

AIR POWER STUDIES CENTRE

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WEAPONS WIN WARS

by

Wing Commander Alan Curr
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THE AIR POWER STUDIES CENTRE

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Australia's strategic guidance advances a policy of defence self-reliance and affords priority to the defence of the nation within the capabilities of the existing force. The Australian Defence Force (ADF) must be militarily able to prevent an enemy from successfully attacking in the air and sea approaches, gaining a foothold in Australian territory, or extracting political concessions through military pressure. Since air power is the dominant element of combat power in modern warfare,¹ the path for the future of the RAAF, which will have considerable leverage on the defence of Australia, heralds the necessity for the RAAF to be equipped with an inventory of technologically advanced air-delivered weapons. As Air Marshal Funnell, then Chief of the Air Staff, noted: 'At the sharp end, where military power is delivered with all of its potency, there will be new equipment purchases but little change in operational concepts'.² Emphasis on a greater apportionment of resources to the combat elements will emphasise the focus on the war winning qualities of the RAAF.

Reflecting the remarkable advances in the operational capabilities of the contemporary fighting aircraft, the pervasiveness and flexibility of air power in today's combat environment were vividly apparent in the 1991 Gulf War. But highly sophisticated aircraft are only as capable as the weapons systems with which they are fitted; and integral to the qualitative edge of an air force are the capabilities of these systems and competency in employing them. Defence budget planning should include the regular procurement of air-delivered weapons to replace training rounds and maintain contingency stocks, and the periodic purchase of new weapons that enhance the effectiveness of existing platforms. In procuring weapons for the

¹ Air Marshal R.G. Funnell, 'The Essential Place of Air Power in an Uncertain 21st Century', *Smaller but Larger: Conventional Air Power into the 21st Century*, Alan Stephens (ed), Canberra, 1991, p. 9.

² Air Marshal R.G. Funnell, 'Defence '91', *The Australian*, 28 June 1991.

RAAF, defence planners should, in general terms, evaluate target types in accordance with endorsed concepts of operations and identify the appropriate weapons for those targets, assess the weapons that are available for purchase, and propose affordable solutions.

DEFENCE IN DEPTH

Langtry and Ball claim that ‘it would be the height of foolishness if Australia were to adopt a military posture which did not give priority to holding, and preferably destroying, an invading force on the high seas or in the air before reaching Australia.’³ This is the layered strategy of denial which emphasises the need for sound intelligence and surveillance capabilities in support of air and naval forces capable of operating effectively in the air and sea approaches to Australia.⁴ However, there are three major limitations with this strategy.⁵

First, such a strategy fails to deny sanctuary to an enemy. Unless denied the opportunity, an aggressor can find sanctuary elsewhere beyond the Australian approaches, whether on the high seas or on expropriated land. The inference that Australia needs to employ wide strategic reach should not be interpreted as an unqualified advocacy of targeting an enemy’s homeland.

A further difficulty of employing a denial strategy concerns disproportionate response. Incursions by an enemy against Australia’s strategy of denial could translate into a series of feints or traps aimed at wearing-down Australia’s air and sea defences. Once again, Australia’s alternative is to reduce vulnerability by incorporating the flexibility to respond with wide strategic reach.

³ J.O Langtry and Desmond Ball, ‘Development of the Australian Defence Force’, in *Strategy and Defence*, edited by Desmond Ball (Sydney: George Allen and Unwin, 1982), p. 273.

⁴ Paul Dibb, *Review of Australia’s Defence Capabilities*, Australian Government Printing Service, Canberra, 1986, p. 5.

⁵ For further discussion on the strategy of defence in depth, see Group Captain B.J. Espeland, ‘Why Defence in Depth?’, *Australian Defence Force Journal*, No. 89 July/August 1991, p. 7.

The third drawback to a strategy of denial stems from the need for Australia to mix the two general operational patterns of strategy that underpin the conduct of war—sequential and cumulative. Sequential strategy refers to a series of discrete steps, each dependent on the preceding one while cumulative strategy defines an accumulation of operations until their effect is critical. Restricting the scope of warfare to the air-sea gap, as prescribed by a strategy of denial, would preclude the development of an enabling cumulative strategy.

In view of the limitations inherent in a strategy of denial, the appropriate strategy for Australia is defence in depth. Mobile conventional military forces will engage in the continental defence of Australia, air and naval forces will deny an enemy access to the air-sea gap, while long range strategic air and naval forces, capable of operating beyond the approaches to Australia, will aim to ensure that control of the threat environment is not lost to the enemy. A selection of air-delivered offensive weapons that can threaten an aggressor's infrastructure and war fighting capability, with a high probability of damage, is essential if Australia is to deter potential enemies. As Air Marshal Gration, when Air Commander Australia, asserted: 'The ability to take the offensive strike initiative will remain a part of our deterrent posture if our strategic concept is not to be reduced to a simply reactive and defensive one, incapable of positively resolving a conflict on our terms'.⁶

⁶ Air Vice-Marshal I.B. Gration, 'Use of Air Power: Needs and Expectations', *Smaller but Larger: Conventional Air Power into the 21st Century*, Alan Stephens (ed), Canberra, 1991, p. 152.

AIR POWER ROLES TO MEET STRATEGIC GUIDANCE

The roles for the RAAF in contributing to a strategy of defence in depth are defined in the Air Power Doctrine Manual, the AAP1000. Before evaluating the appropriate generic weapons types for the RAAF inventory, the offensive roles will be summarised.⁷

Counter Air⁸

Offensive Counter Air (OCA). OCA is an offensive role that aims to deny an enemy control of the air by attacking his air power both in the air and on the ground. To allow an enemy to gain the initiative and force a defensive or reactive effort would result in a gradual contraction in Australia's defence capacity. The objective should be to gain the initiative and present an enemy with those same problems that Australia would face if the ADF remained reactive.

Destroying aircraft on the ground has been, historically, the most widely recognised OCA mission in attacking an enemy's air defence infrastructure and assets. However, in OCA offensive strike missions, as with any bombing campaign, target selection is most important. Command and control infrastructure, radars, ground-to-air weapons systems, or aircrew and support personnel may be more appropriate targets, especially if the enemy's aircraft are dispersed in hardened aircraft shelters.

Another OCA option is the offensive fighter sweep, which has particular appeal for operations in the air-sea gap and the proximate land areas. In its most benign form, an offensive fighter sweep consists of probes beyond a declared Air Defence Identification Zone into international airspace to deter a potential aggressor from similar probes. Once conflict has escalated, the range of fighter sweep options increases significantly. Random and dedicated sweeps over a projected area of operations could achieve local air superiority;

⁷ These definitions of the roles are either contained in the *Air Power Manual* or have been developed at APSC and will be recommended to the Air Power Doctrine Board for inclusion in the second edition of the Air Power Manual.

⁸ The author acknowledges assistance from Group Captain A.W. Titheridge, Officer Commanding No 81 Wing, in refining the descriptions of OCA, DCA and SEAD as proposed for inclusion in the second edition of the *Air Power Manual*.

fighter sweeps could sanitise local airspace for coordinated offensive air strike missions into enemy sovereign airspace.

Defensive Counter Air (DCA). DCA involves the employment of a combination of passive and active measures to nullify or reduce the effectiveness of an enemy air attack. The effectiveness of an air defence system is heavily dependent on its surveillance and early warning systems to provide time in which to marshal an appropriate response to the enemy's initiatives. This response usually entails committing a range of weapons systems against the threat. The primary task of fighter aircraft is to intercept and identify unknown tracks and, if so authorised by rules of engagement, destroy the intruding aircraft. To prosecute and neutralise intruders, interceptors should be armed with superior air-to-air weapons systems that increase the probability of victory.

Suppression of Enemy Air Defences (SEAD). SEAD is usually identified with suppression of ground-based air defence systems; but it also includes the task of fighter escort and involves the protection of friendly air assets against interference from enemy fighters, either as a tied escort (in formation with the strike package) or detached (operating in support). SEAD would be used predominantly to support aircraft in the OCA role or on Strategic Strike operations. SEAD may employ physical (hard kill) or electronic (soft kill) means to attack the radar component which is usually integral to air defence weapons systems. Electronic means of suppression involve the various forms of jamming, for example, deception, barrage and spot. Physical means of suppression incorporate the use of traditional unguided bombs, or an array of 'smart' weapons, primarily anti-radiation missiles, which home on the emissions of hostile radars.

In large air forces, specialist aircraft are dedicated to SEAD; for example, the USAF F4-G Wild Weasel which employ ECM and high-speed anti-radiation missiles (HARM), and the EF-111A Raven. Dedication of platforms to SEAD is not a practical or economical proposition for smaller air forces.

Nevertheless, the RAAF must expect that any target worth attacking will be well defended and therefore, will require some measure of enemy air defence suppression.

Strategic Strike

Strategic strike enables the ADF to seize the initiative and to take the war to the enemy. For Australia, land and maritime strike and interdiction are central to the Air Strike campaign. These capabilities provide significant deterrence and offer the Government a choice in projecting power into the air-sea gap. Land and maritime strike can be pre-emptive and discriminatory. The roles are suitable for all levels of conflict and may be used positively to contain escalation. Interdiction would likely be employed in the air-sea gap with the ADF dictating the tempo and timing of battle. Strategic strike is designed, through attacks on targets under the enemy's sovereignty, to weaken his capacity and will to fight. Air power would aim to degrade the industrial capacity of the enemy to wage war and logistics support to fielded forces which would ultimately fracture their combat cohesiveness.

Land Strike. The most effective use of air power in land strike is to concentrate attacks, in unpredicted and unexpected ways, against targets of high value. The RAAF land strike capability is discriminatory; firstly, in the targets selected, and secondly, in confining collateral damage through the use of Precision Guided Missiles (PGMs). Aircraft availability will always be at a premium. Therefore, techniques, tactics and procedures that enhance stand-off capabilities, night capability, 'smart' weapons, and self-defence equipment, and thorough training are essential. A need for SEAD, whether provided by escorting aircraft or by the strike aircraft's integral equipment and weapons could be anticipated.

Maritime Strike. Maritime strike for Australia is the application of air power against enemy naval targets not in contact with Australian or allied forces but posing an indirect or longer term threat. The element of surprise on which land strike can capitalise through terrain masking is less likely to be achieved in the maritime strike role. Stand-off weapons which permit the strike aircraft to remain outside the defensive perimeter of enemy shipping throughout the launch sequence are crucial to minimise attrition.

Any conflict in which Australia was threatened would be predominantly maritime in nature. The ability to contain escalation through precise offensive action that does not unduly jeopardise assets is a capability which the RAAF must possess because of its limited resources. This will necessitate, as with land strike, an emphasis on attrition management through stand-off capability and crew training. Direct control weapons (where the crew maintains positive control of the weapon until impact) with a high probability of target discrimination are germane to maritime operations in the archipelagic waters to Australia's north and east.

Interdiction. Interdiction is the application of air power against enemy lines of communication to cut and disrupt the flow of resupply and support assets. In Australia's circumstances, where the ADF may have to defend against and defeat a larger aggressor, or where it may be faced with widely dispersed defensive operations, the aggressor must not be permitted an uncontested supply of fresh troops and logistics support to the battle area.

The RAAF is generally well prepared for conducting interdiction—penetrating enemy rear areas, including staging bases, and attacking enemy lines of communications as it seeks to deny movement of appreciable quantities of personnel and material to the surface battle area. Interdiction of enemy lines of communication will primarily be conducted in the air-sea gap.

Combat Air Support - Maritime Environment

Anti-Submarine Warfare (ASW). While the threat to Australia from submarines is considered low, the commitment to ASW is compounded by the vast ocean surrounds, Australia's dependence on shipping and the disproportionate demands ASW imposes on air assets. Even though the need to hunt and kill submarines may not be paramount in lower levels of conflict, the use of the submarine by an enemy in low-level conflict for infiltration purposes should not be overlooked. One submarine could seriously disrupt coastal or international shipping over a considerable area of the Region of Direct Military Interest (RDMI). In general, the mere inclusion of submarines in an enemy's Order of Battle necessitates an ASW capability, especially for an island nation such as Australia that relies so heavily on seaborne trade.

The problem posed by the modern submarine is formidable. It can cruise submerged at high speed for long periods and, by virtue of its high underwater speed, maintain contact with surface forces while submerged, and attack without unduly advertising its position. The problem is further compounded by the threat posed by the missile-firing submarine. Since there would appear to be no alternative for the RAAF except to maintain ASW proficiency, the long lead times in acquiring ASW expertise and capable assets must be recognised.

Anti-Surface Warfare (ASuW). In the event that enemy warships pose a threat to Australian merchant shipping or RAN warships, they may have to be sunk or neutralised. The responsibility for this offensive action could involve surface or sub-surface elements of the RAN or RAAF aircraft. The commitment of RAAF strike, fighter or MPA assets would depend on the circumstances, such as the capability of the threat, priority assigned to that threat and aircraft availability. Anti-ship missiles with extended range and high probability of kill against surface shipping can be carried and delivered by a number of RAAF aircraft types.

Combat Air Support – Land Environment

In the air-land battle several enduring principles have evolved through history. Control of the air is a prerequisite; coordination with surface forces is essential for mutual safety; and the shock effect of air power can compensate at the critical moment for inferior numbers on the ground. Recent technological developments in the self-defence of surface forces, including radar controlled anti-aircraft artillery (AAA) and surface-to-air missiles (SAMs), have introduced a potent defensive ‘umbrella’ over ground forces. While these air defences have altered the operational and tactical calculus which governs air operations in support of land forces, effective tactics can thwart those air defences. Furthermore, in the air-land battle, the allocation of resources to technology and training, and imagination and ingenuity in operational planning, can enhance the prospects for a small air force with limited assets.

Close Air Support (CAIRS). CAIRS describes air attacks against hostile targets which are in close proximity to friendly land forces. Such missions require detailed integration with the fire and movement of those forces. This is a classical role of tactical air forces and, because it provides a visible and immediate contribution to the land battle, it is sometimes considered as

the primary and most effective method of assisting ground forces. However, its effects are local and may not constitute the most efficient use of available resources which will often not be sufficient to satisfy all tasks. CAIRS should not be employed on targets which are within range of weapons organic to surface forces unless those surface-to-surface weapons are incapable of accomplishing the task or the urgency of the situation demands fire support from all available weapons.

The effectiveness of CAIRS is dependent on the timely acquisition of the target and accurate attacks. The problem of target acquisition is sometimes compounded by the high speed of aircraft employed in the CAIRS role, the terrain in the vicinity of the target and the hostile air defence ground environment which may necessitate one-pass attacks at very low level. Furthermore, the traditional method of providing CAIRS via low level operations over the battlefield can be difficult to conduct in bad weather or at night and will not be without risk to friendly forces. Finally, CAIRS aircraft can expect to remain highly vulnerable to modern, shoulder-fired SAMs.

The RAAF should be able to provide air support in most weather conditions, day or night, with minimal risk of platform attrition. By using technologies such as precision weapons systems (including PGMs), Global Positioning System and ring laser gyros, ground forces and aircrews will be able to coordinate CAIRS from much greater distances and altitudes—that is, the aircraft can remain outside the range of battlefield SAMs—without loss of accuracy.

Battlefield Air Interdiction (BAI). BAI is conducted within the land battle area and encompasses air action directed against enemy forces and resources that are in a position to directly influence the land operation. BAI is most effective when one's own ground forces apply pressure to enemy forces compelling them to expend supplies. However, BAI can also have a more direct influence on the surface battle through the timing of its effect. Whether enemy reinforcements are denied to, or diverted from the immediate battle, the outcome would be similar—an advantage accrues to one's own forces.

The RAAF maintains a significant capability for BAI through the intrinsic capacity of its combat assets. As the level of conflict increases, the availability of those aircraft best suited to BAI may be curtailed as they are assigned to objectives with a higher priority. Alternatives in these circumstances would include diverting combat aircraft on an opportunity basis in transit to or from primary missions or using training aircraft that have a BAI capability. While this latter option may carry the risk of high attrition, the level of conflict and the consequences may well warrant the decision.

WEAPON CHARACTERISTICS

If the ADF is to be capable of applying the strategy of defence in depth, it is clear from the preceding discussion that suitable weapons are essential. Some of the features that should be examined in the evaluation of air-delivered weapons will be considered.

Multi-Target Compatibility. Due to the high cost of modern weapons their application should not be restricted to single target types. All possible target sets over the full spectrum of conflict must be considered in the weapon procurement process so that the RAAF does not commit funds to munitions with limited utility.

Aircraft Compatibility. A desirable feature for future RAAF weapons is that they are compatible for carriage and release with as many combat aircraft types as possible. The AGM-84 Harpoon which can be carried by the P3C, F111C and the F/A 18 is an example of such versatility.

Carriage and Release Parameters. Future weapons must have an extensive operational flight envelope. The RAAF cannot afford to compromise the performance of its aircraft through restrictions on the carriage and release parameters of weapons. Employment of the weapons must feature a broad range of speeds at low and high altitude.

Insensitive Munitions. Technological advances in the field of explosive ordnance have resulted in the development of a range of munitions which are less vulnerable than current weapons to accidents or deliberate attack. Categorised as Insensitive Munitions (IM), they remain effective in their intended application but are less sensitive than their predecessors to external stimuli such as heat, shock or blast. The ADF is expected to endorse a policy on IM in the foreseeable future. These munitions will not offer any appreciable improvement in weapon effectiveness but will enhance safety in weapon storage, transport, handling and actual use.

OPERATIONAL CONSIDERATIONS

Weapon Target Matching. In the process of validating the suitability of a particular weapon and an appropriate quantity for purchase, the weapon effort planning cycle must not be neglected. The aim of matching weapons to targets is to achieve the desired level of damage for the least number of sorties while minimising the risk to the weapons delivery platform. Of course, with the long procurement lead time and the training cycle for most modern weapons, this appreciation may tend to be imprecise since many target sets are forever evolving and not rigid. The process follows a logical sequence:

- a. defining the strategic objective;
- b. target selection and functional analysis;
- c. determining the optimum weapon and fusing for the target; and
- d. estimating the ‘over-the-target’ requirement to meet the required level of damage.

Aircraft Survivability. Modern Integrated Air Defence Systems with an overlapping array of SAMs and AAA present a formidable threat to attacking aircraft. A strike aircraft will be afforded the best chance of surviving in a modern air defence environment if the weapon

release point is outside the range of the enemy threat. Stand-off range and altitude of release are dominant considerations.

Also of considerable impact on aircraft survivability is the probability that the desired level of damage will be inflicted on the first pass. Reattacks to redress the failures of first strikes are notoriously hazardous for aircraft and crew. Critical to the success of a strike is the accuracy with which the weapon can be delivered. Accurate and timely battle damage assessment is also critical so that unnecessary second strikes are avoided.

The Law of Armed Conflict (LOAC). LOAC explicitly states that military action is only justified if the humanitarian or environmental trauma is proportional to the military advantage. Although advances in weapon aiming systems have improved the accuracy of unguided air-delivered munitions, collateral damage cannot be discounted. This will especially be a consideration if the tactical freedom of the delivery aircraft is restrained by enemy actions and/or target identification is difficult.

The definition of indiscriminate bombing in Article 51(4a) of Protocol I to the Geneva Convention clearly requires an attacker to employ a method or means of attack which allows the attack to be directed at a specific military object. This may have a profound effect on the types of weapons which can be used to engage targets. Article 51(4a) could be used to argue that PGMs must be employed against military objectives where there is a possibility of collateral damage to civilians or civilian objects.⁹

⁹ Squadron Leader M.J. Gordon, *Protocol I to the 1949 Geneva Conventions and the Implications for Australian Air Power*, Air Power Studies Centre, Paper No. 3, April 1992, p. 19. For a further explanation of the impact of the 1977 Additional Protocols to the Geneva Conventions on air warfare, see Wing Commander E.E. Casagrande, *Air Bombardment and the Law of Armed Conflict*, Air Power Studies Centre, Paper No. 10, February 1993, pp. 13–19.

WEAPONS

Many of today's weapons systems require elaborate base logistics support. These engineering and maintenance resources must feature centrally in weapons procurement decisions when cost and capability are balanced against numbers; the cost of sophisticated weapons will limit quantity. Capabilities and numbers must reflect projected threats, employment concepts and training stocks.

Preferably, weapons will be readily deployable and easily maintained in the field (with a minimum of support); if they are not so, their limitations will be immediately obvious in combat, especially if maintenance support is restrained. Of consideration also is interoperability with allies (in combined operations). Modern weapons are very expensive. A small air force could only expect to afford a limited inventory of high technology weapons and may need resupply from a friendly power at short notice.

If Australia is to capitalise on the decisive military advantage of modern air delivered weapons systems, and wishes to avail itself of the logistics support that is accessible through the ANZUS alliance, then continued purchase of US-sourced weapons would appear prudent. There are some exciting technological developments in aircraft weapons systems currently in progress or on the 'horizon'. Weapons with genuine all-weather capabilities, autonomous and affordable smart weapons, and interchangeable seekers that span multiple frequency bands are typical of research and development programs.

OCA. For OCA attack, a range of stand-off weapons will be required to minimise attrition. Specialised penetration weapons such as the Mk 84 I-2000 bomb fitted with precision guidance kits are necessary for attacking hardened aircraft shelters and for bunkered command and control facilities. General Purpose bombs, cluster weapons and cannon fire are suited to aircraft in the open and radar and communications antennae and arrays.

Offensive Sweep. Offensive sweep requires air-to-air weaponry of superior quality to that of the enemy and, since usage rate could be expected to be high, of sufficient quantity. Effective

‘beyond visual range’ (BVR) and all-aspect short range missiles, as well as the gun, comprise a generally acceptable package.

SEAD. The impact of anti-radiation missiles on attacks against modern air defence and SAM radar systems was clearly demonstrated in the Gulf War. Since dedicated Electronic Warfare (EW) aircraft are beyond the resources of small air forces, the solution for the RAAF is to capitalise on the multi-role capability of its strike aircraft and equip them with the weapons that have a SEAD capability. For example, the F-111C force could be employed with a mixed weapons load which included suppression weapons such as HARM. A stand-off capability is essential to SEAD operations.

Strategic Strike. To successfully prosecute strategic strike, the RAAF must be equipped with a 24 hour day/night capability and a broad range of air-to-surface weapons including precision with which to limit collateral damage. Training and retention of complex aircrew skills will incur expense in peacetime, but not to do so would result in high attrition and quickly reduce capability in conflict.

Land Strike. The F-111C, with its impressive radius of action and diverse weapon carrying capacity, is the RAAF’s premier land strike asset. Explicit weapons policies must be formulated to exploit the formidable capabilities of this aircraft, the life-of-type of which will be extended to 2020 with an avionics update and the purchase of additional airframes over the next few years. An observation from the Gulf War was the impact of high-technology weapons systems and training on all three air power campaigns¹⁰; the efficacy of PGMs—a very affordable force multiplier for the RAAF—was clearly established. A stand-off capability, such as that provided by the AGM-130, will be necessary if ground-based missile/AAA systems have not been contained. While accuracy of weapon impact will always be important, once control of the air has been gained, delivery altitude and release distance from the target will not be critical—the crew will be free to select delivery profiles as they desire without fear of interference.

¹⁰ As espoused in the *Air Power Manual: Control of the Air, Air Bombardment and Air Support for Combat Forces*. (Air Bombardment will be retitled Air Strike and Air Support for Combat Forces retitled Air Support in the second edition of the Air Power Manual).

Maritime Strike. Weapons employed against ships must be inherently manoeuvrable so they can accommodate target velocity after launch; this requirement leads logically to missiles. Given the high incidence of neutral shipping and the prevalence of islands and atolls in Australia's area of interest which would seduce missiles, fire-and-forget, non-discriminatory, long-range, stand-off weapons have limited application. Missiles whose flight path can be manoeuvred until impact (their flight path can be deliberately altered if late recognition of the point of impact indicates it is not the intended target) are an obvious solution.

ASW. A skilfully conducted submarine offensive is a highly flexible threat which can be switched rapidly from one area to another. The main weight of the offensive can be deployed from one side of the ocean to the other; or individual submarines can be switched at reasonably short notice from one target to another. Whilst timing is not of the same order as can be achieved with an air offensive, a submarine force is able to deploy and re-deploy in almost complete secrecy. Therefore, in order to counter this form of offence, an equally mobile and flexible defensive force is needed to detect, identify and localise enemy submarines and, in wartime, to attack and destroy them.

CAIRS/BAI. The balance on the contemporary battlefield favours the inexpensive but effective SAM and the sheer mass of small arms fire against the capable and high speed, but nevertheless vulnerable, modern multi-role aircraft. While the balance can be swung in favour of the aircraft through the use of stand-off techniques and weapons and judicious use of attack helicopters, over-the-target operations still favour the defence.

TRAINING

Training must be recognised as pivotal to the total professional development process. People are the decisive factor in war and how they use the equipment will usually have a greater impact than the equipment itself. The capabilities of modern weapon systems are accompanied by complexities for air and ground crews that can only be mastered through regular and realistic training.

The complexity of the weapons systems fitted to RAAF aircraft requires intensive training programs for the personnel who fly and maintain them; and retention of the skills requires regular training. Crews must train with, and maintain expertise in, the weapons systems that they will employ in conflict. The concept of aircraft being fitted ‘for but not with’ particular weapons—which implies the intention to acquire and become familiar with the weapons at short notice, in preparation for conflict—is inconsistent with the level of competence and familiarity with the systems that would be required for operations, as well as with Australia’s policy of defence self-reliance. While this philosophy may save money in peacetime, in the early periods of combat the risk of attrition and degraded accuracy could be expected to increase through a lack of aircrew proficiency with the particular systems.

If the RAAF is to capitalise on the flexibility and accuracy of PGMs and modern missile systems, then training must be realistic as well as regular. F-111C, F/A 18 and P3C aircrews need to regularly release and guide the weapons so they are proficient in the aiming and delivery procedures. This need for ‘hands-on’ training not only applies to aircrews; maintenance personnel must also receive regular and practical training in assembling, testing and loading the weapons.

To generate confidence that the equipment and hardware will function correctly in combat requires a rational allocation to training stocks. Furthermore, since the rationale for training programs is to prepare an air force for combat, it must be focussed on the ultimate goal of fighting to win. Crews need access to bombing ranges that are approved for high explosive weapons and laser operations.

It will be too late to qualify aircrew and maintenance personnel on sophisticated weapons systems once conflict has commenced. The skills required to effectively employ these systems on combat operations cannot be acquired at short notice. Yet an effective response to short notice military pressure and tension may be expected of the RAAF. The implications are clear: training for, and exercising with, long lead-time skills are essential. Military forces must train as they plan to fight; exercises must emphasise free-play scenarios that address flexible problem solving, rapidly changing situations, operations with degraded capabilities and the actual delivery of weapons. And, at the ‘end of the day’, performance must be

rigorously evaluated to expose weaknesses in force structure, operating procedures and capabilities.

CONCLUSION

The pervasiveness and impact of air power on contemporary warfare is, to a large extent, attributable to the capability of modern weapons systems. Weapons can be delivered with pinpoint accuracy, day and night; current research promises to extend operations to all-weather conditions, no matter how inclement. There are many variables to be considered in the process of selecting the appropriate range of weapons and delivery systems for the RAAF; from the geo-political and threat environment to weapon/target matching, affordability and maintainability. The devastation that modern, precision-guided, air-delivered weapons can inflict is indeed awesome; these weapons will often be the preferred choice in the pursuit of limiting collateral damage and minimising civilian casualties. There are costs associated with the introduction of any system into service; they must not be neglected in cost-benefit analyses and the deliberation processes that are intrinsic to capital equipment purchases for the RAAF. Technologically sophisticated maintenance and support equipment, regular and realistic training programs for both air and ground crews, and high procurement costs illustrate the elements that constitute a weapons system beyond the physical hardware. If the RAAF is serious about ‘devoting attention to specific doctrinal aspects in order to best achieve the objective of air power’, as claimed in the Air Power Manual,¹¹ then the modern and highly-capable generic weapons systems that have been addressed in this paper are dominant components of the RAAF imperatives: *Qualitative Edge* and *Attrition Management*.

¹¹ AAP1000 (1990), *The Air Power Manual*, Air Power Studies Centre, Canberra, p. 98.

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