The Australian Army and Navy are undergoing an organisational and cultural transformation which will allow them to realise the potential of this future amphibious capability.

But what does this mean for the RAAF? Will Australia's approach to air power have to change to enable this evolutionary shift in Australian military capability to occur?

Air power's roles of control of the air, strike, air mobility and intelligence, surveillance, and reconnaissance (ISR) are enduring, however, the shape of these roles has evolved because of ongoing technological advances and the changing face of war. ISR has become more persistent and responsive to the war fighter; while air mobility now has global reach. Precision and standoff inherent in strike puts at risk a greater range of targets across both our maritime and land environment, and unparalleled advances in situational

awareness has increased our ability to obtain and maintain positive control of the air.

The missions conducted to realise these air power roles have also largely gone unchanged through the years and will remain so with the advent of Australia's amphibious capability. Close air support will provide firepower to the landing force troops in contact, counter-air will attain air superiority over the naval task group and ground element, whereas strategic strike and air interdiction will reduce an adversary's ability to threaten the task group. ISR will supply the war fighter with situational awareness, anti-submarine and anti-surface warfare will seek to negate the enemy's maritime abilities, while airlift will insert and sustain follow-on operations.

So, as some of the functions of Australian military power change with the introduction of an amphibious capability, has the role of air power changed?

History has demonstrated that in order to enhance the viability of amphibious operations and reduce the vulnerability of an amphibious force, air power must be integrated into the amphibious capability. Lessons can be drawn from the 1982 Falklands War, where at least eight ships of the Royal Navy were sunk or badly damaged by Argentine air attacks. Amongst these was the MV *Atlantic Conveyor*, a roll-on roll-off ship that was carrying Chinook helicopters, fuel, trucks and other essential elements of the amphibious force. The lack of air cover had serious detrimental impact on the combat power and mobility of the amphibious forces.

Each of Australia's LHDs will be able to carry up to 1000 combat soldiers with all of their weapons, ammunition, vehicles and supplies, along with a mix of MRH-90s, MH-60R Seahawks, Tiger Armed Reconnaissance helicopters and CH-47 Chinooks. Along with the amphibious support vessels and surface combatants, the combined effects this force is capable of creating will have far-reaching strategic influence. However, the loss of any of these vessels would have an enormous strategic impact on Australia that would stretch well beyond the materiel loss. Thus air power will have two major contributing roles in Australia's future amphibious capability; force protection and force projection.

The size and operational importance of an amphibious task force makes it a high-value target for any adversary, thus its protection will

be of paramount importance during its transit and while it is in the area of operation. The degree of force protection required will be dependent on the level of threat and the operational environment.

Force protection will be a jointly delivered effect, enabled by the integration of many elements of the ADF. From RAAF maritime patrol aircraft working with Navy helicopters and surface combatants to protect the task force from any submarine threat, through to the integration of Super Hornets, Wedgetail and surface combatants (and in the future Joint Strike Fighters and Air Warfare Destroyers) undertaking layered defence against enemy maritime forces; the capability to protect the amphibious elements are resident in our current and future force structure.

Equally, the landing force component of the amphibious force, 'the weapon system of the embarked force', will require air power to realise the combat effects they are tasked to deliver. The air power contribution can range from achieving air superiority to counter the threat of air attack, close air support and air interdiction to contain the threat from ground forces, ISR to provide the landing force with situational awareness of their objectives, and electronic warfare to suppress or disrupt the adversary's communications and radar systems. These elements of air power differ little from what could be required by the follow-on land force.

Underpinning this employment of air power will be the missions such as air-to-air refuelling to increase the range and endurance of the majority of our capabilities, Airborne Early Warning and Control to be the 'eyes in the sky' and command the airborne battlespace, air mobility to enhance logistics and deliver the follow-on force, and contributing aero-medical evacuations that are essential in any combat operation.

Essential to the RAAF's employment of air power are airfields. Air-to-air refuelling will extend an aircraft's combat radius, but appropriate forward basing may need to be secured to enable sufficient air power to be projected over the amphibious task group and embarked landing force.

But is having these capabilities sufficient to meet the requirements of our future amphibious force?

To quote the Chief of Army, Lieutenant General Morrison again, 'size does matter', a point echoed by Chief of Air Force, Air Marshal Geoff Brown, on the number of fighter aircraft required to provide

force protection over a desired area. Capability, the ability to do something, is important, but capacity, the amount of what you can do, is the real determinant to achieving both force protection and force projection. The degree of projection and protection is a factor of the number of platforms, range to the objective, required persistence and the threat itself.

Australia's future amphibious force will revolutionise the ADF's force projection capability and Air Force is well positioned, under the current plans for Force 2030, to have the capability and capacity to meet the force projection and protection requirements. Australia's approach to air power may well evolve, but the current roles and missions are sufficiently robust to meet any future challenges.

Air Power Watching Over Australia's Maritime Approaches

Key Points

- *Air power is an essential component of activities to protect Australia's maritime resources, provide maritime security, and defend its maritime approaches.*
- *Since 2001, RAAF aircraft have provided an almost continuous coverage of Australia's northern approaches to monitor those who enter the nation's waters.*
- *RAAF personnel are deployed to Operation Resolute—in the air, on land, and at sea—to provide humanitarian assistance and aid when lives are endangered at sea.*

In April-May 1918, the Department of Defence responded to a flood of alleged sightings of enemy aircraft and ships in Australia's south-eastern sea lanes by ordering the first maritime air patrols in local waters (see *Pathfinder #54*). Since that time, the importance of air power in defending the nation's vast maritime approaches has been recognised. The RAAF deployed maritime patrol aircraft routinely throughout World War II, and then the Cold War, during which they undertook intelligence, surveillance and reconnaissance (ISR) and anti-submarine warfare missions.

As memories of the Cold War started to fade, Australia concentrated more upon its own national security needs, over and above its enduring defence requirements. When the United Nations Convention on the Law of the Sea (UNCLOS) came into force in 1994, Australia became responsible for the management and security of one of the world's largest maritime jurisdictions—over 14 million square kilometres, or almost twice the size of mainland Australia. At that time, the RAAF had the ability to conduct routine maritime patrols, exercises, and special missions 'on demand'; however, the amount of effort required to protect the nation's maritime resources, provide maritime security, and to defend maritime approaches, increased over

time. Missions to enforce UNCLOS spread from a few days into weeks or months. With RAAF resources still allocated at a peacetime level, these ongoing commitments soon brought out issues of capability, sustainment, and crew limitations.

Among the events that challenged Australia's enforcement of its maritime jurisdiction in the decade following the implementation of UNCLOS, and its ability to ensure the security of its maritime approaches, was the unauthorised arrival of people making the long and dangerous journey from mainland Asia by boat to claim political asylum or refugee status. Since the first big influx at the end of the Vietnam War 35 years ago, there have been several waves of 'boat people' seeking to escape conflict in such places as Sri Lanka, Iraq and more recently Afghanistan. To meet this challenge, in 2001 the Australian Government instituted measures to conduct regular, coordinated and systematic searches of the waters off the north and northwest coasts of Australia, to detect, report, and apprehend any illegal activity within the Australian Economic Exclusion Zone (EEZ). The resources of the RAAF and the Royal Australian Navy (RAN), in coordination with other Australian Government agencies, were allocated to what became known within the ADF as Operation *Relex*.

On 30 August 2001 two RAAF AP-3C Orions of No 10 Squadron commenced the first of many thousands of sorties over Australia's northern approaches, followed by aircraft from No 11 Squadron a fortnight later. A standard deployment as part of Operation *Relex* was two to three weeks long and consisted of one AP-3C, with 13 aircrew and 20 maintenance and support personnel (drawn from across No 92 Wing) stationed at RAAF Base Darwin. A second standby crew was ready for operational deployment at RAAF Base Edinburgh. Headquarters Northern Command and No 321 Combat Support Squadron also provided regular support to the high-priority operation. An average sortie would last eight hours, and search an area of about 360 000 square kilometers. Crews completed between four and six sorties a week, during which they searched and identified all contacts within their assigned area and reported any illegal or suspicious activity. When necessary, assistance was also provided to vessels, such as dropping batteries for a sailor's GPS navigation aid or search and rescue activities.

During the first few months of Operation *Relex*, the Orions successfully detected a number of Suspected Illegal Entry Vessels (SIEV) and by December 2001 the unauthorised arrivals had stopped. In March 2002, the operation was resumed. Although renamed *Relex II*, the role remained essentially unchanged. Operation *Relex II* was the ADF contribution to the whole-of-government program 'to detect, intercept and deter vessels transporting unauthorised arrivals from entering Australia through the north-west maritime approaches'. Routine patrols helped to deter the efforts of people smugglers who profited from each boat they sent into Australian waters, and so no SIEVs were detected until July 2003.

The number of unauthorised arrivals has fluctuated considerably since that time, but the need for constant detection and observation has not diminished—rather it has been reaffirmed. Operation Resolute commenced on 17 July 2006, bringing together the entire ADF contribution 'to protect Australia's borders and offshore maritime interests'. It consolidated previous ADF operations including Operations *Relex II* (SIEVs), *Cranberry* (illegal fishing and smuggling), *Celeste* (patrols of Australia's southern ocean), and *Mistral* (patrols protecting Australia's gas and oil infrastructure). Operation *Resolute* continues to this day, as the only ADF operation that currently defends the homeland.

RAAF Orion crews constantly watch and monitor those who enter Australian waters, and by the fifth anniversary of Operation *Resolute* the aircraft involved had notched up about 9000 flying hours. They have conducted long-range surveillance missions within Australia's EEZ, and provided early warning of maritime security threats. It is now 10 years since the first sortie under Operation *Relex*, and it is clear that the need to watch over the maritime approaches is continuous and enduring. The RAAF contribution to Operation *Resolute* is much more than just the aircraft and aircrews. RAAF personnel also serve in the Transit Security Element embarked in RAN patrol boats, supplementing the existing Navy boarding party teams and providing additional security on board apprehended vessels.

In addition, ground and air crew from the RAAF's Air Lift Group have been called in to support activities whenever *Resolute* needs them. In April 2009 this involved the employment of RAAF C-130 Hercules and C-17 Globemaster aircraft, along with aero-medical

health professionals, to assist after an apprehended foreign vessel, SIEV 36, exploded in the vicinity of Ashmore Reef. On 22 August 2011 Leading Aircraftman Thomas Borton and Sergeant Sharon Jager were recognised—alongside Navy and Army colleagues—with a Group Bravery Citation, for their contribution toward rescuing people in the water and on board the burning vessel. Many other RAAF personnel deployed to Operation *Resolute* have become unsung heroes, just by undertaking their daily activities on land, at sea and in the air. They provide humanitarian assistance and aid when lives are endangered at sea. Considering its importance to border protection, maritime air operations will remain a high priority within the RAAF for many years to come.

The Resurgence of the Airship

Key Points

- *Tethered aerostats have proven to be a cost-effective ISR option.*
- *Lighter-than-air vehicles have the potential to become virtual satellites providing ISR and communications.*
- *High-Altitude Long-Endurance airships are likely to become operational in the near future.*

The airship or lighter-than-air vehicle (LAV) was used for intelligence, surveillance and reconnaissance (ISR) purposes as far back as 1794 in France's campaign against Austria. In the early 1900s they were used as long-range bombers and cargo carriers, and even undertook trials for use as aircraft carriers. However, technical issues with materials and a number of unfortunate accidents gradually diminished interest in the LAV and relegated them to mere curiosities by the middle of the 20th Century.

In recent times, there has been increasing interest in airships from military forces wanting long endurance ISR platforms and potential large transport capabilities at relatively low cost. Primarily, the need for persistent ISR platforms that can remain airborne for weeks or even months has been identified by military forces as a critical part of response options in irregular conflict. The basic characteristics of LAVs make them ideally suited for this purpose. The US military is currently exploring the feasibility of fielding airships in Afghanistan to conduct ISR missions.

There are three fundamental characteristics of airships, which are viewed as crucial advantages in the modern battlespace. First, their propulsion requirements are modest in comparison to all other airborne platforms. An airship requires independent propulsion only to overcome the initial inertia during take-off, to facilitate staying on station during a mission, and to assist in landing by overcoming the platform's inherent buoyancy. Second, LAVs can stay aloft expending very minimal fuel for long periods of time, and also reach extremely high altitudes. In combination, this offers the potential for these

vehicles to operate for extended periods as virtual satellites conducting ISR and being effective communication hubs.

Third, the inherent buoyancy of the platform completely alters the basic power-lift equation of aerodynamics in an airborne vehicle. This allows an airship to lift a given payload to a prescribed altitude in a far more cost-effective manner in comparison to a conventional heavier-than-air aerial vehicle. Further, natural buoyancy also permits LAVs to overcome the limitations of endurance that restrict normal fuel consuming aerial vehicles, thereby increasing persistence. This is a distinct advantage in conflict situations requiring very long-term surveillance of the battlespace.

Developments are also taking place that could further increase the endurance and persistence of airships. The design of airships provides them with large surface areas. These surface areas enable the accommodation of photo-electric cells in sufficient quantity to produce electrical power from sunlight at very high altitudes. This could make the airship almost self-sufficient in meeting its power requirements for station keeping as well as for the functioning of its operational payload.

Early airships developed a reputation for being dangerous fire hazards because of the use of volatile hydrogen to achieve the necessary buoyancy to stay airborne. This had made the survivability of an airship in the battlespace questionable. Modern LAVs use inert helium that almost completely rules out the fire hazard. In fact, trials have shown that they are able to absorb considerable ground fire and yet remain airborne for long periods, making them relatively invulnerable to battle damage. This is predicated not only on helium being an inert gas, but also because it is held at extremely low pressures in the envelope making any leakage and deflation a slow process. Airship trials have repeatedly proven that it is able to absorb damage and fly out of harm's way even as the gas gradually leaks out, reducing its buoyancy.

A modern LAV has another survivability feature that is important in the modern battlespace. Despite having a large visual signature, LAVs are surprisingly stealthy. Their all-composite and advanced fabric hulls and control surfaces are almost invisible to radar and the control cabins have a reduced radar cross section through the use of shaping techniques. Low radar, acoustic and infra-red signatures make airships very survivable even in battlespaces where there is a high density of enemy search and track capabilities.

Although LAVs have advantages when employed in some dedicated roles, they also have certain inherent limitations that could diminish their operational effectiveness. Of necessity, LAVs are large in size. While an advantage in terms of survivability and performance at high operating altitudes, it becomes a liability when they are on or close to the ground. They become vulnerable to weather effects and are also prominent targets for concentrated surface or counter air attacks.

Even though external propulsion requirements are minimal, certain technical challenges and issues regarding the engines have still not been fully mitigated. The engines of an airship have to be able to operate at unusually high altitudes for extended periods of time. Further, they also have to be able to run efficiently for long periods of low-power operations—typical of optimum LAV employment. Conventional engines face challenges in ensuring adequacy of lubrication over extended operations. Electrical motors are increasingly viewed as becoming vital features of airship propulsion.

An older application of airships, the Tethered Aerostat Radar System (TARS), has been in operation with the US Air Force for more than two decades. The data available from these operations provide an indication of the potential of LAVs. The operating cost of TARS in comparison to the same surveillance being provided by a US Customs P-3 airborne early warning and control aircraft has been estimated as less than 10 per cent (approximately US$300 as against US$3500 per hour of operation). Further, this does not take into account the disparity in acquisition costs—around US$22 million for an aerostat based system and US$37 million for a P-3 in the 1992 timeframe.

In 2011, the US will evaluate the High-Altitude Long-Endurance Demonstrator that promises to be the first high-altitude airship that will fill the role of a virtual satellite. This LAV will be able to lift a 23 kg payload to 60 000 ft and stay on station for at least 15 days.

While it is still early days in the operational deployment of free moving LAVs, it is not difficult to envisage the advantages that will come with the maturation of these concepts and supporting designs. In the long duration irregular conflicts that seem to be the contemporary norm, ISR is critical to success. The LAVs will be able to provide a cost-effective and affordable solution to the challenge of providing actionable intelligence derived through their capacity for persistent surveillance.

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The Flight of Zeppelin L.59

In November 1917, the German naval airship L.59 departed from Jamboli, Bulgaria, on a mission to German East Africa (now Tanzania) carrying 50 tonnes of urgently needed supplies—weapons, ammunition, food and medicine—for the colony's military garrison. Because it would be impossible to resupply the airship with hydrogen gas at its destination, the journey was intended to be one-way only. Events in East Africa caused the voyage to be aborted on 23 November, while the L.59 was 200 kms due west of Khartoum, Sudan. The airship arrived back at base two days later, having covered 6800 kms in 95 hours—a record not surpassed for many years.

Five Generations of Jet Fighter Aircraft

Key Points

- *Jet fighter aircraft generations clarify the quantum improvements in operational performance brought about by technological innovation.*
- *The concept of a half generation (4.5 generation) stemmed from a forced reduction in military budgets.*
- *Fifth generation aircraft create decision superiority leading to battlespace dominance.*

The notion of aircraft generations, a term that applies to jet rather than propeller driven fighter aircraft, appeared in the 1990s and attempted to make sense of the leap-frogging improvements in performance to jet fighter aircraft brought about through major advances in aircraft design, avionics, and weapon systems. While the rationale that constitutes a generational shift is debatable, a generational shift in jet fighter aircraft occurs when a technological innovation cannot be incorporated into an existing aircraft through upgrades and retrospective fit-outs.

First generation subsonic jet fighters (mid 1940s to mid 1950s). The first generation of jet fighters such as the F-86, MiG-15 and MiG-17, had basic avionic systems with no radars or self-protection countermeasures, and were armed with machine guns or cannons, as well as unguided bombs and rockets. A common characteristic of this generation of fighter was that the jet engines did not have afterburners and the aircraft operated in the subsonic regime.

Second generation jet fighters (mid-1950s to early 1960s). The second generation fighters saw the introduction of air-to-air radar, infrared and semi-active guided missiles, as well as radar warning receivers into such aircraft as the F-104, F-5, MiG-19 and MiG-21. This generation's fighters also incorporated advances in engine design and aerodynamics, which allowed them to reach and sustain supersonic speeds in level flight. During this period, although air-to-air combat

was still within visual range, radar-guided missiles started to extend engagement ranges.

Third generation jet fighters (early 1960s to 1970). This generation witnessed improvements in manoeuvrability, and significant enhancements to the avionic suites and weapon systems. They were also the first cadre of multi-role fighters such as the MiG-23, F-4, and Mirage III. Doppler radar supported a 'look-down/shoot-down' capability, and with off-bore-sight targeting and semi-active guided radio frequency missiles like the AIM-7 Sparrow and AA-7 Apex, aerial engagements moved to beyond visual range. The major change brought about by this generation aircraft was that it was no longer necessary to visually acquire opponents to neutralise them and gain control of the air.

Fourth generation jet fighters (1970 to late 1980s). Through the 1970s and 80s the trend of improvement in avionics such as head-up displays and optimised aerodynamic design continued with the development of 'fly-by-wire' fighters such as the MiG-29, Su-27, F/A-18, F-15, F-16, and Mirage-2000. Most of this generation of fighters had the ability to both switch and swing roles between air-to-air and air-to-ground, as opposed to the previous role-dedicated aircraft. This in turn blurred the distinction between control of the air and strike missions.

Four and half generation jet fighters (late 1980s and into the 90s). The concept of having a half generation increment stemmed from a forced reduction in military spending, which resulted in a restriction in aircraft development. It became more cost-effective to add 'stealth', radar absorbent materials, thrust vector controlled engines, greater weapons carriage capacity and to extend the range of fourth generation fighters, such as the Hornet, Eagle and Flanker, than to design new aircraft. The F/A-18E/F Super Hornet is an example of a 4.5 generation fighter evolved from a fourth generation aircraft. The addition of an Active Electronically Scanned Array (AESA) radar was a significant enough game-changing combat capability for these redesigned fighters to be deemed a generation of their own, hence the generation 4.5 rating. Some manufacturers designed new platforms, such as the Eurofighter Typhoon, Saab JAS 39 Gripen and Dassault Rafale, which incorporate many of the generation 4.5 advanced characteristics. Advances in computer technology and data links also allowed 4.5 generation fighters

to be integrated into a network centric battlespace where fighter aircraft have much greater scope to conduct multi-role missions. As an example, the AESA radar allows fighter aircraft to perform a limited Airborne Early Warning and Control function.

Fifth generation jet fighters (2005 to date). The F-22 Raptor, introduced in 2005, is considered the next generation fighter aircraft. Soon to follow are aircraft designs like the F35-Joint Strike Fighter, the Sukhoi PAK FA (and the planned joint Russian/India variant) as well as the Chinese Chengdu J-20 which is believed to reflect features of this generation of fighter. A quantum improvement in the fighter's lethality and survivability has been a qualifying requirement to achieve generational change and the fifth generation fighters personify these traits. The advances over earlier generational fighters include nose-to-tail low observable or stealth technologies as part of the aircraft's design that make it almost impossible for even other generation five fighters to detect them; improved situational awareness through having multi-spectral sensors located across all aspects of the airframe which allows the pilot to 'look' through the airframe of the aircraft without having to manoeuvre the fighter to obtain a 360 degree picture which in turn, enhances the aircraft's ability to use its suite of weapons to engage and neutralise an adversary without the adversary even being aware of the threat. These aircraft are also 'born' networked which allows them to receive, share and store information to enhance the battlespace picture. Fifth generation fighter capabilities are largely defined by their software and it will be the ongoing development of their software that will ensure they maintain their edge against evolving threats. The F-35 has more software than any other air combat aircraft, with 7 million lines of code in the aircraft, and a further 7 million lines of code in the supporting ground systems. An example of the complexity and sophistication of the F-35 software is that it uses about 100 times the number of parameters than a fourth generation fighter does to define a potential threat.

Ultimately, a fifth generation aircraft allows the pilot to maintain decision superiority over an adversary. This provides greater chances of survivability, which when combined with effective lethality, assures battlespace dominance.

Facets of Air Power: An Element of National Power

Key Points

- *Air power can enhance or be the lead agency in applying a strategy of deterrence.*
- *It is effective in implementing a coercive strategy if and when necessary.*
- *National air power is the ability of a nation to assert its will through the medium of the air.*

The term 'air power' was first used by H. G. Wells in 1908 in his novel *The War in the Air*. However, it became common usage only in the 1920s after air power had been extensively used as a military capability during World War I. At that time it was generally accepted that understanding air power theory was a complex issue and its optimum application even more so. Even now, although air power has matured into an indispensable military force within a single century, the complexity in its employment is profound. Air power has now become integral to the conduct of modern warfare and in certain instances in the recent past the central element in conflict. Therefore, a clear understanding of its employment and the effects it can create is necessary at the strategic level of national security.

Air power encompasses all the uses of aviation and related capabilities in the pursuit of the security interests of a state, and in some cases non-state entities. Although air power is primarily considered an instrument of national military power, under certain conditions it transcends the purely military realm and affects national security directly. In these cases it becomes an element of national power *per se*. As a corollary, a number of non-military factors within the nation influence the development of air power capabilities. In this context, some of the broader considerations that have a salutary impact on a nation's air power are national technology base, sociological dimensions, economic considerations and cultural orientation of the population. All of these factors significantly affect a nation's ability to generate, employ and sustain air power.

The military and foreign policies of a nation, in combination with its intelligence and other policies, support the national security policy. These policies provide the means to seek an end that secures the nation. The primary concern should always be to deter all potential adversaries and if that fails, to be able to fight and win the ensuing war. Air power provides two fundamental inputs to this broader national security equation, over and above its principle use as a military force in conflict. First, it can support or assume a lead role in enhancing the deterrent posture of the nation. Second, air power can be very effective when employed in a coercive role.

In its simplest form deterrence aims to prevent someone from doing something that is contrary to one's own inclinations. From a national security perspective, deterrence starts with attempts to avoid conflict through the employment of appropriate elements of national power and further steps that provide graduated responses to emerging situations. A nation that adopts a strategy of deterrence must ensure that its response capabilities, in case of attack, are extremely robust and demonstrated, and that potential adversaries perceive them as such. This must be reinforced by the national will to employ the forces available.

In a deterrent role air power encompasses the four cardinal principles on which a strategy of deterrence is based—intelligence, credibility, perception and applicability. Airborne intelligence, surveillance and reconnaissance capabilities provide major inputs to the enforcement of a deterrent strategy by collecting and disseminating timely and accurate intelligence on adversary manoeuvre and capability. Credibility of a strategy of deterrence is dependent on the adversary being convinced that they will be attacked if actions inimical to the state are initiated. Air power's ability to carryout lethal attacks with precision, discrimination and proportionality directly reinforces this credibility.

Deterrence is a matter of perception. Air power incorporates the ability to detect, deter and defeat adversaries and these same attributes can be tailored to emphasise the deterrent capabilities of the nation. Further, they can also be employed to alter the perceptions of the adversary through both kinetic and non-kinetic operations better than many other types of military forces and thereby uphold the strategy of deterrence. In fact non-kinetic actions that indicate to the adversary

that their centres of gravity and value systems have been identified and can be targeted at will are potent tools of deterrence. Applicability of deterrence is dependent on the quantum of influence that a state can bring to bear on an adversary. Sustained operations, with the inherent risk of high casualty levels, will detract from the effectiveness of deterrence.

While deterrence aims to avoid the use of force, coercion requires the ability to achieve a systematic and escalating level of destruction, if required, of the adversary's warfighting capabilities and other centres of gravity. In other words the necessity is to compel the adversary to accept the demands placed on them. Air power could achieve this through graduated non-kinetic action, such as show of force, although the success rate of these operations may not be high. However, the concept of coercion through the application of force is particularly suited to the employment of air power because of its inherent ability to carryout precision strikes against high-value targets.

The application of lethal force has become a last resort in the current global security environment. Accordingly, deterrence and coercive strategies, based primarily on non-kinetic actions, have become more predominant and acceptable. These strategies have also become heavily dependent on influencing and shaping the environment rather than adopting a more belligerent posture. Air power comes into its own in these circumstances through the delivery of humanitarian aid in a responsive manner and by demonstrating the nation's innate ability to secure its interests. While these actions contribute directly to achieving national objectives and indirectly to national security, they have to be clearly underpinned by the ability to respond rapidly with force when necessary. Therefore, in order to be effective, air forces need to be flexible and retain a balanced force that can create the necessary effects across the full spectrum of conflict.

Under these circumstances, air power can be considered an element of national power. National air power therefore could be defined as the ability of a nation to assert its will through the medium of the air. This is a broad and overarching definition but provides an insight into the capacity of holistic air power to influence national security imperatives.

Facets of Air Power: Control of the Air

Key Points

- *Control of the air is a prerequisite for the success of all joint operations.*
- *For a long period of time Western forces have been assured of adequate control of the air in their operations.*
- *Surface forces have to be cognisant of the need to conduct a control of the air campaign within a joint campaign.*

The demonstrated impact of airborne intelligence, surveillance and reconnaissance on surface battles during World War I, led to control of the air becoming a fundamental requirement to ensure freedom of action. However, the theories developed during the inter-war period concentrated on the offensive strike capabilities of air power to defeat the opposing air force on the ground and thereby gain control of the air rather than having to fight for it in the air. Further, the importance of ensuring that one's own operations could be conducted without enemy interference from the air was diluted in the theories that proposed defeat of the adversary through air attacks aimed at breaking the will of the people.

The practical experience in the beginning of World War II however, demanded a rethink regarding the importance of the freedom of manoeuvre of one's own forces—both in the air and on the surface. This realisation was further advanced by the technology facilitated improvements in aircraft performance and its war making potential. While the concept of control of the air had always been understood, these improvements made it a defining role and a doctrinal tenet for air forces. So what does control of the air entail?

In a very broad manner, control of the air can be defined as the ability to conduct friendly operations in all three dimensions without effective interference from enemy air power. The corollary is that such control must also be able to ensure that one's own air forces must be able to prevent the adversary from undertaking effective operations in

any of the three dimensions. This corollary stems from the fact that, in general terms, only an air force can neutralise another air force while air power, under certain conditions, can defeat surface power and can even be used as a substitute.

In the context of joint operations, control of the air provides commanders with the flexibility to exploit the air environment and conduct effective surface operations at a time and place that is optimal to the achievement of campaign objectives. It must be kept in mind that gaining control of the air will not generally be the ultimate objective in a joint campaign and neither does it guarantee the success of other operations. However, it is the primary prerequisite for the success of all other operations to achieve campaign objectives. In situations where the adversary has even limited credible air power capabilities, this requirement is greatly emphasised and ignored only at the peril to one's own forces. An adversary who can pose a credible air threat that cannot be overcome by friendly air power will almost always be able to preclude the conduct of friendly air and surface activities.

The level of control of the air varies with a number of factors, the main one being the adversary's ability to contest it. There are five levels in understanding control of the air, three of which indicate positive control. First, air supremacy, which is that degree of control wherein the opposing force is incapable of any interference from the air. Second, air superiority, which is that level of control over the air domain that permits friendly land, sea and air forces to operate without effective interference by the adversary's air power for the required period of time and necessary space. Third, a favourable air situation, which is said to exist when the effort by an enemy's air power is insufficient to prejudice the success of one's own land, sea and air operations for a specified and delineated period of time and demarcated space. The two levels below this do not provide positive control of the air—air parity where either side could potentially gain control of the air and an unfavourable air situation where the adversary has better control than one's own forces. Both these levels could result in the chances of a successful joint campaign being jeopardised.

Control of the air entails air power assets being employed to defeat an adversary's air power capabilities while simultaneously conducting other operations that contribute directly to the surface campaign. For almost 60 years—with the exception of the Falklands conflict and the

1973 Arab-Israeli conflict—Western air forces have not had to conduct a serious campaign to obtain control of the air. In fact, it has been a long time since a Western army has been attacked from the air in any significant way. The trend in contemporary conflicts, wherein the adversary is most likely to be irregular in nature with almost no air power and very limited surface to air capabilities, indicates that this situation is likely to continue. This state of affairs has brought about a sense of complacency—an attitude of taking it for granted—within the Western military forces regarding the need to ensure control of the air. This is a serious flaw in the broader military thinking that can distort not only concepts of operations, but also force structure development.

Air power capability development has brought about a subtle change to the way in which air operations are conducted and the manner in which control of the air can be viewed. Control of the air is the primary prerequisite for all operations—air and surface—to succeed. However, enhanced capabilities in its core and enabling functions now permit air forces to operate mission packages that are capable of fighting their way in to attack targets and then effectively fighting their way out, while limiting attrition to acceptable limits. In other words, capable air forces can now ensure adequate control of the air as and when required to conduct air operations. The success of a joint campaign is still predicated on the ability of the air force to control the air in a sufficiently extended period of time and space and is therefore a critical part of the air campaign. Effective control of the ground is only possible with positive control of the air. In effect, control of the air for a prolonged duration is now perhaps comparatively more important for the success of surface operations.

A nation uses all elements of national power to achieve its national objectives. The efficacy of such employment of national power elements is directly dependent on the environment being safe and secure for them to operate without hindrance. Adequate level of control of the air is the fundamental requirement for this to happen efficiently. Air forces therefore, must retain the ability to achieve the necessary level of control of the air, failing which the assured achievement of national objectives may be in doubt. Contemporary conflict scenarios—wherein control of the air is not effectively contested—are not fully indicative of the future. A nation will be ill-served by an air force and a defence force that assumes this to be the case. Complacency in military thinking

of control of the air being an expected right rather than a privilege that has to be fought for and won does not serve one's own national strategic interests.

Facets of Air Power: Employment in Urban Conflicts

Key Points

- *The urban operating environment poses unique challenges to conventional military forces.*
- *Air power can mitigate a number of issues that may otherwise become insurmountable.*
- *In a seamless approach to conflict in urban areas, air power is a key element in the integration of all force elements.*

The character and conduct of conflict have changed significantly over the past few decades. This has been primarily the result of an evolutionary change in the understanding of the concept of national security that in turn has altered the perception of current threats and challenges. Today, the occurrence of conventional conflicts—state-on-state, military fighting military using conventional weapons to achieve national objectives—is increasingly rare. Instead, armed conflicts that pit state forces against irregular adversaries pursuing a plethora of objectives—most of them not linked to the notion of national security, using asymmetric operational tactics and not bound by the Laws of Armed Conflict—are now common place. The RAAF understands such conflicts as *irregular warfare*. This shift has also resulted in most of the contemporary conflicts being initiated and conducted in urban areas where the terrain is more advantageous to small groups of irregular forces than to modern conventional military forces.

The urban operating environment poses a number of challenges to conventional military forces such as the difficulty in distinguishing combatants and civilians and avoiding collateral damage. Inherent air power characteristics and capabilities can be selectively optimised and employed to mitigate many of these issues.

First, urban conflict normally occurs as a result of intervention requiring the deployment of external forces, the legitimacy of which will always be questioned at the global and ideological level. Prolonged

presence of foreign troops in disputed areas usually leads to resentment from the local population who view them as occupying forces. The reach and penetration capabilities of air power can overcome these challenges by operating from bases that are not in contested territory. While troops on the ground may almost always be required, the numbers and duration can be minimised by using air power. Further, the use of air power will diminish the probability of mission creep since it leaves only a small and transient footprint. In the contemporary international politico-security scenario, air power provides a more acceptable solution to this vexed problem.

Second, adversaries operating in small and diffused groups require a much larger number of troops on the ground to contain them. Effective employment of airborne intelligence, surveillance and reconnaissance (ISR) capabilities makes the task of monitoring the activities of these dispersed groups comparatively easier. In fact the high endurance of airborne ISR assets and their relatively unobtrusive nature along with their ability to rapidly identify and fix both stationary and moving targets are key ingredients to success in urban operations. Airborne ISR is also critical to coordinating surface operations that may otherwise become disjointed because of the complex terrain encountered in urban conflicts.

Third, the necessity to minimise collateral damage sometimes negates the use of a surface force's organic firepower in the urban environment. Modern air power has unique strike capabilities that can be leveraged to meet the stringent demands of the accurate placement of weapons in urban areas. All modern conflicts demand precision, proportionality and discrimination in the application of force. This is particularly important in urban conflict where the risk of collateral damage and unintended consequences increases. Air power can carry out such precision strikes by combining its inherently broad perspective with its ability to carry out ISR using airborne platforms that have reach and persistence. A combination of long duration ISR and time-sensitive targeting is a lethal mix that can negate many of the asymmetric advantages that an irregular adversary might gain through movement and concealment in urban areas. Essentially, air power provides a 'bird's eye view' where it is possible to see, understand and strike precisely and rapidly from the air. The integration of air power's kinetic and non-kinetic capabilities permits immense flexibility in

conflict and provides for very rapid transition from benign to lethal operations.

Fourth, the ability to carry out long-range but swift strikes makes air power an important strategic deterrent. A combination of advanced technology, innovative operating concepts and closely coordinated ISR activities gives air strike a unique ability to achieve very high levels of strategic influence with relatively minimal effort. In urban conflict this could be leveraged to achieve the desired end-state even before ground forces are deployed. This takes on added importance considering that the urban battlespace poses a number of problems for surface operations.

In conflicts in urban environments, air power can take on another unique role—air control. Air control is the ability to control surface operations through the employment of air power. Air power can effectively cordon off a delineated operating area to deny irregular adversaries external support, both in resources and personnel through anti-infiltration and curfew enforcement activities. Since urban conflicts are mostly irregular in nature, non-kinetic options, such as information operations and show of force, take on added importance.

The evolutionary process of understanding the threat, both strategic and operational, and refining and adapting concepts and technology to counter it underpins operational success in urban areas. Air power can achieve a blend of persistence, precision and minimal presence at a rapid rate making it a decisive capability in low-intensity, irregular and urban conflicts in a contextual manner. Effective integration within the joint force enables air power to relieve the ground forces of some of the warfighting requirements. Close-in employment of air power in urban areas has the potential to challenge the traditional notion of the primacy of ground combat. However, this should not be viewed as air power assuming the prime role in urban conflicts. A truly joint force will be able to seamlessly integrate the unique advantages of all of its elements to ensure that the force as a whole is successful. The innovative employment of air power is the key to achieve this.

Facets of Air Power: Strike

Key Points

- *Strike is now understood more in terms of the effects it creates rather than within the traditional distinctions of range and nature of target.*
- *Technology is a critical enabler in making air strikes precise, proportionate and discriminate.*
- *Air campaigns can now be conducted to simultaneously achieve strategic as well as tactical objectives.*

The potential of air power to readily overcome geographic barriers, transcend borders and attack surface targets deep inside enemy territory was conceptually recognised almost from the beginning of military aviation. However, it took a great deal of time, technological innovation and procedural maturity to turn the concept into reality. Arguably World War II saw the extensive use of air strike as a decisive capability and its ascendance as a primary air power role. The advent of advanced bombsights, radar-guidance and precision guided munitions increased the accuracy, effectiveness and economy of effort of air strike amplifying its importance as a crucial military capability.

Traditionally, strike has been divided into strategic and tactical, a division based on the nature of the target being attacked and the impact of its destruction on the war or battle being fought. Strategic strikes were ones that attacked the adversary's war-making potential deep inside enemy territory and did not have an immediate effect on the conduct of the war, while tactical strikes were normally carried out on targets on or near the battlefield with their destruction having an almost immediate impact on the outcome of the battle. Within this construct, strikes were further divided into convenient groupings—strategic strikes, interdiction and close air support—which is relevant even today. Interdiction is carried out to divert, disrupt, delay or destroy the adversary's military potential before it can be employed against one's own forces, whereas close air support is conducted against an enemy who is in close proximity or in actual contact with friendly forces. Further, strikes can also be conducted against maritime targets through

the conduct of strategic strike, interdiction, anti-submarine and anti-surface warfare strikes.

Typically exhibiting the complexity of air operations, strike also contributes to obtaining control of the air. Termed 'offensive counter air', it is aimed at destroying enemy air power capabilities on the ground, before they can be brought to bear against friendly forces. A classic example of such strikes being able to obtain almost complete control of the air is the pre-emptive strikes that Israel carried out in 1967, which destroyed the Arab air forces' ability to operate effectively for the duration of the war that followed and permitted uninhibited freedom of manoeuvre for Israel's forces.

In recent times, the demarcation between the different types of air strikes has become diffused and they are now considered as a single entity—strike. There are three primary reasons for this development. One, the conduct and characteristics of armed conflict have evolved over a period of time. Today a single target could be the critical centre of gravity, the destruction of which the adversary may not be able to absorb. Secondly, technology now permits air strikes to be proportionate, discriminate and precise to an extent where there is only minimal possibility of error. Thirdly, the prevailing international politico-strategic environment makes it difficult for even a stabilising military force to occupy territory, albeit for a short period of time. Therefore, the use or threat of air strikes to deter is considered a viable option. Further, in contemporary conflict, air strikes are now not only considered a necessity but in a majority of cases, the weapon of first choice. In these conditions, the traditional division of strategic and tactical strike is no longer valid. Every single strike now has the potential to create strategic effects.

While the changes in the conduct and characteristics of war are overarching elements in making strike a crucial element of the offensive air capability, it is technology that has given it the primacy that it now enjoys. Air to surface weapons now have some inherent characteristics that were unheard of even a few decades ago, and which make them extremely effective. The trend is for them to become even more lethal and precise.

Strike weapons have now become truly all-weather and can retain the necessary navigation and terminal accuracy necessary for them to be used in adverse weather and at night. This effectively denies the

adversary the traditional sanctuaries of weather and darkness. Their increased precision and the development of variable yield warheads minimise collateral damage, while the reduced size and weight of the weapon and the increase in load-out capability makes it possible for a single platform to carry multiple weapons. This facilitates the prosecution of multiple targets in the same mission, acting as a force multiplier and increasing the efficiency of the system.

Air to surface weapons now have extended range, making it easier to avoid heavily defended targets and reducing the risk to the launch platform. This reduces attrition risk, which is a primary consideration in most military forces. The extended range provides the ability to reach out and strike the enemy without being threatened, which is a powerful deterrent on potential adversaries. It also permits a single platform to cover a larger area of the battlefield if the launch aircraft is adequately linked to the air battle management assets. The improved tracking ability of strike weapons gives them improved mobile target kill probability. In contemporary conflicts where many targets are mobile and provide only fleeting opportunities to be attacked, this ability could be the difference between operational success and failure.

Current weapons have configurable warheads and therefore have increased flexibility in their employment. It also becomes easier to match weapons to targets, which in turn ensures increased lethality and the ability to achieve the desired effect while minimising collateral damage. Perhaps the most significant improvement in strike capabilities have come about because of the improvements in launch aircraft capabilities that permit enhanced connectivity between the platform, command and control nodes and intelligence, surveillance and reconnaisance (ISR) capabilities. This creates the capability for the weapons to be retargeted, weapon tracking in flight and, if required, the ability to abort a strike even after weapon launch. Improved communications between all mission elements reduces the kill-chain timeline, enabling real-time re-attack tasking as required. Integration of precision guided munitions with real-time command and control and ISR provides greatly enhanced strike accuracy and effectiveness.

Air strikes now meet the universal requirement for attacks to be precise, proportionate and discriminatory while being able to threaten an adversary's strategic infrastructure simultaneously. The enhanced strike capabilities permit the conduct of air campaigns,

focused on neutralising enemy 'target systems' and centres of gravity to achieve strategic objectives from the beginning of the campaign, while simultaneously contributing effectively to the surface campaign. Air strikes have now evolved into being a primary choice for offensive action in a campaign.

Facets of Air Power: A Balanced Air Force

Key Points

- *A balanced air force must be able to carry out the four fundamental roles of air power.*
- *Sustaining a balanced air force is resource intensive.*
- *National security is dependent on a credible defence force within which a balanced air force is a critical element.*

Conventional wisdom is that an air force of calibre must be inherently balanced, meaning that it will be the repository of all air power capabilities in order to carry out its mandated function. In other words, it must have a sufficient balance of air power capabilities resident within it. The term 'balanced' is now almost common usage in contemporary discussions of air power capabilities. So what exactly does a balanced air force mean?

Air forces have traditionally been platform and system-centric organisations, measuring their competence in terms of the number of aircraft that could be fielded as demonstration of their capability. However, in the contemporary information age, with the increasing sophistication in the concepts of operation, facilitated by technology-enabled application of air power, this measure is no longer indicative of the actual capability of a force. The effectiveness of a force is now measured in terms of the effects that it can create through the synchronisation and synergistic application of its capabilities of the required quality, in adequate quantity, and in the appropriate mix. The efficiency of such application is dependent on the force being able to employ the inherent advantageous characteristics of air power in such a way as to mitigate the limitations. It is in this context that the need for balanced air power becomes critical.

A balanced air force must be able to carry out four fundamental roles. First, it must obtain and maintain control of the air, delineated in terms of a predetermined quantum of time and space. The ability to do this is paramount to being balanced. The level of control of the air

could vary vastly—from parity to supremacy. However, a balanced air force should normally create the minimum necessary control of the air for other operations to be conducted in a relatively safe manner, even if opposed by an equally competent air force. Another aspect of control of the air is that it is the product of the synergistic application of the other primary roles of airpower. This means that, in a cyclical manner, achieving adequate control of the air will require the air force to be balanced.

Second, a balanced air force should be capable of carrying out strike at all levels of war. The distinctions between strategic and tactical strike have blurred in the recent past. Even then, a balanced air force must have the capability to strike with reasonable assurance of success at the centres of gravity of the adversary, exercising the inherent characteristics of reach and penetration. These centres of gravity could be the fielded forces, maritime force elements or national infrastructure. Further, a balanced strike capability should encompass the ability to do so with precision, discrimination and proportionality. In today's terms this entails the possession of precision guided munitions and the associated systems necessary to wield them effectively. Strike capability is one of the distinguishing elements between military and civil air power capabilities. Therefore, an air force without adequate strike capabilities cannot be considered balanced.

Air mobility is a unique capability of air power, one that is used by governments to meet a number of challenges. An air force needs to have air mobility, spread sufficiently between large, medium and small airlift capabilities to be considered balanced. Air mobility is a term that encompasses general airlift, aeromedical evacuation, search and rescue, air-to-air refuelling, as well as specialist capabilities such as airborne operations and Special Forces insertion and extraction. While having the spread of capabilities is important, it is critical for a balanced air force to provide the flexibility for rapid deployment of a minimum amount of forces sufficiently removed from home base. The size of the force to be deployed and the distances involved would be a function of the national security policy and the posture developed from it.

Fourth, it must maintain the ability to gather, analyse and distribute information and intelligence in a timely manner. In an air force this function comes under the aegis of intelligence, surveillance and reconnaissance (ISR). The ISR capabilities of an air force must have

the minimum capacity to provide adequately analysed and high fidelity information to all who require it with minimal time delay. Airborne ISR capabilities have improved incrementally in the past few decades and now have the capacity to carryout observation continuously for extended periods. To optimise the use of this capability an air force needs a robust command and control network and a number of associated high-technology systems that are integrated. The ability to provide the right information to the right person at the right time and location is a primary requirement for a balanced force. Further, in a dynamic combat situation, requirements of timeliness and accuracy of information may be conflicting. The ISR capabilities of a balanced air force must be able to meet this challenging demand.

In addition to the four primary roles already stated, there are a number of secondary enablers that also have to be integrated into the functioning of the air force. A balanced air force therefore is a complex organisation that requires significant resources to be dedicated to it. Since air power capabilities are technology-enabled, the training required to achieve a minimum acceptable level of competence is complex and lengthy. Further, sustaining the necessary quantum of air power, both in relative peace and conflict, requires substantial resources to be made available. This may not always be within the reach of all nations and therefore, there are now only a limited number of balanced air forces world-wide.

There are two overriding facts that must be considered whenever the issue of a balanced air force is discussed. First, a balanced air force does not mean a large air force. Even a small air force can be balanced and the numerical size of the force will be dependent on the threat perception and other broader security issues within the overarching geo-political environment. Second, is more nuanced and establishes the need for a balanced air force. It is now an accepted belief that wars can only be won by a joint force and that single Services do not win campaigns or wars by themselves. Therefore, the national requirement would be to have a balanced defence force that can achieve the desired objectives. For a defence force to be credible it will always be necessary to have a balanced air force as an integral element within it. A balanced air force is critical to national security.

Facets of Air Power: Generating and Sustaining Air Power

Key Points

- *Generating air power is a function of the national government and air force in equal measure.*
- *A robust national technology and industrial base is a prerequisite to generate air power of calibre.*
- *Sustaining the application of air power must be carefully factored in the planning stage of a campaign itself.*

Each element of national power must have a source from which it is derived and generated to a desired level. This is true of national military power, and within it air power, that also requires a founding source for it to be generated. The sources from which air power is generated can be divided into two categories—one, the national infrastructure necessary to develop air power and two, the elements resident in an air force, which are critical to generating air power of the required quality. Intimately connected to the capacity to generate air power is the capability to sustain it at a desired level and for the time required. Generation and sustainment are two sides of the same coin and one without the other will not serve the purpose for which air forces are created—underpinning national security.

There are two primary factors within the national infrastructure needed to generate air power. The first factor is the availability of state-of-the-art technology and the ability and will of a nation to use it optimally. Air power is founded on technology and it continues to be a technology-based and enabled capability. Therefore, it is necessary for any nation aspiring to generate air power—through maintaining a standing air force of sufficient calibre—to have a critical minimum technology base. The robustness of this technology base is dependent on four major factors: the national educational system and its bias, the state of development and relative sophistication of the overall national industrial base, the competence of the aviation industry component within that base, and an intangible factor of the national mindset

regarding technology and aviation. Even minor shortfalls in any of these factors will have significant impact on the nation's capacity to generate air power.

The second national factor is the challenge of adequate resource allocation. Aviation is inherently a resource-intensive capability, within which air power—the ability to project force at will through the medium of air—is at the higher end of the resource requirement spectrum. Resources expended in generating air power do not provide a clear return that is visible to the general population, unlike resources used to build hospitals or schools. The dividends of air power are in terms of continued stability and security of a nation and the freedom from interruptions to trade and commerce, and in extremis, freedom from direct attack. This situation always produces a tension in the resource allocation between domestic priorities and defence requirements. To ensure adequate protection of a nation, the government must be willing to allocate the necessary resources to generating air power, even during long periods of comparative peace. This is crucial because the lead-time required to acquire and generate air power is by far the longest of all military power projection capabilities.

The generation of air power and creating a demonstrable air power projection capability, is the function of the air force. In an overarching manner, even civil aviation capabilities feed into the national air power calculus, but air power, as envisaged in a military context, is primarily resident in a nation's air force. Generating air power is the fundamental task of air forces and the process is complex and involved. There are two distinct aspects to generating air power—a vigorous capability development process which will decide the acquisition of necessary equipment and an adequate training infrastructure to create sufficient numbers of qualified personnel. The capability development process takes into account a nation's security stance, grand strategy, national policy on security as well as the military strategy and is the link between national security objectives and the air force. Based on the identified capabilities necessary to ensure that national security objectives are achieved, equipment that can generate the capabilities of the necessary quality is acquired. This is only one part of the equation. The methods of acquiring equipment are many and could vary from indigenous manufacture to outright purchase from foreign sources. There is also an indirect, but critical, connection between the acquisition process

and the issues discussed within the national infrastructure that will influence the entire process.

The second part of the equation is the training capability of an air force. Irrespective of the technological sophistication of its equipment, at the base level it is the people who employ them that distinguish an air force as one of excellence and competence. Adequacy of training is dependent on the ability of the air force to attract people with the requisite education and aptitude, the competence of the training process by itself, the capability to train the required numbers, and the capacity of the force to retain well-trained personnel for sufficiently long periods to make the training investment cost-effective. The right people employing the right equipment to implement the right concepts of operations that support a strategy that is fully aligned with national security objectives is the acme of professionalism in the generation of air power.

Sustaining the desired level and quality of air power is the other prime responsibility of the air force. This capability however comes at a high cost both in resources and in personnel requirements. The framework necessary to sustain air power is both elaborate and expensive and consists of air bases, the infrastructure within the bases to generate air power, technical services that maintain sophisticated equipment, qualified personnel and on-going training capability. Since maintaining this framework is resource-intensive air forces, especially smaller forces, normally plan for eventualities in terms of the minimum time that they would be required to sustain the application of air power. This period is calculated as a function of the national security planning and based on the strategic guidance provided by the government from time to time. An intangible factor in sustaining air power is the national will and commitment to allocate the resources necessary to do so.

For smaller air forces sustaining the focused application of air power will always be a challenge. The challenge is exacerbated when there is a requirement to employ air power in different theatres simultaneously. This challenge of concurrency could become unsustainable for forces with limited numerical capacity and those facing resource constraints for any reason. The corollary is that sustaining air operations for the duration necessary is vital to the success of any campaign and therefore terminating or reducing air operations to a more manageable level during the campaign is not a

viable option. Therefore, sustaining air power application is a vexed issue for air forces and merits careful consideration at the highest levels of national security planning.

Generating and sustaining air power is the primary function of an air force. However, its capacity to do so is critically dependent on a number of factors over which the air force has little or no control. It is necessary for the government to ensure the availability of necessary resources for an air force to deliver its commitments within the national security imperatives.

The Concept of Strategic Bombing: Has it Come of Age?

Key Points

- *The concept of strategic bombing to win wars was developed without any empirical information to support it.*
- *World War II demonstrated that modern, urban societies were robust enough not to capitulate to incessant aerial bombardment.*
- *Strategic air attacks can now be carried out with precision, proportionality and discrimination to create the necessary effects and achieve political objectives.*

The concept of long-range or strategic bombing was implemented in the early years of World War II. Essentially it implies that aircraft carrying bombs can attack an adversary's 'vital centres' and undermine their ability and will to fight. As a concept this seems straightforward. However, no other military power projection capability or concept generated so much controversy and aroused such emotional intensity during and after the War. The arguments for and against the concept are still on-going, and the issue remains as contentious today as it did when the early air power theorists—Douhet, Mitchell and Trenchard—proposed in the inter-war years that it would be possible to bomb an adversary into submission without having to defeat their surface forces or invade their territory.

The idea of strategic bombing was developed based on certain assumptions, which in turn brought about a set of expectations. It was championed by the US and Britain who relied heavily on this modern concept during World War II as a central mode of modern warfare. There are three primary reasons for this. First, both these nations had built their defences based on powerful naval forces founded on their mastery of science and technology. It was not surprising that the advent of the aircraft—a technological marvel of the day—as a weapon of war automatically made its use for deterrence and offensive power projection an acceptable option.

Second, bomb-carrying aircraft were seen as a means of fighting and winning a war without having to undergo the trauma of the enormous number of casualties suffered during the Great War of 1914-18. At the beginning of World War II, both sides were unwilling to accept a repetition of the horrors of trench warfare. Further, although strategic bombing was not successfully carried out during World War I, the initial seed for the generation of the concept was laid by the Zeppelin raids on London and the civilian reaction to it. Third, at the end of World War I, the first independent air force was formed in Britain. However, the inter-war experience of the newly formed Service was that it was constantly at peril of losing its institutional independence. For a fighting Service, independent status is predicated on it having a role that no other Service can fulfil; although there was no precedence to commend it, strategic bombing was considered the best option to be advanced as a unique role.

The concept of long-range bombing had started to be discussed long before heavier-than-air platforms became a reality and was fundamentally based on the perceived behaviour patterns of modern society. This became fundamental to the thinking about and development of strategic bombing as a war-winning concept. It was asserted, without any real empirical proof, that modern, urban-based societies were fragile and vulnerable, easily broken psychologically through disruption brought about by aerial bombardment. This was based on the presumption that modern societies have only limited political loyalty to the ruling regime and that modern economies are highly susceptible to disruption of any kind. These arguments also gave credence to the air force claim of its efficacy as an instrument of coercion, further bolstering its independence. In an indirect manner the concept of targeting the industry, economy and population of an adversary from the air made it imperative for a nation to maintain an air force, for both defence and offence, if it wanted to survive in the case of a war. This further cemented the independent status of air forces. There were two flaws in this concept development process. First, was that assertions of human vulnerability and the effects that strategic bombing would create on the national ethos rested squarely on wishful thinking and not on facts. Second, it was buttressed by the overriding belief of the time that the bomber would always get through to the target.

Three major factors proved to be the undoing of the claim of the primacy of strategic bombing to winning the war at a low cost. First, modern society was found to be very resilient and robust with the inherent capacity to accept tremendous punishment and yet not capitulate. Second, the bombers themselves were found to be vulnerable to both airborne and ground-based air defences that inflicted heavy damage on them; and third, the accuracy of aerial bombing was nowhere near what was needed to make an impact on the economy of industry of the adversary. It can be said that the concept of strategic bombing, as applied in World War II, did not verify the claims that were made by air power advocates.

In the aftermath of World War II, both the Korean and Vietnam Wars made extensive use of air power, primarily as an attack element. However, these wars failed to establish a connection and satisfactory balance in the crucial relationship between strategic bombing and political outcomes. The air campaign of the 1991 Gulf War radically changed air power employment beliefs. It brought to the fore the concept of air strikes on selected targets to achieve strategic, operational or tactical effects as a prominent element in warfare. Thereafter, air attacks on the adversary's vital centres of gravity have become standard modus operandi to elicit concessions from or remove recalcitrant regimes.

The evolution of the concept of air attacks has to be understood in terms of developments in air power efficacy. First, the perception that long-range strikes create 'strategic' effects has become redundant. In contemporary warfare, creating the right effects at the right time is critical to success. These effects could be created to achieve very short term tactical goals, medium term operational objectives, or long term strategic aims, in line with the broad political imperatives that initiated the conflict. Second, these effects can be created through actions at the tactical, operational or strategic level of combat. The fundamental change in the concept has been that purely tactical actions can now create strategic effects. This revolutionary change has been made possible through technology-enabled weapon systems that assure the necessary precision, proportionality and discrimination in their application.

Since air power has repeatedly demonstrated its ability to strike with precision, the concept of strategic air attacks—as opposed to

strategic bombing—has once again become an idea that is being pursued by military forces. This is so because a single missile is now capable of creating more damage than a number of World War II era bombs, and aircraft are also capable of attacking multiple targets in the same mission. Precise and discriminate attacks on leadership, command and control facilities and economic targets that would produce the desired effects on the adversary are now within the ambit of air power. This has resulted in creating a mode of warfare—essentially based on air attacks—that could produce the desired results with minimal probability of own casualties. Further, such air attacks also provide a viable alternative to physical ground intervention and the associated political conundrum that emerges.

Current air power combines technology, like stealth, and innovative ideas to make strategic air attacks capable of delivering on the promises of early air power theorists. It can now create effects to achieve political end-states through precision attacks. The concept of strategic bombing, it seems, has come full-circle.

Air Power's Anti-Piracy Role

Key Points

- *Anti-piracy operations are inherently difficult because of the large area to be patrolled and the lack of sufficient assets.*
- *Airborne wide area surveillance provided by HAVs could improve the safety of merchant shipping.*
- *The use of airships in maritime surveillance is an innovative concept in the employment of air power.*

Piracy on the high seas is not a new phenomenon, but in recent years it has become a serious challenge to maritime activities, which constitutes the major part of international trade and commerce. The sea off the Somali coast has evolved as the epicentre of such activities, although, the straits of Malacca is also pirate infested. Since 2008, the international community has deployed a large number of warships to the Indian Ocean near the east coast of Africa to counter the Somali pirates and stop the loss of shipping. While the initial phase of this initiative was successful in reducing losses, especially in close proximity of the Somali coast, it also resulted in extending piracy activities further out to sea by operating a mother ship concept similar to large fishing fleet operations.

The increasing efficiency of the naval task forces in patrolling the coastal areas, have forced the pirates to adapt and shift their activities outwards. In 2005, the furthest recorded attack was around 165 nautical miles off the Somali coast, whereas in 2010, pirates were attacking ships as far away as 1500 nautical miles into the sea. This translates to an area of operations of about four million square kilometres—the size of mainland Europe—for the international naval task force to monitor and patrol. With the current level of asset availability, which is unlikely to increase, this is not a realistic task; the ships are limited in numbers and their average persistent radar range is 40 nautical miles. Although shipborne helicopters can, and do, increase the range of surveillance, this can only be done for very limited periods of time. Beset with these constraints the anti-piracy mission is gradually faltering.

The key to success is obtaining intelligence regarding pirate movements so that the ships can be at the right place at the right time. The key to gaining such intelligence is the ability to carry out persistent large area surveillance that could provide a wide enough pattern of activities to initiate actions in a timely manner. The newly developed Hybrid Air Vehicle (HAV), an optionally manned heavier-than-air airship, is a tool that offers a low-cost option to provide wide area surveillance to fight piracy.

The HAV, when operated in the uninhabited mode at about 20 000 ft above a host frigate, can remain aloft for 21 days, providing around-the-clock surveillance over about 325 000 square kilometres of sea. In comparison, a crewed fixed wing aircraft of the P-3 Orion class can provide about 18 hours of persistent surveillance over a much smaller area. The persistence and wide area surveillance of the HAV provides a live picture of the activities within a large area, making it possible to monitor even the smallest pirate boats and identifying areas of potential risk to merchant shipping. This would also permit surface and air assets to be vectored to the threats rapidly. The presence of HAVs will obviously also create deterrent effects.

Greatly increased persistence is achieved mainly through the airship design. Around 40 per cent of the lift required to stay aloft is provided by the aerodynamic design properties of the shaped hull, and the helium that fills the airship provides the remainder. This permits the HAV to conserve fuel in getting airborne and staying at height, allowing it to operate for a number of days without having to be replenished.

There is an added advantage to employing an HAV that is critical in the contemporary economic climate. The operating costs of these airships are a fraction (estimated to be a tenth) of those of other conventional maritime patrol assets. Persistence calculated in the number of days rather than in hours and extremely low operating costs is an unbeatable combination for providing wide area surveillance over the high seas. Further, the technology required to operate an HAV is available off-the-shelf and its procurement costs are relatively modest, making it an attractive proposition to resource constrained governments and military forces.

There are other advantages to the employment of HAVs. First, when it is optionally piloted it can transit controlled airspace en route to the area of operations while an uninhabited vehicle cannot do so.

Second, the HAV can be supplied and controlled directly by a frigate at sea, thereby negating the need to operate from a land base in a foreign location, avoiding the accompanying complexities. Third, the size of the hull permits the carriage of a much larger array of sensors than is possible with any other currently available maritime surveillance air asset. This not only allows greater coverage across a broader spectrum of sensors, but also provides greater sensitivity to the surveillance.

By using a number of HAVs in tandem, and all the surveillance pictures being combined with those of the host ships, it will be possible to create a corridor in the high seas that can be protected and within which all activities will be known at all times. Such corridors, when laid out optimally, can permit merchant shipping to route direct, as opposed to the current requirement to circumvent known pirate-infested areas, potentially saving large amounts money in operating costs.

There is a historic precedent to using airships in maritime surveillance—during World War II, airships operating over the US East Coast forced German submarines to confine themselves to the mid-Atlantic region. However, airships are still considered 'new' technology. The main challenge to the acceptance and employment of this concept of wide area surveillance with the use of heavier-than-air airships, therefore, would seem to be a cultural push back. However, the operational need for wide area surveillance and globally declining defence budgets could act as catalysts to changing the reluctance to open acceptance.

Understandably, the concept is outside the traditional line of thinking, but air power has always been innovative in its conceptual development, a fact demonstrated by the progress it has made in just a single century of existence. The need of the hour is for all nations to be able to carry out their legitimate trade and commercial activities unhampered by illegal and criminal activities such as piracy. It must be noted here that national sovereignty extends to a nation's commercial shipping and therefore its protection is also a national responsibility. The policing of the high seas, therefore, cannot be left solely to the naval forces of a few countries. The current combined naval assets on anti-piracy duties are unequal to the task, and airborne wide area surveillance through airships will provide a mitigating capability that will permit the limited maritime assets to control large swathes of sea at minimal cost.

The shooting down of Admiral Yamamoto.

Airship *Norge*, the first aircraft to reach the North Pole.

Australian Flying Corps aircraft over Palestine during World War I.

The wreckage of Dakota VT-CLA shot down by Dutch-flown Kittyhawks.

FA-18 Hornet firing a AIM7F Sparrow missile.

RAAF AP-3C Orion watching over Australia's maritime approaches.

The RAAF Heron Remotely Piloted Aircraft deployed to Afghanistan.

The new RAAF F/A-18F with AGM-154C Joint Stand-Off Weapon.

HISTORY

Those who study warfare only in the light of history think of the next war in terms of the last. But those who neglect history deprive themselves of a yardstick by which theory can be measured.

Cyril Falls
The Nature of Modern War

The Experience of Air Power in Libya

Key Points

- *The Italians conducted the first air reconnaissance, the first naval gunfire direction, and the first aerial bombing operations in wartime.*
- *Air power has been used in irregular and hybrid warfare since the Italian-Turkish War of 1911-12.*
- *Even though technology changes rapidly and history does not repeat itself, much of the human experience of the past continues to inform—history does indeed rhyme.*

Events in Libya in the first months of 2011 have a remarkable resonance with events in this same region exactly 100 years ago. Following an uprising against the government of Muammar Qaddafi, an international coalition of powers decided to act to prevent a civilian bloodbath as the Libyan regime moved to crush the rebellion. Eschewing all suggestions of invasion, the coalition turned to air power as its chosen means of intervention—with the limited goal of establishing a no-fly zone to prevent the indiscriminate use of government force against the Libyan population. It is ironic, then, that the bases used by many of the aircraft enforcing the coalition's mandate from the UN lie just across the Mediterranean, in Italy.

In September 1911 the Kingdom of Italy launched its own military action against Libyan territory, which was then part of the Ottoman Empire. Italian nationalists longing for a North African empire put the government in Rome under such pressure that the decision was taken to conquer the Ottoman provinces of Tripolitania and Cyrenaica (now known as Libya). Little opposition was expected from the politically unstable Ottoman Empire, and the public was led to believe that the war would be quick, with few casualties to the Italian forces which were equipped with the latest technology, including warships, armoured cars and aircraft. The Italian Navy, the Regia Marina, already dominated the Eastern Mediterranean, and the Italian Army was thought to be more than a match for the relatively small garrison of 4000 Turkish regulars supplemented by Arab and Bedouin troops.

In fact, while Tripoli was captured easily within days of war being declared on 29 September, the Italians soon found themselves involved in an irregular conflict, which quickly degenerated into a hybrid war of attrition. The Italian force of 20 000 originally committed to the operation had to be surged to about 100 000 in order to maintain control over the territory occupied. While the war officially ended on 18 October 1912 with the two provinces ceded to Italy, Italian control over Libyan territory was ineffective due to a long and determined guerrilla war that went on for another 20 years.

When Italy invaded Libya, the Turks had no aircraft in North Africa. The Ottomans did attempt to purchase aircraft from France and send them to the battlefield via Algeria, but nothing materialised from these plans. As a result, Italian aviators were able to test their latest aeronautical equipment in wartime conditions without opposition. Nine aircraft—two Blériot XIs, three Nieuport monoplanes, two Farman biplanes, and two Etrich Taube monoplanes—were dispatched by boat to Libya, along with 10 officers and 29 soldiers.

Captain Carlo Piazza flew the first military reconnaissance mission in wartime over Turkish lines on 23 October 1911. The flight, from Tripoli to Azzizia in a Blériot XI monoplane, took about an hour. Subsequently, on 25 October a reconnaissance patrol flown by Captain Ricardo Moizo and Piazza discovered advancing Turkish troops and their reports enabled the Italian Command to defeat a major counter-attack. The value of aerial reconnaissance had been proven decisively. On 26 October, during the Battle of Sciara-Sciat, Lieutenant Guilio Gavotti flew above the Turks and delivered messages to the Italian Navy battleship *Sardegna* to guide the ship's guns. As there was no wireless in aircraft at that time, Gavotti was forced to scribble notes on paper, place them in small metal tins, and carefully drop the tins onto the *Sardegna's* deck. This was the first of a number of naval gunfire direction flights conducted by the Italians.

On 1 November the first ever aerial bombs were dropped by Gavotti, on Turkish positions at Ain Zara and Taguira, from an early model Etrich Taube monoplane. While flying at 600 ft (185 m), he took four small 4.5 lb (2 kg) bombs from a leather pouch, screwed in the detonators, and threw each bomb over the side by hand. No one was injured and little damage was done. The Turks launched an official diplomatic protest, pointing out that one of the buildings damaged

at Ain Zara was a military hospital, but this did not deter the Italians from making more such attacks. After Captain Moizo again bombed an enemy gun battery located at Ain Zara on 6 November, the Italian General Staff issued the first official communiqué boasting of their aerial bombing operations.

On 11 December five Italian aircraft conducted the first ever direct fire support mission when they assisted their infantry in an assault on Ain Zara. Turkish troops at Azzizia opened fire with a 90mm Krupps gun on a high-elevation carriage against an Italian aircraft on 15 December, which became the first anti-aircraft artillery effort in military history. The earliest recorded instance of psychological warfare from the air occurred on 15 January 1912 when leaflets were dropped into an Arab encampment. Later, on 24 February, Captain Piazza made the first photo-reconnaissance flight in history using a 'Baby' Zeiss camera. The first night reconnaissance flight was undertaken on 2 May, and the first night bombing mission was conducted by Captain Alberto Marenghi on 11 June. The first aircraft to be brought down in a war was that of Lieutenant Piero Manzini, who was shot down on 25 August, and the first aircraft captured was that of Captain Moizo on 10 September. Italian aircraft were also utilised to transport military equipment to the troops at the front in what were the first airlift operations.

Two Italian airships were also deployed to Libya, although they were not used in operations until 5 March 1912. In what was to be a successful deployment, these made 127 ascents before they returned to Italy in January 1913-86 of these missions involved attacks on Turkish positions in which some 330 bombs were dropped. On one occasion an airship succeeded in thwarting a Turkish surprise attack by discovering and bombing an enemy cavalry ambush. One of the airships also conducted nine missions after it was deployed to Benghazi on 29 May 1912, including one where it dropped incendiary bombs and another where it made a night bombing raid.

The British War Office estimated that between March and June 1912 Turkish losses from air attack were 26 killed and 70 wounded—not devastating results but, added to the value gained from air reconnaissance, sufficient to justify the use of the new arm. The experiences of Italian aviators during the Italian-Turkish War of 1911-12 not only confirmed the practical viability of military aircraft,

they helped establish many of the roles that we associate with air power today. Libya was heavily fought over—from the air as well as on the ground—in World War II, and later also felt the striking power of USAF F-111s and naval aircraft during Operation *Eldorado Canyon* (in retaliation for a Libyan sponsored terror attack in April 1986), but these episodes have none of the symbolic associations with 1911 that are invoked by the current NATO intervention in Libya's civil war.

History doesn't repeat itself but it rhymes.

Mark Twain

Air Power in the Balkans, 1912-13

Key Points

- *Both the Greeks and Turks utilised aviation in support of operations during the First Balkan War, providing an early example of basic air power roles—especially ISR.*
- *The Greeks fought the first naval-air battle while on a reconnaissance flight over the Ottoman fleet in the Dardanelles in 1913.*
- *The experiences of small to medium-size nations with air power are often as valuable as the experiences of great powers.*

Gallipoli is well known to most Australians as the place where the original ANZACs fought a dogged but ultimately unsuccessful campaign against the Ottoman Turks. Indeed Anzac Day, which commemorates the Gallipoli landings of 25 April 1915, is deeply imbedded in the Australian national memory. While there has been growing awareness in recent times of the aerial dimension of the 1915 Dardanelles campaign, there is limited knowledge about the part that aviation played during the First Balkan War of 1912-13 between the Greeks and the Turks—much of it also fought in the Dardanelles area.

On 8 October 1912, Montenegro declared war on the Ottoman Empire and over the next 10 days the other members of the Balkan League (Serbia, Bulgaria and Greece) followed suit. The Balkan League forces, numbering 750 000 men, rapidly advanced on all fronts against the 420 000 Turks in the European provinces of the Ottoman Empire. Despite stiffening Turkish resistance, the Bulgarians managed to advance through Thrace to the outskirts of Constantinople (Istanbul), cutting off the Turkish forces in the Gallipoli peninsula, and besieging the garrison in Adrianople (Edirne). At the same time, the Greeks conducted a series of successful maritime operations in the eastern Mediterranean, defeating the Ottoman Navy in the Aegean Sea and blockading the Turks at the Dardanelles.

The First Balkan War ended on 30 May 1913 with approximately 270 000 casualties on both sides. In eight months, the Ottoman Empire

had lost most of its remaining European territory, including all of Macedonia, Albania and the islands of the north eastern Aegean. To the people of the Balkans, the war was clearly not a minor conflict—even if that is how it was perceived in the rest of Europe, both at that time and subsequently.

Interestingly, both sides in the war had made use of the new technology of aviation to aid the efforts of their forces. Inspired, no doubt, by their conflict with the Italians in Libya (see *Pathfinder #152*, p. 85), the Turks had formed an Aviation Commission within the War Ministry late in 1911—thereby providing, incidentally, the basis for celebrating the centenary of military aviation in Turkey this year. During 1912 eight Turkish officers were sent to France for flying training, an Air Academy was opened at Constantinople, and efforts were stepped up to acquire aircraft. These measures ensured that the Ottoman Air Service was able to field 17 aircraft over the course of the Balkan conflict.

Early establishment of an aviation arm also enabled the Greek military and naval forces to achieve decisive strategic victories in the war. In 1911 the Hellenic Government had hired French experts to establish an Air Service. Six Greek officers were posted to France to train as pilots, while the first military aircraft were ordered from the

French aviation firm, Henry and Maurice Farman. These aircraft arrived in Greece in early 1912 and the first Greek Army Air Company was formed, as part of the Hellenic Army, at Larissa in late September 1912.

The activities of a few Greek aviators influenced events on land and at sea to a far greater extent than their relatively small numbers and flimsy machines would suggest. On the very first day of the war, Lieutenant Dimitrios Kamperos conducted an air reconnaissance mission over Turkish positions at Elasson, in Thrace. More reconnaissance missions followed and they soon included light bombing raids. Even though such bombing caused little significant physical damage, the raids were effective in weakening Turkish morale. On the Epirus front, the mountains initially prevented flying operations but the Greeks acquired more powerful aircraft, and from December 1912 they dominated this front as well.

During the remainder of the land war, Greek aircraft were used to observe Turkish forces between Nicopolis and Ioannina, also dropping improvised bombs on the Bizani strongholds and carrying out airdrops of food supplies and newspapers to the besieged population of Ioannina.

The Greeks formed a naval air arm in mid-November 1912, when the first Maurice Farman MF.7 hydroplane, *Nautilus*, entered service with the Royal Hellenic Navy (RHN). Following its defeat in the Naval Battle of Lemnos on 18 January 1913, the Ottoman fleet withdrew from the eastern Mediterranean into the Dardanelles. Early the next month the RHN sent *Nautilus* on its first long-distance flight to the island of Tenedos off the Gallipoli peninsula, in preparation for flying a reconnaissance mission over the Dardanelles to gain intelligence on the enemy's whereabouts. Coming from the direction of Gaba Tepe, the Greek crew spotted the Turkish fleet at anchor off Nagara Point. After dropping four light bombs on some of the ships, the pilot maintained position overhead while his observer prepared a detailed diagram of the fleet's dispositions. Although their bombs scored no hits, this was the first recorded naval-air battle in history. The Turkish press expressed surprise and concern over the apparent defencelessness of the Dardanelles, and Gallipoli, against air attack.

The Greeks and the Turks both learnt considerably from their experiences during the First Balkan War, especially regarding the value

of aircraft in the intelligence, surveillance and reconnaissance role. Most outsiders, however, seemed to dismiss the notion that anything new had emerged from this conflict. The war was well covered by foreign journalists reporting on it for the international media, but they were generally disappointed that the conduct of 'war had not been revolutionised'.

Many of Europe's leading military powers were also represented by observers eager to glean whatever lessons the war had to offer. Most of these apparently felt that air power in the Balkans fighting did not produce the dramatic results that they had envisaged. In early 1914 General Sir Ian Hamilton, Britain's commander-in-chief in the Mediterannean, expressed the belief that air reconnaissance had proved 'deceptive' and 'of little value'. Just over a year later, when the Allies confronted Turkey at Gallipoli, Hamilton was forced to learn the value of military aviation—the hard way. The importance of aviation during the First Balkan War is still little known, and perhaps this is to be expected when the role of aviation in the 1915-16 Gallipoli campaign is also largely neglected. Today a few scholars are trying to redress this imbalance.

Oswald Watt: The Leader the RAAF Never Had

Key Points

- *Oswald Watt was the Defence Department's first pilot and played a prominent role in shaping steps towards establishing military aviation in Australia.*
- *His service in World War I made him an obvious and logical contender, by virtue of rank and experience, to head the RAAF upon its formation.*
- *After the war Watt was disinclined to accept an active role in aviation, either in civil flying or the Air Force, and his early death prevented him from changing his mind.*

Accounts of the period when command arrangements for the RAAF were decided prior to its formation, on 31 March 1921, have usually focused on the competing claims of two local officers: Lieutenant Colonel Richard Williams, formerly of the Australian Flying Corps (AFC) during World War I, and Wing Commander S.J. ('Jim') Goble, an Australian whose wartime flying had been with Britain's Royal Naval Air Service. In fact, the choice of head for the new air service need not have been confined to these two alone. There was at least one other candidate available within Australia whose rank and experience equally qualified him to lead the RAAF.

Walter Oswald Watt had enjoyed a longer association with military aviation than either Williams (who gained his wings at Point Cook, Victoria, in November 1914) or Goble (who got his in England in October 1915). Known as Oswald, or by his nickname of 'Toby', Watt had been an officer in the citizen forces in New South Wales for a decade before Williams attained this status in South Australia in 1911, the year in which Captain Watt went to England to learn to fly at the Bristol School on Salisbury Plain. Qualifying for a Pilot's Certificate from the Royal Aero Club in July 1911, he returned home in November.

A month after Watt's arrival, the Defence Department took the first steps towards acquiring aircraft and instructors for a local flying

school. Early the next year, it was Watt—as the department's first trained pilot—who was sent to Canberra to select a suitable site for the school, which the Minister for Defence wished to see located close to the national capital. In March 1912 Watt recommended a location near the new Royal Military College, Duntroon, which was expected to provide a proportion of the school's trainees.

On 20 September 1912 the Military Board (which administered Australia's army) authorised the establishment of 'a Flying School and Corps'. Watt very likely expected himself to have a major role in the new establishment, because soon after delivering his recommendation regarding the school's site, he departed for England to investigate aviation developments abroad on behalf of the Defence Department.

Unfortunately for whatever plans had been made for Watt's future involvement in an Australian flying corps, events in his personal life intervened at this point. In 1913 his marriage ended in the Sydney divorce court, in a case reported around Australia. Watt took himself off to Egypt where he bought a Bleriot XI monoplane and set himself up as a civilian pilot. In May 1914 he moved to Paris, and when World War I began three months later he joined the military aviation section of the French Foreign Legion as an ordinary soldier.

Over the first 18 months of the war, Watt won great experience and distinction in action. Awarded the Legion d'Honneur and the Croix de Guerre, he also received the brevet rank of Captain. In March 1916 he transferred to the AFC and went to Egypt in May to join No 1 Squadron. Six months later he was promoted Major and appointed to command the AFC's newly-formed No 2 Squadron. Taking the unit to England in January 1917, he continued its training in a fighter role flying DH.5s and by September he was leading the squadron across to France.

No 2 Squadron arrived on the Western Front at a time of heightened activity. During the Battle of Cambrai beginning in November, six of the unit's pilots won the Military Cross—a record which was regarded as a tribute to Watt's leadership. But this reputation took a considerable toll on Watt in terms of physical and emotional strain. The punishing hours that he worked in his office, along with concern for the well-being of the young pilots he was daily sending off into combat, soon wore him down. When the Australian war correspondent, Charles Bean, visited in December 1917 he found Watt

looking 'very wan' and watched him fall asleep in his chair immediately after dinner, shivering even though it was not a cold night.

In February 1918 Watt was promoted Lieutenant Colonel—four months before Williams was promoted to the same rank in Palestine—and sent back to England to take command of the four squadrons of the AFC's 1st Training Wing in Gloucestershire. Even away from the front line, Watt still continued to inspire those under him. When novelist W.J. Locke visited the wing shortly after the Armistice in November 1918, he was impressed to find not one of Watt's men 'who did not confide to me his pride in serving under a leader so distinguished'.

Appointed an Officer in the Order of the British Empire in January 1919, Watt returned home in May and immediately took his discharge from the AFC, preferring to immerse himself in his family's lucrative business interests. He maintained his interest in aviation, however, and was elected president of the New South Wales section of the Australian Aero Club. In August that year he became the senior member on a committee of former AFC commanders which helped vet the suitability of applicants for the Air Force, which was even then being planned. With formation of the Air Force delayed, Watt's views were sought regarding appointments to the Australian Air Corps when that was set up as an interim organisation in January 1920.

Although Watt's name was never directly raised—so far as is known—as a contender for the leadership of the new Air Force, he was considered for the position of Controller of Civil Aviation (CCA) which also came up that year. Reportedly offered the latter post by the Minister, he declined because of his business commitments. That he was not pressed to change his mind, both with respect to the CCA post or a more active role in the Air Force, was probably attributable to several considerations. His age probably told against him (at 42, he was a dozen years older than both Williams and Goble), and he probably still felt worn out by his wartime service. Privately wealthy, he did not need public employment; and possibly there was still a whiff of scandal attached to his name because of his divorce.

In any event, Watt's life did not long outlast the RAAF's formation. On 21 May 1921, his manservant found him floating in shallow water at Bilgola Beach at Newport, New South Wales, where he owned seven acres overlooking the ocean. Apparently he had slipped on rocks while collecting firewood early one morning, struck his head in

falling, and drowned in a few inches of water when the tide came in. He was accorded a military funeral at Randwick, Sydney, attended by representatives of the AFC and the RAAF. Later in 1921 a bequest from his estate established the Oswald Watt Gold Medal, which was awarded to serving members of the RAAF on numerous occasions in later years (in 1924, 1926, 1952, 1953 and 1958). Also in 1921 an Oswald Watt Prize was established for annual competition at the Royal Military College, with the cadet writing the best essay on military aviation or aeronautics receiving a pair of binoculars.

The Australian Air Corps

Key Points

- *The AAC was Australia's first air service that was independent of Army and Navy.*
- *Its primary role was to receive and maintain the aircraft and stores of the Imperial Gift after World War I.*
- *The AAC also kept valuable aviation skills alive until the formation of the RAAF.*

On its formation on 31 March 1921, the RAAF was the second independent air force in the world—after the Royal Air Force (RAF) (see *Pathfinder #114*). But another distinct 'air force' flew aircraft, set records and carried out government tasks in Australia well before this date. How did this force come about and what happened to it?

Even before the end of World War I, there was political debate about the future of military aviation in Australia, which at that stage consisted of little more than the Central Flying School (CFS) at Point Cook, Victoria, for training pilots. By May 1918, both Army and Navy had submitted detailed proposals for permanent air arms—one for each service. When a compromise could not be reached within the allocated budget, a sub-committee that was set up to examine the problem recommended on 20 January 1919 the creation of a separate air force as a third service. The government accordingly formed the Air Services Committee (ASC) as a temporary body to organise the new air force. The ASC soon produced a plan for new airbases, an organisational structure and an Air Board to administer the service.

At this time, Australia had few combat aircraft. In the first months of 1919 the squadrons of the Australian Flying Corps (AFC) abroad began handing their aircraft over to the RAF in preparation for the AFC's disbandment and return home. In April, the CFS received a number of Avro 504 and Sopwith Pup aircraft which had been ordered the previous year. The number of aircraft was adequate for a training school, but provided no aircraft to equip the proposed new squadrons.

Then in June, the British Government offered a gift of military aircraft, the object being 'to assist Dominions wishing to establish air

forces and thereby develop defence of the Empire by air.' The Australian Government quickly accepted the offer but requested a delay to the dispatch of the aircraft until arrangements could be made for their reception. The 'Imperial Gift' consisted of 100 aircraft, spare engines, tools, motor transport and 13 transportable hangars all packed away in over 19 000 packing cases. Another 28 aircraft were provided at the same time to replace aircraft donated by the people of Australia to Britain during the war.

With dozens of new aircraft on their way, the pressure to form the new air service was immense. In its report dated 30 June 1919, the ASC recommended the creation of a temporary 'Australian Air Corps' (AAC) formed into two wings (one wing to meet the needs of the Navy and the other for the Army). An Air Board, answering to the Minister for Defence, would administer the new service. According to the Commonwealth Gazette of 31 December 1919, the CFS, its personnel and equipment were seconded from the Army and placed under the AAC. Major William Anderson, who had extensive service in the AFC, including as Commanding Officer of No 3 Squadron, was selected to command at Point Cook. An establishment of nine officers and 70 other ranks was initially authorised but was soon increased to 160 other ranks to handle the volume of gift stores arriving in Australia.

Command arrangements for the new air service were controversial from the start. An Air Council, with Army and Navy representatives, was formed in early 1920 to decide matters of higher policy and to ensure that the new air service did not stray too far from its primary role of meeting the needs of both the Army and Navy. In January 1920, Lieutenant Colonel Richard Williams (later Air Marshal Sir Richard Williams) was appointed Acting Director of Aviation Services, responsible to the Air Council for all matters connected with the AAC.

The interim nature of the new organisation was shown by the order issued by Captain H.H. ('Neil') Kilby, the Adjutant of CFS, less than three weeks after its formation:

> …it has been approved that no distinct uniform shall be designed—that uniform at present in possession of members may be worn out, and that should members find it necessary to purchase new uniform while the Corps is constituted at present, AIF pattern, as worn by the AFC is to be worn.

Despite this order, over the next 12 months, the AAC gradually assumed an identity of its own. A major step in this direction occurred in November 1920, when the change was made from Army ranks to those adopted by the RAF in August 1919.

On 9 November 1920, the Air Board was formally established as the body responsible for the administration of the AAC and the future Air Force. Wing Commanders Richard Williams and Stanley James ('Jimmy') Goble (later Air Vice-Marshal Goble) were members of the board alongside Squadron Leader P.A. McBain, Major P.E. Coleman (the civilian Secretary) and a civilian finance member, Mr A.C. Joyce.

Although the AAC was formed primarily to maintain equipment in good order, it achieved some commendable aviation milestones. Its aircraft set a new Australian altitude record of 27 000 ft in June 1920 and made the first non-stop Sydney to Melbourne flight the following month. Between July and November, an Avro 504 floatplane and AAC personnel embarked aboard the battlecruiser HMAS *Australia* (I) for sea trials. In addition, AAC aircraft flew many aerial displays, and made at least one aerial search for a missing vessel.

Throughout its short existence, the AAC consisted of one flying unit—the CFS—and one airfield—Point Cook. Most of its aircraft were still in storage or in transit from Britain, but it operated a number of training, bomber/reconnaissance and fighter aircraft. It was a uniformed service with a command and rank structure and most importantly, personnel with extensive operational experience from World War I. And it was technically separate from the Army and Navy; its director answered to the Minister for Defence, through the Air Council. In effect, the AAC was Australia's first independent air force, albeit an interim one.

The senior officers of the AAC went on to influential careers in the RAAF. Apart from Williams and Goble, William Anderson served more than 10 years as a member of the Air Board before retiring in April 1946 with the honorary rank of Air Vice-Marshal. 'Harry' Cobby, Frank McNamara, Henry Wrigley and a large number of technical staff also went on to distinguished careers in the RAAF after serving in the AAC. However, not all AAC personnel automatically transferred to the RAAF—some chose to return to civilian careers.

The AAC achieved much in its short existence. It was the physical embodiment of an Australian air service that was broadly independent

of Army and Navy. Its most important function was to form the core of the Australian Air Force when it came into existence on 31 March 1921. With the personnel from the AAC and the aircraft and equipment from the Imperial Gift, the RAAF was a viable, independent air force capable of flying missions from the first day of its existence.

The RAAF at Sea Before World War II

Key Points

- *During the inter-war period the RAAF helped pursue a maritime strategy for the defence of Australia.*
- *Technical limitations hindered efforts to operate from warships, but in 1929-33 RAAF aircraft were embarked in a RAN seaplane carrier.*
- *Navy's cruisers carried Seagull V amphibians in 1935-44, meaning many RAN combats resulted in RAAF casualties.*

In the 1920s, when the RAAF came into being, the concept of the Australian government's national defence was based predominantly on a maritime strategy led by Navy. Not only did the Royal Australian Navy (RAN) have the largest proportion of permanent full-time personnel but it also commanded the largest share of Australia's total defence budget, despite expenditure cut-backs which inevitably followed the end of World War I. Doctrinally the RAN was tuned to operate in close concert with the Royal Navy within an imperial defence construct. The Singapore naval base, which served as the lynchpin of Britain's (and hence Australia's) plans for the defence of the empire east of the Suez Canal from the 1920s until 1942, was equally part of a maritime strategy.

The RAAF was formed in March 1921 on the explicit basis of maintaining the capability to support both the RAN and the Australian Army. This injunction was, no doubt, intended as unifying balm after a protracted and bruising battle between Army and Navy to win endorsement for their competing post-war air schemes. Their debate ended with the government's decision in 1919 to have one separate Air Force serving the needs of both. Viewing the outcome purely in these terms, however, risks obscuring the fact that, from its earliest days, the RAAF had an underlying but rarely-articulated mission to assist the Navy in pursuing a maritime strategy for the defence of Australia.

Among the aircraft on the RAAF inventory in 1921 were six Fairey IIID floatplanes acquired from Britain to equip one of two planned seaplane squadrons under the initial organisational structure

of the new service. The units failed to materialise after the planned scheme was curtailed for financial reasons, but the floatplanes remained in periodic use at Point Cook, where they proved useful for conducting surveys over coastal waters, including the famous first flight around Australia in 1924. Although a training course for naval observers was started at Point Cook in 1923, it was realised that Air Force had no aircraft that could operate from the Navy's main warships. Since the Fairey IIID was too large and heavy to fit into the limited space available, efforts were soon underway to find a more suitable aircraft type to replace it.

The Supermarine Seagull III amphibious flying boats that entered RAAF service in 1926 were actually little better than the Fairey IIID in both size and performance, but they were better suited to the task of assisting the Navy's program for surveying the Great Barrier Reef —which became the main form of naval cooperation required of the RAAF for the next three years. The purchase of these aircraft was overtaken shortly afterwards by a government decision to also acquire for the RAN a 6000-tonne seaplane tender, HMAS *Albatross*, with a surprise for the RAAF when it learnt that it was required to supply the aircraft and operating personnel to put on board the new vessel. Putting the Seagull III into *Albatross* was an expedient which lasted from February 1929 until the ship was paid off from the RAN as an economy measure in 1933. During these years, however, Australia at least had the capability to conduct reconnaissance at sea, gunnery direction, torpedo spotting and survey work, all for the first time.

When first told in 1926 that it would be required to provide the aircraft for *Albatross*, Air Force set about drafting a specification for a new type of catapult-launched boat amphibian, but this failed to attract a manufacturer interested in building it—at least initially. By 1931, however, the Vickers Company in Britain had developed a design and asked the RAAF for a commitment to purchase. Although lacking any such authority, the Air Force chief gave the go-ahead and the result was that the RAAF received the first of 24 Seagull Vs in 1935. This aircraft (the first used by the RAAF with an enclosed cabin) proved useful not just for sea rescue work, but also carried bombs or depth charges, and soon won Vickers additional large orders from the RAF (which named the type the Walrus).

The Seagull V and Walrus aircraft, which the RAAF's No 9 Squadron operated off the RAN's cruisers, gave distinguished if unspectacular service until the squadron was disbanded in 1944. It was a sad statistic of the war that whenever the Navy lost one of its cruisers, it usually lost the RAAF detachment carried on board. The RAAF took casualties when HMAS *Sydney* was sunk in a clash with the German raider *Kormoran* in November 1941, when HMAS *Perth* encountered a Japanese invasion force in the Sunda Strait in March 1942, and when HMAS *Canberra* went down in the battle of Savo Island in August 1942. HMAS *Australia* also lost its Walrus and crew while attacking Vichy French naval forces at Dakar (in Senegal, West Africa) in September 1940. At least fifteen of No 9 Squadron's fatal wartime losses occurred during embarked action with the Navy.

In the preparations of the rearmament period before war began in 1939, the RAAF was also taking major new steps to strengthen its capacity to undertake long-range maritime patrols using land-based forces. From 1927 this role had been carried out mainly by two giant Supermarine Southampton flying boats based at Point Cook, but by the mid-1930s these were well and truly obsolescent. On the eve of World War II, the RAAF was in the process of raising a new maritime patrol unit (No 10 Squadron) equipped with giant long-range Short S25 Sunderland flying boats, to operate from a new seaplane base at Rathmines, on Lake Macquarie, New South Wales. Steps were in train to take delivery of the new aircraft as war began, causing the government to leave the squadron in England to fight alongside the RAF in Coastal Command.

Elsewhere within the RAAF, the Service had begun taking delivery from late 1936 of Avro Anson GR1 aircraft purchased from Britain. These twin-engine low-wing monoplanes, armed with bombs or depth charges, were considered suitable for coastal reconnaissance and had been adopted by RAF Coastal Command. Ultimately the RAAF would have over 1000 of these aircraft, though most were acquired for training rather than operational purposes. Late in 1938 the government had also approved the purchase of Bristol Beaufort aircraft, also from Britain, also for coastal patrol work, although none entered service before 1941.

The needs of fleet or naval cooperation, and the capacity to exert control over sea lanes and lines of approach to Australia, had demonstrably featured prominently in development plans for the

RAAF virtually throughout its first two decades. This is exactly what might be expected of a Service required to participate in implementing the maritime strategy which underpinned planning for the defence of Australia between the world wars.

Australian Air Power in the European Theatre, 1942-45

Key Points

- *Australia's initial contribution to the war in Europe was primarily as a training organisation within the EATS.*
- *Australian airmen in Bomber Command made Australia's greatest contribution to the Allied war effort in the European theatre.*
- *The dispersal of RAAF personnel throughout the RAF severely restricted the development of an Australian air power doctrinal foundation, and limited the sense of national identity.*

From April 1940, Australia was partner in a vast and ambitious scheme to provide trained aircrew to help Britain meet the challenge of defeating German and Italian forces in Europe. By the time the Empire Air Training Scheme (EATS) was wound up in March 1945, more than 37 000 young Australians had been dispatched to England and taken their place in units across the Royal Air Force (RAF). Under the terms of the EATS Agreement, 17 squadrons were designated as 'Royal Australian Air Force' once the number of Australians in them became a majority, although large numbers of Australians continued to serve outside these units, in more than 200 RAF squadrons.

About 10 000 Australian airmen took part in the bombing offensive against Germany, which was perhaps the greatest contribution made by Australia to the Allied war effort. Until the D-Day landings in France in June 1944, RAF Bomber Command was the only means available to Britain to strike deep into the German homeland, suppressing the enemy's war effort and tying up forces in air defence duties that would otherwise have been able to fight against the Russians. The losses from the bomber offensive were heavy and disproportionate. Although the 6500 RAAF airmen who lost their lives in combat during World War II represented about one-fifth of the deaths suffered by all three Australian Services in that conflict, fully 83 per cent of these men (5400) were killed in the European theatre alone.

And of those who died in Europe, two-thirds (3486) died while serving with Bomber Command.

A total of eight of the squadrons that were nominally-RAAF under the terms of the EATS Agreement ended up serving with Bomber Command—these being Nos 455, 458, 460, 462, 463, 464, 466 and 467. Three of these (455, 458 and 464) spent only a relatively short time with Bomber Command, but Nos 460 and 462 stayed there for their entire existence. As the RAAF's most distinguished heavy bomber unit, No 460 Squadron alone lost 1018 aircrew, which effectively meant that the entire unit had been wiped out five times over in the space of three years of combat.

The attacking bombers faced multiple threats, not only from Germany's highly sophisticated night fighter and anti-aircraft defence systems, but from the dangers of flying at night. Mid-air collisions, technical problems, and crew fatigue all contributed to the very high loss rate suffered by Bomber Command. During World War II an average of 2.3 per cent of aircraft were lost on each Bomber Command mission. On one occasion, 95 of 608 aircraft (or 14 per cent) were lost. Whether the results of the bombing campaign justified the appalling loss of life on both sides has been debated ever since.

From March to July 1943, Bomber Command launched an all-out night-time campaign against German industries in the Ruhr Valley. Three RAAF squadrons, Nos 460 and 467 with Lancasters, and No 466 with Halifaxes, took part in these raids. Beginning on 5 March, the offensive virtually eliminated the industrial centres of Dortmund, Dusseldorf and Cologne, and severely damaged Essen and Duisburg. Increasing numbers of available aircraft and the effectiveness of the Pathfinder Force (PFF) contributed to the success of the campaign. The most famous operation of the 'Battle of the Ruhr' was the low-level precision attack conducted by No 617 Squadron of the RAF on the night of 16–17 May, against the Mohne and Eder dams that supplied water and hydro-electric power across the Ruhr and helped control winter flood waters. Thirteen Australians took part in this celebrated 'Dambuster' raid. A total of 27 operations were mounted during the Ruhr Valley campaign, during which RAAF squadrons lost 45 aircraft.

In late 1943 Air Chief Marshal Sir Arthur ('Bomber') Harris, Commander-in-Chief of Bomber Command, planned the Battle of Berlin, involving air operations designed to cripple the German

capital and force Germany to capitulate. On 18 November 1943, in cooperation with the daylight bombers of the US Eighth Air Force, Bomber Command launched a campaign of night-time area bombing. The campaign was conducted in winter, when the long nights gave more hours of darkness to cover the bombers on their long trip to Berlin. Four RAAF squadrons—Nos 460, 463, 466 and 467—flew 785 sorties during the 17 operations mounted by Bomber Command.

The bombers battled adverse winter weather and Berlin's formidable air defences that included anti-aircraft artillery and *Luftwaffe* night fighters, working in unison with radar and searchlights. The Australian squadrons lost 41 aircraft through enemy action. The high Bomber Command losses lowered the morale of the surviving crews. This, in combination with the increased number of new, inexperienced crews being inducted to cover the losses, led to deteriorating effectiveness of the campaign at an ever-increasing cost in aircrew and aircraft. Berlin did not fall and the campaign concluded indecisively on 24 March 1944.

British doctrine at the beginning of the bomber offensive was overwhelmingly based on area attack, in which entire cities were devastated by high explosives and incendiaries. This policy was necessitated by the lack of target visibility, and poor and inconsistent bomb aiming accuracy. Numerous innovations, technical and tactical, led to a gradual improvement in the accuracy of bombing. The technical innovations included inventions such as the Norden bombsight, H2S radar and Oboe radio guidance. One of the tactical innovations was the formation of PFF, developed and led by Group Captain (later Air Vice-Marshal) Don Bennett, an ex-RAAF Australian, which performed the vital task of marking targets for the attacking bombers. With PFF guidance, the bomber crews were able to increase the percentage of strikes within five kilometres of the aiming point, from just over 20 per cent in early 1942 to 90 per cent by war's end.

Rarely have Australian airmen conducted strategic attack operations like those routinely performed by Bomber Command in 1942–45. Undertaking direct attack missions against German targets these aircrews were able to achieve strategic effects far in excess of similarly sized military forces, yet they paid a high price. However, since Australian personnel were widely dispersed within a huge allied

structure, they rarely had the opportunity to develop a mature and cohesive doctrinal grasp of air power.

Each year, in early June, a commemoration ceremony is held at the Bomber Command Memorial in the sculpture garden at the Australian War Memorial, Canberra, to pay tribute to the steadfast resolve, camaraderie and courage of those who served. This year, the Chief of Air Force will also be attending the dedication of the new Bomber Command Memorial in London's Green Park on Thursday, 28 June 2012.

First into Action in the Pacific War

Key Points

- *RAAF units were prepositioned in Malaya from mid-1940 to defend British Imperial interests and to deter Japanese aggression in the region.*
- *No 1 Squadron RAAF was the first Australian combat unit to go into action in the Pacific War.*
- *RAAF personnel, aircraft and support arrangements had to be prepared and ready to fight in the air with little, if any, notice. Preparedness and readiness remain just as important today.*

It is an interesting phenomenon that more Australians know of the Japanese surprise attack on the Americans at Pearl Harbor in Hawaii than of the RAAF's heroic defence of Kota Bharu on the Thai-Malay border in northeast Malaya, which commenced almost an hour earlier in real time. The Japanese offensive on that fateful day, 7 or 8 December (depending upon the International Date Line), actually involved seven coordinated attacks against British, American and Thai territory. Over the next 14 hours Malaya, Hawaii, Thailand, the Philippines, Guam Island, Hong Kong and Wake Island were attacked—in that order. The first commitment of Australian combat units against the forces of Imperial Japan occurred shortly after 0200 hours on Monday 8 December 1941 when seven Lockheed Hudson aircraft of No 1 Squadron RAAF attacked the Japanese Kota Bharu Invasion Force.

The Japanese air attacks against Hawaii were very much a surprise for the Americans, as no-one anticipated that the Japanese carrier fleet could avoid detection on its approach half way across the Pacific. In contrast, the attack against the British in Malaya was not a surprise at all. Considerable tension existed between the British and the Japanese empires during the 1930s but it increased alarmingly after the Tripartite Pact was signed in September 1940. RAAF units were deployed to Malaya in increasing numbers from mid-1940 in order to strengthen the British Imperial defences at Singapore and to deter Japanese aggression in south-east Asia.

Over the following 18 months four RAAF squadrons, Nos 1 and 8 with Hudsons and Nos 21 and 453 with Brewster Buffalo fighters, conducted maritime patrols and exercises in preparation for the much anticipated Japanese offensive. In July 1941, Group Captain John McCauley was given operational command of the RAAF units under the British Far East Command. On taking up his appointment he developed a reconnaissance plan to guard against any Japanese moves by sea into the South China Sea and the Gulf of Siam. In order to extend the coverage of the air reconnaissance, No 1 Squadron was moved to Kota Bharu in August and No 8 Squadron to Kuantan on 1 December 1941. McCauley's plan was activated in the days leading up to the Japanese invasion of Malaya and as a result the Australians in Malaya were well informed of the Japanese fleet's approach.

On 6 December 1941 two No 1 Squadron Hudsons searching the South China Sea off Malaya independently sighted the Japanese force about 260 nautical miles from Kota Bharu. As it was unclear whether these vessels were heading for Thailand or Malaya the Commander-in-Chief British Far East Command, Air Chief Marshal Sir Robert Brooke-Popham, decided he needed more accurate information of Japanese intentions before he could order any aircraft to engage. The Japanese split into three separate invasion task forces with the majority headed for Singora and Patani in southern Thailand. Three transports and eight escorting warships headed for Kota Bharu. After the war, records confirmed that a Catalina flying boat from No 205 Squadron RAF managed to find the Japanese force on 7 December but was shot down before it could send a report—this was Japan's first act of war. At dusk on the same day two Hudsons from No 1 Squadron observed Japanese shipping approaching Patani and Kota Bharu.

After midnight on 8 December, No 1 Squadron personnel were startled by the sound of naval gunfire coming from the direction of the Kota Bharu beaches. Air Chief Marshal Brooke-Popham was advised and he ordered all of No 1 Squadron's available Hudsons to launch an immediate offensive against the Japanese ships.

The first of six Hudsons took off at 0208 hours and a few minutes later released bombs over the Japanese transports. Although the anti-aircraft fire was very heavy, the crew managed to score two hits. The other Hudsons conducted individual attacks and several 250 lb bomb hits were observed. However, one Hudson (A16-94) was lost without

trace, with Flight Lieutenant John Jones, Flying Officer Ronald Siggins, Sergeant Graham Hedges and Sergeant David Walters onboard.

Over the next two hours No 1 Squadron flew another 10 sorties against the Japanese invasion force. Bombs were dropped, hits were observed and barges were machine gunned by the air gunners. Three Japanese transports were soon ablaze and one, the transport *Awagisan Maru*, exploded—it was the first Japanese ship of any type to be sunk in the war. Three of the crew of Hudson A16-19, Flight Lieutenant John Ramshaw, Sergeant Garet White and Sergeant Jeffery Coldrey, were lost but the aircraft's navigator, Flying Officer Donald Dowie, was pulled from the sea by the Japanese—becoming the first Australian prisoner of war in the Pacific War.

No 1 Squadron continued to fly sorties throughout the day, mostly to interdict the Japanese ground forces and their barges. Soon after dawn Hudsons of No 8 Squadron RAAF and Blenheims of No 60 Squadron RAF, both based at Kuantan, achieved some success against the retiring Japanese shipping in the South China Sea but they were too late to help in the defence of Kota Bharu.

The Kota Bharu airfield was attacked by Japanese aircraft flying from their newly established base in Thailand, causing a number of casualties. Japanese ground troops, although unable to capture the airfield due to determined resistance by British Indian troops, did set up pockets of snipers who soon made any movement by airmen in the dispersal areas and barracks dangerous. The five serviceable Hudsons were ordered to evacuate and around 1700 hours they departed for Kuantan loaded with as many squadron personnel as they could carry.

Efforts were made to destroy the abandoned aircraft, ammunition, stores and facilities at the Kota Bharu airfield before the rest of the squadron departed, and a few hours later the remaining No 1 Squadron personnel left by truck for Krai where they managed to board a train for Singapore. After the fighting the RAAF received some criticism from Army elements over its perceived 'flight' from Kota Bharu, however it was clearly better to withdraw what remained of the squadron to fight another day than to order these airmen to fight-on as untrained infantry against experienced regular Japanese troops.

The landings at Kota Bharu were some of the most violent of the whole Malayan Campaign. The Japanese losses included 150 onboard the transports and 350 inflicted during the short journey to the shore,

the majority of which were caused by No 1 Squadron air strikes. Seven RAAF aircrew lost their lives in this action.

Hudson engine retrieved in 1976

In 1976 Malaysian fishermen snared the remains of a Hudson aircraft engine in their nets off the coast of Kota Bharu. It was recovered and identified as the Pratt and Whitney radial engine from No 1 Squadron aircraft A16-19 which crashed into the sea after attacking Japanese shipping on 8 December 1941. The engine is now on display at the Australian War Memorial in Canberra.

The Bombing of Darwin 19 February 1942: The RAAF Experience

Shortly before 1000 hours on 19 February 1942, 188 Japanese carrier aircraft arrived over the port city of Darwin and began attacking naval and civil shipping, harbour facilities and the city itself. While RAAF Station Darwin was also attacked during this raid, it was clearly not the focus of the bombing, with the waterside area taking the brunt of the main attack.

This was not the case when a second wave of 54 land based bombers arrived two hours later. This attack was aimed directly at the air base, causing extensive damage to aircraft, the airfield and related base infrastructure. In these two attacks, together lasting less than an hour, at least 243 people were killed with approximately 320 wounded, eight ships were sunk with a further 25 damaged, and 23 aircraft destroyed.

The purpose of the attack on Darwin was to prevent the place from being used to support counter-attacks against the planned Japanese invasions of Timor and Java. In this the raid was extremely successful. At the cost of about a half-dozen aircraft, Darwin was neutralised—if only temporarily—as a base of offensive operations.

The RAAF experience of the Darwin attacks was both positive and negative. Errors in leadership, airbase design and

Key Points

- *The active and passive defence mechanisms of airbases are a product of initial design, investment in capability and sustained through well-trained and equipped personnel.*
- *The integration of surveillance and reporting systems into networks is essential, as is the training and exercise of the systems in order to refine their efficiency.*
- *While not the RAAF's finest hour, the experience of the Darwin bombing demonstrated the RAAF's growing capabilities as well as the enduring qualities of a majority of its personnel.*

capability were counterpointed with courage, professionalism and evidence of an emerging air force with strategic depth. While not the RAAF's finest hour, the Darwin experience is not the disgrace portrayed by popular myth.

Established only in 1939, RAAF Station Darwin was the first permanent RAAF presence in the far north of Australia and home to No 12 Squadron, consisting of a mixed establishment of Hudson, Anson and Wirraway aircraft. At the time of the attack the normal base complement was bolstered by elements of Nos 2 and 13 Squadrons that had withdrawn from the Netherlands East Indies. Yet while having gone onto a war footing, RAAF Station Darwin was still little more than a regional airfield with limited improvements to base infrastructure or personnel training necessary to provide some tolerance and defence against air attack.

This lack of preparation was despite warnings from a RAAF officer with extensive experience of Japanese air attacks on airfields in China. Squadron Leader Garnet Malley had witnessed the destructive force of Japanese air power and the vulnerabilities of airfields to aerial attack in the Sino-Japanese War, and he was well placed to advise RAAF station commanders on the passive and active defence options available to them.

Unfortunately, none of the recommendations made by Malley after visiting the Darwin base during 1941 were implemented prior to 19 February. The base's facilities were not 'hardened' against air attack, being vulnerable to direct and indirect blast and shrapnel damage. These shortcomings, coupled with the concentration of base facilities into one small area, ensured more extensive damage than would otherwise have been the case.

The RAAF's active defence measures were also similarly lacking. The 'fighter' force in Darwin consisted of a small number of Wirraway advanced trainers. While armed with two forward firing machine guns, these slow and relatively underpowered aircraft were never intended to be front line fighters. Even if the five Wirraway aircraft in Darwin had been serviceable, they would have been unable to intercept the bomber aircraft due to the lack of an efficient early warning and fighter control system.

The radar sent to Darwin to help establish such a system was still to be assembled (it was not operational until a month later), and

the lack of faith in radar's ability to locate and track incoming aircraft suggests a lack of education in the senior officers and training in more junior personnel. The overall lack of active defence measures was further underscored by the inadequacy of the anti-aircraft guns positioned around the airfield.

However, not every aspect of RAAF capability at Darwin was found wanting. Two emerging surveillance systems did in fact detect the incoming raids. Warnings were received from Melville and Bathurst Islands through an observation network, but unfortunately these sighting reports were taken for 10 US Kittyhawk fighters known to be in the area. Even so, the observation and coastwatch system around the north of Australia and throughout the south-west Pacific area would soon mature into a vital surveillance tool.

In addition to the observer network, the RAAF had a technology that also correctly predicted the incoming raid. A highly secret and covert radio interception section based at RAAF Station Darwin noted suspicious transmissions during the mid-morning. The intensity of signals then spiked alarmingly, followed by a total radio silence. The assessment of this radio traffic along with telltale bearing changes led the section to report that a raid was inbound. Here the secrecy and relative unknown capability of the radio interception section played against it, as their warning was not appreciated for what it was, and no action was taken. Like the observation network, the RAAF's radio interception and analysis capability was later to develop well beyond the rudimentary system in place at Darwin and make a significant contribution to Australia's intelligence services.

During the raid, many of the RAAF's personnel responded to the crisis admirably. The Administration Officer, Squadron Leader Andrew Swan, and Warrant Officer Chapman operated a Lewis gun throughout the first wave, supported by at least 50 other RAAF members who also engaged the enemy aircraft with machine guns and rifles. The first RAAF casualty of the raid was one of these defenders, Wing Commander Archibald Tindal, who was killed as he fired a Vickers gun from the edge of a trench.

When the first attack ended, Swan led a group of airmen into a burning hangar to retrieve ammunition from a store, while others secured an ammunition-laden truck away from other burning wreckage. All around the base personnel went to work endeavouring to

create order out of chaos. In the confusion after the final attack when an order to regroup half a mile from the base was misinterpreted by many as an evacuation order, Swan again took charge of the situation and managed to direct large numbers of RAAF personnel back to the base and on to essential recovery tasks. It is unfortunate that the achievements of so many RAAF members are overshadowed by the often-exaggerated stories of desertion and panic.

The air raid on Darwin was a wakeup call to many in Australia—in the age of air power, no country was safe from attack. In the reconstruction of Darwin, RAAF Station Darwin was built up with radar networks, command and control systems as well as a fighter wing, including the first operational Spitfire squadrons in Australia. Attacked an additional 63 times, Darwin never again suffered as it did on 19 February 1942.

Longest Fighter Intercept in History

Key Points

- *Targeting enemy military leadership is a legal and ethical objective among the range of effects which commanders may be tasked to generate within a battlespace.*
- *Precise and reliable intelligence is critical to conducting the time-sensitive operations entailed in pursuing military leaders that have been targeted.*
- *Only by optimising the unique characteristics of air power can such operations be successfully undertaken.*

On 18 April 1943, aircrews of the US Army Air Forces operating in the South Pacific pulled off one of the most spectacular coups in the history of air warfare. Taking off at 0720 hours from a base on Guadalcanal, at the southern end of the Solomon Islands chain, sixteen P-38 Lightning fighters fitted with long-range fuel tanks covertly flew north 300 nautical miles across open sea, deliberately avoiding all islands along their route and flying at no more than 50 ft above the waves, and successfully intercepted a group of Japanese aircraft approaching Buin on the southern tip of Bougainville Island.

In an aerial combat lasting a maximum of 10 minutes, the American fighters tore into the Japanese formation comprising two G4M1 bombers escorted by six Mitsubishi A6M3 Type 32 fighters. While most of the Lightnings engaged the fighter escorts, a designated team of American pilots attacked and pursued the two bombers, shooting both of them down—the first into the jungle a few miles from the coast, the second into the sea within sight of the airfield at Buin which had been their destination.

All on board the first aircraft perished, including the intended target of the operation Admiral Isoroku Yamamoto—the commander-in-chief of the Imperial Japanese Navy's Combined Fleet. Yamamoto was also the man reviled across the US as the mastermind of Japan's surprise air assault on the American naval base at Pearl Harbor, Hawaii, which had brought America into World War II eighteen months earlier. The aerial ambush of Yamamoto, hailed as the longest fighter intercept

in history, unleashed a torrent of debate and comment, though much of it conducted away from public view.

The mission which targeted Yamamoto with such precision had been possible only because of accurate and reliable intelligence regarding the Admiral's travel that day. This information had fallen into US hands by virtue of a top secret allied enterprise which involved breaking the codes that protected Japanese radio communications. It was this project that had handed allied intelligence the detailed itinerary of Yamamoto's planned visit to Buin, and enabled American air power to shoot his aircraft down.

Because signals intelligence (or SIGINT) was making such a valuable contribution to the joint allied war effort, it was recognised that knowledge of codebreaking successes had to be prevented from reaching the enemy. In this instance, though, the Americans decided that snaring a figure like Yamamoto justified the risk of alerting the Japanese, and thereby prompting them to make a change of codes which could throw allied intelligence analysts into the dark for a period of months. The intrusion of US fighter aircraft so deep into Japanese-held territory and so far from their bases, on that day and at that time, was to be explained publicly as the result of 'information from Australian coastwatchers'. They also continued to fly operations in the area for some time afterwards, to give the impression that the Yamamoto mission was not a one-off.

The decision to target Yamamoto deeply offended America's allies, who considered that they had an equal investment in the codebreaking operation and still regarded protection of the 'ultra secret' as paramount. British Prime Minister Winston Churchill was so incensed that he protested directly to US President Franklin Roosevelt. He could not believe that such highly sensitive sources had been put at risk 'in so venal pursuit as the killing of an enemy admiral'—something he regarded as an 'act of self-indulgence, not a military operation at all.' To reinforce his displeasure, Churchill ordered a long pause in negotiations which were then underway between Britain and the US for a regular and full exchange of SIGINT information.

At the heart of Churchill's complaint was his assessment that there was little point to killing an enemy commander like Yamamoto. The American rationale for going after the admiral was certainly not driven by consideration of necessity, based on the admiral's actual power,

command authority or strategic vision. Underscoring its true motive was the codename selected for the mission: Operation *Vengeance*. In later years this aspect would prompt some commentators to characterise such targeted killings as assassination, and something unethical even in time of war, although the weight of legal opinion still holds that because Yamamoto was a combatant he was a perfectly legitimate target.

The death of such a revered figure as Yamamoto was undoubtedly a huge blow to Japanese national morale. Following the return of his cremated ashes, he was accorded a state funeral in Tokyo on 5 June which was only the second for a non-royal person in Japan's history and attracted an estimated three million onlookers. But the impact of his loss soon passed. He was simply replaced as naval commander by another admiral whose performance (before he, too, died in a plane crash a year later) was arguably no better or worse—given the huge problems and limitations that Japan already faced in prosecuting its war aims.

While the point and justification to undertaking the military operation that resulted in the killing of Admiral Yamamoto might be in dispute, there is one aspect to that event that remains incontestable. The allied capacity to carry out such a mission in 1943 was due entirely to the unique characteristics of air power: penetration, precision, reach, and speed. Air power still provides the key to enabling such blows to be delivered today.

Six months after the killing of Yamamoto, the RAAF was involved in a very similar operation in the New Guinea area. On 2 October 1943 eight Kittyhawks of No 77 Squadron were sent on temporary detachment from Goodenough Island to Nadzab, near Lae, to fly escort for Boomerangs and Wirraways of No 4 Squadron conducting tactical reconnaissance for the Australian 7th Division in the Markham Valley.

When intelligence—almost certainly from intercepted radio communications—indicated that a Japanese general would be flying from Wewak to Rabaul on the morning of 6 October, the No 77 Squadron detachment was briefed to attempt to shoot down his aircraft as it passed over Karkar Island, a volcano off the north coast which lay along the general's expected flight path. After getting airborne at 0830 hours the Kittyhawks broke into two groups of four, each orbiting north

and south of the island from 0945 hours, but in the event no enemy aircraft turned up at the anticipated time.

As the headquarters of the Japanese 18th Army was at Wewak, the intended target of No 77 Squadron's unsuccessful mission was most probably Lieutenant General Hatazo Adachi. Having been spared Yamamoto's fate (for whatever reason), he survived the fighting in New Guinea and surrendered to allied forces at Cape Wom in September 1945. He suicided at Rabaul in September 1947, having been sentenced in July to life imprisonment for war crimes that included encouraging his men to kill captured allied airmen.

Double Sunrise Flights

Key Points

- *With RAAF support and expertise, Qantas successfully operated the longest commercial air route in the world under war-time conditions.*
- *The RAAF and Qantas combined resources to carry out a task that neither could achieve on their own.*
- *National air power maintained this international link so essential to the allied war effort.*

With the fall of Singapore in February 1942, the air route between Australia and Britain was severed, preventing the rapid movement of VIP passengers and government mail between the two countries. In early 1943 the British and Australian governments agreed that British Overseas Airways Corporation would conduct an air service between Britain and Karachi, while the Australian airline Qantas would pioneer a new route from Ceylon (now Sri Lanka) to Australia using Catalina flying boats. These latter flights, which became famous as 'Double Sunrise' flights because crew and passengers often saw two sunrises during the 30-hours plus spent in the air, were the longest commercial air service in the world at the time. Less well-known is the RAAF support that made these flights possible.

To avoid all areas controlled by Japanese forces, the route over the Indian Ocean was selected. As the Cocos Islands were within range of Japanese aircraft, they were considered unsuitable as a refuelling stop. Original planning had the route going from Exmouth Gulf, near RAAF Learmonth, to Royal Air Force Trincomalee, Ceylon, which was the shortest route and would have allowed the greatest payload to be carried. However, at the heavy weights that were necessary, take-offs were only possible from smooth water, so the route from Swan River in Perth direct to Lake Koggala, Ceylon, was chosen. This distance was 22 per cent longer than the next longest commercial air route, which was from Montreal, Canada, across the Atlantic Ocean to Scotland.

RAAF Catalina aircraft were fully committed to flying bombing and reconnaissance missions against the Japanese. However, Qantas

had spare aircrews that were experienced in pre-war flying boat operations on the route to Singapore. The British Government made available Catalina aircraft stripped of defensive weapons, de-icing equipment, oxygen system and all cabin insulation that was unnecessary, in order to save weight. To make the 8789 km journey, additional fuel tanks were fitted in the fuselage, so that with full tanks, a couple of passengers and some mail, the aircraft's take-off weight was 35 000 pounds-6000 pounds (2.7 tonnes) above normal. The loss of an engine in the first 10 hours would necessitate a forced landing in mid-ocean, with little chance of rescue.

The first of the Double Sunrise flights departed Perth on 29 June 1943, flown by Captain Russell Tapp, an experienced Qantas flying boat captain, and Senior First Officer Rex Senior. Rex had joined the RAAF in 1940 as a member of the first Empire Air Training Scheme pilots' course. After an operational tour on Sunderland flying boats with No 10 Squadron in the UK, he was posted to No 2 Air Navigation School at Nhill, Victoria, where he qualified as an astro-navigator. In early 1943, he volunteered for discharge so that he could take up a position on flying boats with Qantas, where he remained until after the war.

Qantas's only international route before the war was from Darwin to Singapore, which was largely flown in daylight hours following the island chain through the Dutch East Indies (now Indonesia). The Double Sunrise route was quite different. To prevent interception by Japanese aircraft, the Qantas aircraft flew the mid-ocean part of the route at night and operated the whole flight in radio silence. Navigating by the stars was the only practicable means of accurately guiding the aircraft under these conditions, but few Qantas crew members had these skills. However, many RAAF aircrew experienced in long oceanic flights over the Atlantic or the Pacific were ideal for the Double Sunrise service. On the first few flights, the co-pilots (such as Rex Senior) did the navigating, but within a few months, the RAAF seconded more than eight navigators to Qantas as well as a number of pilots experienced on flying boats. Despite being employed by Qantas, all crew on the Double Sunrise flights were members of the RAAF Reserve and wore RAAF flying suits over their Qantas uniforms.

Supplying aircrew was not the only support the RAAF provided. As Qantas had not operated Catalina aircraft before, the aircrew

for these flights were trained at No 3 Operational Training Unit, the Catalina training unit at RAAF Base Rathmines, located on Lake Macquarie, New South Wales. The Pratt and Whitney Twin Wasp engines from the Qantas Catalinas were overhauled at No 4 Aircraft Depot workshops at Boulder, near Kalgoorlie in Western Australia, alongside RAAF Catalina engines.

To fly an overwater air service of that length without accurate meteorological forecasts would have been a disaster. Forecasting for the air route from Perth to Ceylon was complicated by the fact that it stretched over two hemispheres and included both tropical and temperate regions (both with completely different weather patterns). Three RAAF meteorological officers, led by Squadron Leader John Hogan, maintained an around-the-clock service in Perth to provide the most accurate wind and weather forecasts that were possible at that time.

Later, when Qantas obtained B-24 Liberators for the Australia to Ceylon service, the days of the Double Sunrise flights were numbered. The faster, more comfortable Liberator could do the trip in 10 hours less than the Catalina and carry over four times more payload. On 17 July 1945 the last Catalina service took off from Lake Koggala for Perth. After making 271 crossings of the Indian Ocean without loss, the era of the Double Sunrise flights had come to a close. The Double Sunrise crews had carried 648 passengers and 18 tonnes of mail and priority cargo in defiance of the Japanese attempts to blockade the country.

The experience gained by Qantas in the Double Sunrise flights allowed the company to restart the major air routes that linked Australia with the world immediately after the war. This included pioneering the Pacific route to Hawaii and San Francisco. The flights were also invaluable to Australia, providing a fast, secure link to its major ally, Britain. By combining the strengths and resources of the RAAF and a commercial airline, a vital air service was established and maintained. It was a great example of an air force supporting an airline to carry out a strategically important task.

An Australian Airman at the Birth of Indonesia's Air Force

Key Points

- *WGCDR Noel Constantine is known as an Australian airman caught up in events that marked the founding of the Indonesian Air Force.*
- *There is misunderstanding whether his Australian origins also involved service with the RAAF, but he actually served only with the RAF.*
- *Both Constantine and his English wife perished in tragic circumstances during Dutch attempts to resist Indonesian independence in 1947.*

In Indonesia, 29 July each year is celebrated as 'Hari Bakti' (Day of Consecration) of the Air Force, initially known by the Bahasa acronym AURI and later as the TNI-AU. The date commemorates events in 1947 which saw the TNI-AU come into being during the struggle for Indonesia's independence against the Dutch, who were attempting to reimpose colonial rule over the former Netherlands East Indies (NEI) after Japanese occupation in World War II. It is not generally known—outside Indonesia at any rate—that a notable Australian airman of the war years featured in those events.

On 29 July 1947, eight days after the Dutch military forces invaded Republican areas of Java under the guise of a 'police action', the fledgling Indonesian air service struck back with dawn air raids against Dutch positions at Semarang, Salatiga and Ambarawa. Launched from an airfield at Maguwo, on the southern outskirts of Yogyakarta, the attacks were made against each place by lone aircraft. These were a single-engine Guntei monoplane and two Cureng (or Churen) single-engine biplanes left behind by the departing Japanese.

As soon as the third aircraft returned from its mission and landed back at Maguwo at 0620 hours, it was quickly concealed like the others—in anticipation that the Dutch would hit back. This reaction duly came at 0705 hours when two Curtiss P-40 Kittyhawks roared in

over Jogyakarta to deliver an intimidating display, although reportedly without causing any casualties. The Dutch were not finished, however, with retaliation for the attacks initiated from this area.

At 1730 hours that afternoon, a C-47 Dakota transport approached Maguwo from the west. The aircraft bore the civil registration VT-CLA, as well as the words 'Government of Orissa' indicating its Indian identity. The aircraft's owner was a member of the Orissa Legislative Assembly and a personal friend of India's prime minister, Pandit Jawaharlal Nehru. As it happened, the Dakota was arriving from Singapore with two tons of medical supplies provided by the Red Cross in Malaya.

After completing a circuit of the aerodrome, the aircraft lowered its undercarriage and commenced a landing approach. It was at this moment that two Dutch-flown Kittyhawks attacked, setting the Dakota's port engine on fire. Moments later the aircraft struck a tree with one wing and crashed into a rice field in the village of Ngoto Balanda at Bantul (west Maguwo).

Eight of the nine people on board were killed, including three 'pioneers' of the TNI-AU, along with Indonesia's Trade Consul in Malaya, and all three of the Dakota's crew: an Indian technician, the British co-pilot (ex-Squadron Leader Roy Hazelhurst), and the Australian pilot, Noel Constantine. The pilot's wife, Beryl, was also among those on board who died. The sole survivor was an Indonesian, the General Secretary of the Republican Ministry of Information.

The incident caused an international furore, not least because the Dakota's mercy mission had been previously announced in messages broadcast by both Radio Batavia and Radio Malaya, even though no prior arrangements had been made with the Dutch authorities for a safe passage. The Dutch attempted to claim that the unarmed aircraft was mistaken for a 'Helen', a twin-engined Japanese bomber similar to a type alleged to have been seen over Semarang during the air raids earlier that day.

The two Dutch pilots, who were named in the press, were both former members of the NEI fighter squadron which had served in Australia as part of the RAAF during the Pacific War. Their inability to identify the C-47, in broad daylight, as a type which other Dutch units had also operated as part of the RAAF as late as January 1947, lacked

credibility. So did their claims that they had fired only warning shots, and that the Dakota had actually crashed while taking evasive action.

Lieutenant Colonel Peter Ratcliffe, a British military observer in Yogyakarta who later spoke to the foreign media about what he had witnessed that day, described the incident as the 'most cowardly and single brutal action of folly I have ever seen or wish to see'. He said that he had viewed the corpses of the eight persons killed in the hospital mortuary that evening, and categorically stated that Mrs Constantine had been killed by a bullet through the left cheek.

Among the storm of protest which erupted, there were many assumptions made regarding Constantine's Australian connections. Even today, some Indonesian accounts refer to him as a former member of the RAAF, whereas in fact he never had any service or association with Australia's Air Force. His service in World War II was entirely as a member of the Royal Air Force (RAF). Even some Australian accounts confuse the details of his personal story. Until recently, no-one has troubled to sort out the fact from the myth.

Noel Constantine was born on 13 December 1914 at Moama, New South Wales, and educated at Albury High School and apparently at Cowes on Phillip Island, Victoria, before directly enlisting in the Royal Air Force in July 1938. The flying career that he subsequently enjoyed from December 1939 was entirely with the British service. In July 1940 he became a member of No 141 Squadron, with which he flew Defiants throughout the Battle of Britain.

Soon after his promotion to Flight Lieutenant was gazetted in September 1941, he left England for the India-Burma theatre, where—in April 1942—he was made acting Squadron Leader and given command of No 273 Squadron at China Bay, Ceylon (now Sri Lanka). In June 1943 he was posted to command No 136 Squadron (a Hurricane fighter unit) at Baigachi, Burma, shortly before the unit moved back to India to re-equip with Spitfire VCs.

It was only after the squadron began flying fighter defensive patrols and escort missions over Burma from December 1943 that he shot down the six Japanese aircraft that made him an 'ace'. Promoted acting Wing Commander in April 1944, he was placed in charge of Air Fighter Tactics until 1945, when he joined the headquarters staff in Delhi, India. It was about this time that he became pilot to Admiral Lord Mountbatten, the Supreme Allied Commander in South-East Asia.

Discharged from the RAF in December 1946, he was appointed unofficial civil aviation adviser to the Indonesian Government. So far as is known, he never became involved in civil aviation in Australia. His wife Beryl, a well-known London dress designer, moved to Singapore to be with him, leaving the couple's two children back in England. She was in the news in February 1947 for her criticism of local fashions while visiting Australia to make contacts for an export business she planned to open, and again in May, after the couple's home in Singapore was robbed of jewellery. Two months later, the Constantines were both dead, killed over Java.

Operation Trikora: Indonesia's Takeover of West New Guinea

Key Points

- *With supply lines reaching halfway around the world, the Dutch defence plan in WNG was logistically vulnerable.*
- *The demonstrated intent of the Indonesian government to initiate a large-scale air, sea and land campaign made the Dutch military position in WNG untenable.*
- *The use of air power in the three phases of the campaign demonstrated its deterrent capabilities by bringing diplomatic pressure on the Dutch government.*

In 1962, a military operation on Australia's doorstep resolved a territorial conflict that otherwise could have drawn Australia into a protracted war. Although this operation is virtually unknown outside Indonesia, air power played a decisive role in its conduct.

When the Netherlands government handed control of their former East Indies colony to the Republic of Indonesia in December 1949, they excluded the western half of the island of New Guinea which remained Dutch territory. From 1949 until 1961, the Indonesian government attempted to gain control of West New Guinea (WNG) through efforts in the United Nations. Since these attempts were unsuccessful, on 19 December 1961, Indonesia's President Sukarno announced Operation *Trikora* – the annexation of the territory by force.

The Indonesian operational plan had three phases: infiltration, exploitation and consolidation. The first phase involved the infiltration of troops by sea and airdrop, with the intention of forcing the Dutch to deploy their forces away from major centres. The exploitation phase was the invasion and seizure of key locations within WNG by a combined airborne and amphibious force. The consolidation phase was the gradual expansion of control to eventually encompass the whole of WNG.

Indonesia had been building up its Air Force since 1958 with the acquisition of Soviet MiG-15 trainers, MiG-17 fighters and Il-28 medium-range bombers. Additionally, 10 C-130B Hercules transport aircraft, six B-26 Invader bombers and 20 P-51D Mustangs were obtained from the US. In June 1961, Indonesian offensive capability was further increased by the arrival of Tu-16 Badger long-range bombers (including reconnaissance and maritime strike versions) and additional MiG fighters of later marks.

The Dutch defence of WNG was founded on a series of strong points that were to be reinforced with reserves from outside the province if threatened. Biak was the air defence hub and overall defence headquarters, with Sorong the second key airbase. The Dutch Air Force in WNG consisted of 12 Hawker Hunter fighters and 10 Neptune maritime patrol aircraft. The available air surveillance radars were insufficient to cover the large area to be defended. The weakness in the Dutch defence plan lay in its logistics. By retaining a colonial territory, the Dutch had alienated themselves from most of the Asian countries who were themselves recovering from their colonial past. Dutch naval ships were not welcome at most Asian ports, making resupply from European ports both expensive and slow.

Morotai in the Halmahera Islands was the major permanent Indonesian airfield in the area, but smaller airfields to the southwest and south of WNG were used as forward operating bases. Early in 1962, Mustang and Invader ground attack aircraft and C-47 Dakota transport aircraft were deployed to airfields at Morotai, Ambon, Amahai and Kai Islands. C-130 aircraft operated in a covert role from their permanent base in Java, and also used forward operating airfields close to WNG. A small number of MiG-17 fighters were based on Morotai for air defence missions.

On 15 January 1962, the first phase of Operation *Trikora* began, when three Indonesian Navy motor torpedo boats departed the Aru Islands on a mission to insert troops at Kaimana on the south coast of WNG. The boats were detected by Dutch Neptune aircraft and one was sunk by intercepting Dutch frigates. Despite the loss, seaborne infiltration continued, landing 562 troops on the WNG coast over the next eight months.

From April to August 1962, C-47 Dakota and C-130 Hercules aircraft flew 17 paratrooping missions, deploying 1154 Indonesian

troops widely across WNG. These missions were typically preceded by Tu-16 photo-reconnaissance flights. At the time of the drop, close air support by P-51 Mustang and B-26 Invader aircraft and deception flights by Il-28 Beagle aircraft kept the defenders occupied. Despite all the effort expended, the infiltration missions were not a success. Indonesia suffered 94 soldiers killed and 73 wounded in the guerrilla operations, which resulted in minimal damage to Dutch facilities. On 17 May 1962, an Indonesian C-47 was shot down by a Dutch Neptune near Klamono, with the loss of all crew and paratroopers.

By mid-1962, the level of Indonesian military activity increased significantly in preparation for the next phase in Operation *Trikora*. Strike aircraft deployed to Morotai and Ambon and began flying missions to probe the Dutch air defences. MiG-17s deployed to Morotai, Amahai and Kai Islands provided air defence cover to the west and south of WNG, but not over the entire area. In early August, a naval task force was assembled to make an amphibious assault to seize Biak Island, the Dutch military stronghold. Two Army parachute brigades (7000 men) were to secure the beachhead perimeter while a 4500 man marine brigade made an amphibious assault. Four infantry brigades (13 000 men) were ready to follow over the beach and secure the island. To divert attention from the amphibious task force, large-scale airdrops were carried out on 13 and 14 August at locations from Sorong in the northwest to Merauke in the southeast. Despite the diversionary tactics, Dutch Neptune aircraft detected the fleet heading for Biak and alerted the Dutch commander.

While Operation *Trikora* was occurring, secret negotiations were underway in Washington. The Kennedy administration, fearing that US opposition might push Indonesia toward Communism, sided with the Indonesians and applied pressure on Australia to do likewise. Unable to sustain a protracted large-scale conflict, the Dutch government gave in to diplomatic pressure. On 15 August 1962, both sides signed the New York Agreement, which gave control of WNG to Indonesia after a brief transitional period overseen by the United Nations. On the signing of the agreement, the second and third phases of Operation *Trikora* were cancelled and the amphibious task force returned to port.

The infiltration of Special Forces, the threat of air strikes, and the approach of an amphibious task force demonstrated the political will of the Indonesian Government. Whether Indonesia could have annexed

WNG is open to question. However, it is clear that the demonstrated intent to use military force influenced the negotiations that ended the conflict.

Operation *Trikora* was primarily based on the employment of air power. The three phases of the campaign were founded on air power's capacity to generate and sustain the military effort. Although the operations did not proceed to the third phase, the ability of the Indonesian Air Force to air drop and support forces on the ground contributed heavily to the diplomatic pressure that was brought on the Dutch government to handover WNG to Indonesia.

Integrated Area Defence System: 40 Years Old and Still Going Strong

Key Points

- *The air forces of Australia, Malaysia, New Zealand, Singapore and the United Kingdom have worked together harmoniously through IADS for 40 years.*
- *IADS has helped shape a secure framework for regional cooperation on the Malay peninsula.*
- *RAAF officers at HQ IADS have gained valuable operational command and staff experience within a coalition environment.*

On 11 February 1971 the Headquarters of the Integrated Air Defence System (HQ IADS) was formed at Butterworth air base in Malaysia under the command of Air Vice-Marshal Ron Susans of the RAAF. Over the past 40 years, IADS has been an important mechanism for the cooperative defence of Malaysia and Singapore. As the main instrument for coordinating military action in defence of the Malay peninsula, it has helped build security in the region.

In 1967 Britain announced its intention to withdraw military forces from territories it had formerly governed 'east of Suez'. Two years later US President Richard Nixon announced the 'Guam Doctrine', which made it clear that America expected its regional friends and allies to contribute more to their own security. As a result, the newly independent nations of Malaysia and Singapore had to find the means to provide for their own defence. Australia and New Zealand, recognising that stability in South-East Asia was essential for their own security, also had to rethink the basis for their own continued military involvement in the region. In 1970 Britain guaranteed that it would not entirely abandon the region; instead, 'a modest presence in the Far East' would be retained.

A series of talks between Australia, Britain, Malaysia, New Zealand and Singapore began in June 1968, and concluded in April 1971 with the Five Power Defence Arrangements (FPDA). Although

none of the parties specifically committed themselves to military action in the defence of Malaysia or Singapore, it was expected that ongoing consultation and cooperation between the services of each nation would generate a strong military partnership which added to the overall security of the region.

In the FPDA talks defence ministers had acknowledged that the defence of Malaysia and Singapore was indivisible, and it was decided that a single headquarters, IADS, would be established to organise the air defence of both nations. The Commander of IADS was given emergency powers to employ assigned forces against surprise attack, although in practice the role was limited to the command of HQ IADS and did not include control of the various national forces. As such, IADS was the operational cornerstone of the FPDA.

Six months after HQ IADS was formed, it was declared operational on 1 September 1971, even though the FPDA did not formally come into effect until 1 November of that year. Under the terms of the agreement covering IADS, Australia provided the commander of a staff drawn from each of the FPDA nations. As a consequence, when Air Vice-Marshal Susans vacated the post of Commander in 1974, he was replaced by the first of another 16 senior RAAF officers who have held it since. The current Commander, Air Vice-Marshal Warren Ludwig, took up the reins only in December 2010.

From the start of IADS consensus has been the keyword, for although the Commander was delegated great power he operated under a formal directive issued by an Air Defence Council (ADC), and the ADC chairmanship was rotated every six months between Malaysia and Singapore. These two nations exercised the leadership role, and ensured that IADS always met their national interests.

As the Royal Malaysian Air Force (RMAF) and the Republic of Singapore Air Force (RSAF) developed and matured, the IADS evolved and rapidly established its reputation as the focal point of the region's air defence capabilities. By late 1972, the Commander IADS was responsible for two major Air Defence Exercises (ADEXs) and two minor ADEXs annually, centred on Butterworth and Tengah. A no-notice air defence exercise (*Kumpul*) was also added to test the readiness of the air defence units assigned to the FPDA. In addition, HQ IADS planned and coordinated a program of air defence training to meet each nation's requirements.

The effectiveness of IADS has evolved gradually over time. The conduct of air operations and exercises was simplified and made significantly safer when combined IADS Air Defence Instructions were approved in 1976. The scope and complexity of the ADEXs also increased rapidly, the major ones growing from two to four days, to the extent where they needed to be carefully coordinated to manage disruption to civil air operations.

All IADS exercises have been constructed around the defence of Malaysia and Singapore rather than on offensive operations. One success followed another and, although achievements were kept very low-key, the air defence of Malaysia and Singapore improved considerably. By 1981, the mature RMAF and the RSAF were able to take on much more of the load, and the other three nations reduced their FPDA contributions accordingly. While Australia based two Mirage fighter squadrons and a rifle company at Butterworth, New Zealand maintained a single squadron and a battalion in Singapore, while the UK contribution was limited to visiting units.

During the 1980s the first Malaysian officer was appointed to the new Deputy Commander IADS position and a Singaporean officer filled the Senior Air Staff Officer position, now Chief of Staff. RMAF fighter aircraft replaced the two RAAF Mirage squadrons at Butterworth—No 75 Squadron departed in 1983, and No 3 Squadron in 1986. Since then, Australia has sent aircraft such as F-111s, F/A-18 Hornets and P-3 Orions to both Malaysia and Singapore for the duration of each FPDA exercise.

As the scope of FPDA activities expanded, land and naval activities were also incorporated within the exercises, and IADS became increasingly 'joint' by including Army and Navy on the staff. During 2001 the acronym IADS was redesignated to refer to the 'Integrated Area Defence System' and has concentrated on building interoperability. Subsequently IADS has been the glue that has held the region's network of military capabilities together.

The *Bersama* series of FPDA exercises were introduced in 2004, partly in response to the new security environment that emerged after the 9/11 terror attacks on the US. They are now some of the most advanced military exercises conducted in the region. Last year Exercise *Bersama Padu 2010* included 14 ships, 66 aircraft and about 3000 personnel, and once again demonstrated the professionalism of

the forces of the FPDA nations. The very presence of such FPDA forces provides a measure of stability throughout the region, and by extension also helps to protect other nations that have adjacent maritime zones in the neighbouring seas.

IADS has been working to protect Malaysia and Singapore for 40 years. Although largely unsung, it has shaped a secure framework for international cooperation in the region which, as the 21st or Asia-Pacific century progresses, seems likely to only increase in importance. In all of this, the RAAF has played a crucial role, providing the professional guidance which has helped maintain stability while the regional partners developed their own forces and skill levels. Hopefully, IADS can continue its constructive function well into the present century.

Operation Gateway: Prosecuting Soviet Naval Movements in the Cold War

Key Points

- *The RAAF presence in the Indian Ocean and South China Sea strengthened our relationship with friends and partners in the region, and helped to deter Soviet aggression.*
- *RAAF maritime surveillance aircraft detected, tracked and identified Soviet submarines during the later stages of the Cold War under Operation Gateway.*
- *Maritime surveillance and anti-submarine warfare remain essential capabilities for the defence of Australia and its interests.*

The Soviet invasion of Afghanistan in late 1979 was a wake-up call for Australia. Prime Minister Malcolm Fraser warned that the Soviets had 'virtually pushed détente aside', and if Russia took control of Middle East oil then the Australian economy could be destroyed. The ability of the Soviet Union to direct military power into the Indian Ocean was not only posing a threat to our friends and partners in Southeast Asia, it threatened Australia and its interests. Australia's response was to offer the US military support.

Early in 1980, Fraser offered US President Jimmy Carter access to Australian military facilities, including use of the naval base at Cockburn Sound in Western Australia and staging facilities in Darwin for B-52 bombers. In addition, 'Australia would need to further develop its role and relationships in the Southeast Asian and South Pacific regions as part of overall policies directed at minimising Soviet influence in these regions.' Although the RAAF had conducted maritime patrols in the Indian Ocean, on and off, throughout much of the 1970s, Cabinet agreed that it was now necessary to bolster defence activities in the Indian Ocean with the continuous deployment of RAAF long range maritime patrol aircraft.

Operational planning commenced on 18 February 1980 when No 92 Wing was advised that Government policy to increase

surveillance of the Indian Ocean included a long term detachment of P-3 Orion aircraft to RAAF Base Butterworth in Malaysia, subject to Malaysian Government concurrence. Operational support activities to set up a Butterworth detachment commenced in March, including upgrades to the Operations Room and communication facilities, while discussions with Malaysia were underway. On 3 December the Malaysian Government agreed to the deployment of up to three P-3 Orions at Butterworth. This was the genesis of Operation *Gateway*—the deployment of RAAF P-3 Orion aircraft to conduct maritime surveillance of the Indian Ocean, Straits of Malacca and the South China Sea.

Operation *Gateway* commenced on 1 February 1981 when the first detachment of 35 personnel from No 11 Squadron, flew into Butterworth with the first P-3 Orion. Two days later, 11 aircrew arrived on a second P-3. Group Captain Graeme Smith was the first commander of the detachment from No 92 Wing at Butterworth. Flying operations commenced on 5 February and continued with routine patrols conducted on five or six days each week. At the end of their 30-day deployment, detachment personnel and aircraft were rotated with others from Nos 10, 11 or 292 Squadrons. In this way, the Operation *Gateway* aircraft were able to maintain a strong presence over the neighbouring waters throughout much of the year.

The P-3 Orion was originally designed for detecting surface and sub-surface threats. During the later part of the Cold War this aircraft type was a critical deterrent in the never-ending struggle to detect, localise, track, and identify Soviet submarines—a process known as a 'prosecution'. RAAF Orions were able to 'prosecute' Soviet submarines before and after they transited the Straits of Malacca, frequently cooperating with US Navy P-3s and warships that continued to prosecute the same targets once they left the RAAF's designated area of responsibility. These missions were carried out with all the determination that would normally be associated with attacking enemy surface and sub-surface targets during time of war, short of live weapons release.

The first of many submarine prosecutions undertaken under Operation *Gateway* commenced on 21 February 1982 with the crew of a P-3 Orion from No 10 Squadron prosecuting a Soviet *Echo II* class submarine. Over the next five days Orion crews used radar

and sonobuoys to detect, track and identify the submarine. Soviet submarines, running on the surface and accompanied by one or two escort vessels, would take four or five days to transit through the Straits of Malacca before entering the western Indian Ocean. The RAAF aircraft from Butterworth would follow the submarine's progress with daily relocates, while a third aircraft would be deployed from RAAF Base Edinburgh for the duration of the activity.

Throughout the surface transit, acoustic data would be gathered to assist in the submerged tracking phase which would follow. 'Sinker' (the activity of the submarine submerging) would normally take place during darkness, with the Soviets employing a variety of deception tactics to hinder the ongoing surveillance of the submerged submarine. Under-surface tracking by aircrews had varying success, ranging from immediate loss without further contact to extended tracking, loss, and then regaining of contact. Soviet submarines would use various countermeasures to prevent successful underwater tracking, such as using sonar to confuse and jam the sonar picture, deploying sound decoys, explosive jammers and mechanical noise makers.

As Australian P-3 aircrews prosecuted Soviet submarines and their escort vessels, they were illuminated by radar, and even fired at with flares. The Soviets either stopped to collect the disposable sonobuoys that the Orions dropped, or else used small arms fire to sink them. On one occasion in October 1982 the crew of a RAAF aircraft believed that small arms fire was directed at them, although probably more for show than effect. On an earlier occasion, during a night sortie in June 1982, an aircraft was struck in the searchlight by a flare fired from either a Soviet *Victor III* class nuclear submarine or its escort. Tension remained high during every prosecution, and when RAAF aircraft were illuminated by Soviet fire control radar there was little chance of avoidance if the Cold War suddenly turned hot.

The Cold War ended in 1989 but Operation *Gateway* continues to this day with a new focus on maritime security. Although the level of commitment has reduced since the early 1980s, RAAF P-3 Orion aircraft continue to make a significant contribution to regional security by monitoring normalcy patterns, conducting anti-piracy patrols and helping to train the Royal Malaysian Air Force in maritime surveillance. It remains an important part of Australia's commitment to the Five Power Defence Arrangements.

Aircraft Gifts to Regional Forces

Key Points

- *Ex-RAAF Mustang, Sabre and Dakota aircraft, with training and spare parts, have been donated to a number of air forces in the Asia-Pacific region.*
- *Former RAAF Iroquois and Sioux helicopters were also donated to regional defence forces.*
- *Gifting of aircraft strengthens regional stability and enhances Australia's relations with its neighbours.*

When the RAAF was formed on 31 March 1921, most of its aircraft had been donated by the British Government (see *Pathfinder #145*, p. 97) for the purpose of assisting Australia with the establishment of an air service. Without these gifted aircraft, the RAAF would have had little, if any, operational capability in its first years. Like the British Government in 1919, the Australian Government in more recent times has seen the value in making aircraft gifts to assist neighbouring countries to develop their air forces.

Improving a nation's ability to defend its territory contributes to that country's stability, and the stability of countries in our region is very much in Australia's interest. However, aircraft on their own do not provide any capability. Without the trained personnel to operate and maintain them and without adequate spare parts and weapons, aircraft are a liability rather than an asset. For this reason, the gifts of former RAAF aircraft have usually come with training for aircrew, groundcrew, and in many cases logistic personnel, as well as a supply of aircraft spare parts.

The RAAF's first gift of aircraft to another air force was small but significant. In April 1951, No 77 Squadron (77 SQN) flew its last Mustang sorties over Korea and withdrew to Japan to re-equip with the jet-powered Gloster Meteor. At a ceremony at Iwakuni air base in Japan in November 1952, two ex-77 SQN Mustangs were gifted to the Republic of Korea Air Force to add to the ex-USAF Mustangs already being flown in combat.

In April 1969, the Australian Prime Minister announced that 10 ex-RAAF Sabre Mk32 fighters would be gifted to the Royal Malaysian

Air Force (RMAF), which at that time had no air combat capability. As a sub-sonic, first generation jet fighter, the Sabre was outclassed by supersonic aircraft such as the Mirage III and the MiG-21, but it provided a useful training and combat capability.

In May 1969, 12 ex-77 SQN Sabre aircraft, tools and spares were taken over by the newly-formed RAAF Sabre Advisory Flight at Butterworth and the training of RMAF personnel on the Sabre began. The first of 10 Sabres was handed over to No 11 Squadron, RMAF, in October 1969, adding a new capability to the RMAF. A Sabre flight simulator and two other non-flying airframes were also supplied as training aids. Another six Sabres were gifted two years later, making a total of 18 aircraft. They continued in RMAF service providing valuable introductory fighter training and experience until replaced by F-5E aircraft in 1972.

The easing of tension between Australia and Indonesia in the early 1970s led to the gift of 18 Sabres to the Indonesian Air Force (TNI-AU) in February 1973. In addition to the aircraft, the gift included aircraft spares, a flight simulator, air traffic control (ATC) radio transmitters and a radio direction finder to provide ATC with an instrument approach aid. The training package included formal training of 150 TNI-AU personnel at RAAF Base Williamtown and a team of RAAF personnel in Indonesia for three years to provide on-going aircrew, technical and logistics training.

Over a 10-day period in February 1973, 18 Sabres were flown from Williamtown to Iswahyudi Air Base in Java via Mt Isa, Darwin and Bali. RAAF pilots from No 2 Operational Conversion Unit flew the aircraft to Bali where they were handed over to the TNI-AU pilots for the last leg to Iswahyudi. One Sabre was damaged in an accident at Bali, but within days was replaced by another aircraft flown from Australia. In July 1976, an additional five Sabres were obtained from Malaysia and donated to Indonesia to cover attrition losses. The RAAF Sabre Advisory Unit remained at Iswahyudi conducting training until 14 February 1975, when it disbanded. The Sabres were flown by No 14 Squadron, TNI-AU, until 1982 when their role was taken over by ex-US F-5Es, A-4Es and British Hawks.

RAAF C-47 Dakota aircraft frequently proved to be useful gifts to other air forces in our region. Their ruggedness and ability to operate from rough airfields, and the ready availability of spare parts,

made them an ideal general transport aircraft. In November 1971 the Australian government made a gift of five ex-RAAF Dakota aircraft to the Cambodian Air Force. Another two aircraft were gifted to the Philippines Air Force in February and May 1973 to augment their existing Dakota fleet. Over the period 2-6 September 1973 two ex-RAAF Dakotas were flown from East Sale to Halim Air Force Base, near Jakarta, by RAAF crews and handed over to Indonesia for use as navigation trainers.

When Papua New Guinea became independent in 1975, the formation of an air transport force within the Papua New Guinea Defence Force (PNGDF) was a high priority. In a country consisting of many islands and jungle-covered, mountainous terrain, air transport was the only rapid way of moving ground forces, police and government officials around the country. In 1974, PNGDF members began training in Australia as pilots, loadmasters and aircraft technicians. Three Dakota aircraft with PNGDF markings were flown to Port Moresby in August 1975 to provide the initial air transport capability, with a fourth aircraft gifted in January 1976. The gift also included spare parts and ongoing training of air and ground crew. Another two aircraft and one airframe training aid were donated in 1981.

To expand its capability to support ground forces, the PNGDF was also gifted four Iroquois helicopters in August 1989. Although these aircraft had been in RAAF service, they were transferred to Army aviation regiments several months before being handed over to Papua New Guinea. As with other aircraft gifts, the Iroquois came with spare parts and training. Another gift of ex-Army aircraft occurred in 1978 when 12 Bell 47 Sioux helicopters were gifted to the Indonesian Army for use as training aircraft.

As an air force that started its life with a gift of British aircraft, the RAAF has, on many occasions, seen the value in assisting its neighbours with gifts of aircraft and training. The value of these gifts is returned to Australia in terms of regional stability and strong relationships with neighbouring air forces.

Air Power and Coercive Diplomacy: A Historical Perspective

Key Points

- *The inherent characteristics of air power make it a credible tool for the government to use in support of coercive diplomacy.*
- *The range of options available for the employment of air power in a coercive diplomacy role is broad and can also be carried out concurrently with wider military activity.*
- *There is no one template for the employment of air power, each situation demands a unique response.*

Coercive diplomacy, often cited as the 'hard power' part of what is normally a polite interaction between governments, is the threat of military force to resolve points of contention between states. As detailed in *Pathfinder #177*, (see pp. 27–30) air power's inherent characteristics of reach, flexibility and responsiveness has made it a powerful coercive instrument in diplomatic negotiations.

The ready threat posed by air power has been demonstrated throughout the history of aviation. The ability of air power to bombard cities and seats of government had become a point of political discussion well before any such capability actually existed. Growing concerns in Europe about the destructive potential of air power led to the Hague Convention of 1899 that prohibited aerial bombardment of cities from balloons. Later, the Hague Convention of 1907 extended such prohibitions to heavier than air aircraft. Likewise, the broader public's fear of air power being used to transport enemy troops directly into a nation's capital was exploited in literary works such as H.G. Wells' book, *The War in the Air*, published in 1908. Against such a backdrop of historic concerns regarding the use of air power directly against national interests and the general population, it is not surprising that the threat of air power has become an important element of coercive diplomacy.

The spectrum of military, and especially air power's, contribution to coercive diplomacy is extremely broad, and ranges from the effects of enforcing sanctions offensively through to selective attacks on key targets to demonstrate political resolve or to prevent an adversary from exercising coercive options of their own. Examples of the employment of air power over the last 100 years serve to illustrate the potential of air power in support of diplomatic initiatives.

The Australian decision, in 1963, to purchase the F- 111, changed the balance of power within the region. The range, offensive potential as well as the precision strike capability of the F-111, represented Australia's resolve to protect national interests with force. That resolve was clearly expressed through both the political willingness and the resource allocation to acquire such a capability. As Australia was one of the few countries the US was prepared to sell the F-111 to, the sale illustrated a healthy relationship between coalition partners, each prepared to contribute to shared security goals and strategies. Any potential adversary had to contend with the F- 111's operational threat as well as a significant strategic partnership.

A more direct application of diplomatic coercion through the threat of air power was illustrated in February 1938, at a time of heightened tensions between Austria and Nazi Germany over the forced unification of the two countries. When the Austrian Prime Minister, Kurt Schuschnigg, refused Hitler's demands to include a Nazi sympathiser in the Austrian Government, Hitler's response was to suggest that the *Luftwaffe* would enjoy visiting Vienna 'like a spring storm'. The German threat to bomb Austria's capital had credibility because Germany had already demonstrated a willingness to attack a national capital when it conducted a three year bombing offensive on London during World War I. Further, the German *Luftwaffe* was already demonstrating an ability to attack cities as part of its operations in Spain. Fearful of the consequences, Schuschnigg agreed to Hitler's more immediate demands.

While Hitler had the advantage of creditability when negotiating with Schuschnigg, the process of coercive diplomacy at times needs to be emphasized with example. Through the selective and scalable application of air power, limited military force can be applied, and then withdrawn to lend weight to diplomatic discussions. In 1999, when Serbian forces under the leadership of Slobodan Milošević

were carrying out ethic cleansing operations in Kosovo, all normal diplomatic negotiations failed to stop the atrocities. Consequently, NATO began an air campaign that targeted Serbian ground units operating in Kosovo as well as selected Serbian communications, infrastructure and industrial targets.

The air attacks mounted within Serbia were more than just a demonstration of resolve, each target was a financial asset of Milošević's inner cycle of supporters. Prior to the destruction of these targets, the owners were sent messages via text, e-mail and fax, informing them that the asset targeted for that night would be destroyed, and that it would be in their best interests to encourage Milošević to withdraw from Kosovo. This 'crony targeting' strategy conducted in concert with the diplomatic pressure being applied to Serbia was ultimately successful. Bereft of a power base, Milošević was subsequently handed over to face the international courts at the Hague in 2001.

The Milošević example also illustrates the sometimes-difficult demarcation line between where coercive diplomacy stops and military operations start. However, within the complex environment of international conflicts, these activities can be concurrent, with the military campaign carefully orchestrated to align with and support the diplomatic effort. The first significant example of this concept in which air power was the central military component directed in support of political activity was during the terror bombing of London by German Zeppelins and fixed wing bombers in World War I.

In December 1914, a German airship attacked mainland England. Following this minor raid, the German Kaiser personally directed a steady escalation of aerial attacks that first targeted the Thames estuary and progressively moved into central London. While hardly accurate, the attacks were not intended to cause mass destruction, but rather influence British public opinion and force the United Kingdom to seek a separate peace with Germany.

In 1917 when German fixed-wing bombers attacked London for the first time in daylight, the public outcry was enormous. There was a very real threat that the population, already fatigued by three years of war would force the Government into seeking terms with Germany. By a narrow margin, the British Prime Minister, Lloyd George was able to convince his Cabinet colleagues and the population to continue with the war—and to unify the Royal Flying Corps and Royal Naval Air

Services to form the Royal Air Force in order to better deal with the aerial attacks on the United Kingdom. While unsuccessful, the German bombing campaign is an example of a coercive strategy being directed at Government level quite independent of other military operations.

History shows us that air power can be an effective tool of coercive diplomacy. In the complex environment of international relations, its use must be carefully tailored to meet each specific case—there is no one template that can be applied to all situations. Importantly, history has shown that air power is just one response option, and that it must be used as part of a broad suite of options to be truly effective.

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