SPECIAL REPORT

ASPI

Contested skies

Our uncertain air superiority future

Peter Layton

January 2018

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Cover image: A United States Air Force F-35A Joint Strike Fighter flies in formation with a Royal Australian Air Force KC-30A Multi-Role Tanker Transport during boom refuelling trials in the United States. The F-35A is equipped with symmetrical external stores for this trial.

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INTRODUCTION

Since the end of the Cold War, Western air power has dominated the skies, but that's rapidly changing. Peer competitors and armed non-state groups alike have been seemingly so impressed by Western air power that they're developing their own. Our use of the skies is now contested, and we now need to be able to counter potential adversaries' use of the air.

Australia appears well placed for this emerging challenge, given our extensive air, maritime and land combat re-equipment plans. However, those plans, and the new major systems being acquired under them, originated more than a decade ago, when America was palpably *the* unipolar power. Strategic circumstances, operational doctrines and technology are now considerably different from the early 2000s and are continuing to evolve in concerning directions.

This paper doesn't take a top-down approach that works from some imagined future to suggest a new force structure. The future, as is often stated, is uncertain and becomes more so the further into the future you scan. Instead, I take the ADF's planned force structure—or at least that which is in service or being delivered within the next several years—as a given. Working from this known point, I analyse our air superiority capabilities relative to others to better understand their broad effectiveness. I then develop three strategic options that are practical in terms of the extant force structure, although I suggest some possible modifications in two of the options.

This approach may seem problematic, but strategy is a practical art; reality bites, and arguably air superiority matters. Strategic ends can't be determined independently of the capability 'means'. Instead, the two are interdependent. When the means are fixed, it makes sense to discuss alternatives that might reasonably bring strategic ends into alignment.

OUR STRATEGIC SETTING

Even so, our strategic options are not unconstrained. Just as the *2016 Defence White Paper* (DWP) built on what earlier white papers had constructed, so our future strategic options are bounded. The strategic options suggested here fall within the broad 2016 DWP—and more recent *2017 Foreign Policy White Paper*—strategic settings rather than being radical, incompatible new alternatives.

The 2016 DWP directed Defence to use three equally weighted 'strategic defence objectives' to guide force structure and force posture decisions:

- the defence of Australia
- making effective military contributions to the security of maritime Southeast Asia and the southwest Pacific
- contributing military capabilities to coalition operations supporting the rules-based order globally, albeit with a clear stress on the Indo-Pacific region.

Importantly, these objectives are to be met with the force structure and funding elaborated in the 2016 DWP, which looked out some 20 years to 2035.

In defence planning, a distinction's sometimes made between the military capabilities a nation has and its intent. As the old saw observes, capabilities take decades to develop but intent can change overnight. Given the global scope of the strategic defence objectives, it's problematic to attempt to ascertain intent across multiple nations. Instead, as in Australian force structure planning in the 1980s and 1990s, the focus in this paper is on discussing capabilities. The problem is eased by an assumption in such planning methodologies that comparing one's own capabilities against the most effective capabilities in the region of interest can provide useful insights, including by revealing capability gaps.

In the Indo-Pacific, the most capable air superiority forces—beyond those of our close alliance partner, the US—are those of the People's Republic of China. Chinese air superiority capabilities are therefore a useful benchmark to use when considering the relative effectiveness of Australia's air superiority capabilities. Only Chinese military capabilities impinge upon all three areas covered by the three strategic defence objectives, especially given China's building of new airfields and other facilities across southern parts of South China Sea. In this analysis, using a single benchmark, rather than multiple ones, helps to simplify the discussion.

Importantly, it must be noted that China's air superiority capabilities aren't unique. Many capabilities that China possesses are also fielded by others across the globe. Moreover, new operational doctrines and technologies tend to quickly proliferate globally. What China has now, many more others may have tomorrow, and will certainly have by 2035.

This paper doesn't assign hostile intent to any nation, but instead focuses on capabilities. Others have addressed the intent issue and come to somewhat alarming conclusions: 'Australia's strategic outlook is deteriorating and, for the first time since World War II, we face an increased prospect of threat from a major power.'[1] That's a judgement call, not a quantifiable fact, although it's made by very experienced strategic thinkers. In suggesting three strategic

alternatives, this paper simply aims to allow the reader to make similar judgement calls on the options presented. Different readers with different value sets will undoubtedly prefer different options. Judgements will vary between people, but the relative effectiveness of military capabilities is a more tangible matter.

This paper concerns air superiority, which is doctrinally defined as 'that degree of control of the air by one force that permits the conduct of its operations at a given time and place without prohibitive interference from air and missile threats, including cruise and ballistic missiles.'[2] This abstract definition has important practical aspects: air superiority is a condition, not a mission; it can be limited in time and space; it includes unmanned systems such as rockets and missiles, not just manned aircraft; and it's fundamentally all about force protection.

Classically, air superiority options fall into two broad categories: offensive counter-air operations in which an adversary's air capabilities are attacked before they launch to attack us; and defensive counter-air operations in which our fighters try to shoot down adversary air capabilities that have launched to attack our forces. In more functional terms, this becomes a simple matter of 'Can we penetrate their airspace to attack them?' and, conversely, 'Can we defend our airspace to stop them attacking us?'. These two issues lie at the heart of air superiority matters.

PENETRATING HOSTILE AIRSPACE

The quintessential ADF offensive counter-air asset is the soon to enter service: the F-35A Lightning II, also known as the Joint Strike Fighter (JSF). Indeed, the then Chief of Air Force highlighted this mission in a 2004 ASPI paper that he wrote to justify the aircraft's purchase.[3] Discussing such a mission beyond 2022, when the F-35A fleet is in service, reveals how circumstances have changed.

Strike aircraft today operate in large packages that include air-to-air refuelling aircraft and airborne early warning and control (AEW&C) aircraft. Tankers are essential because contemporary strike fighters such as the F-35A are short range and fuel hungry. Without tanking, they would be unable to reach most potential targets in the Indo-Pacific region. This shortcoming is unexceptional—it applies to many Western air forces, including the US Air Force (USAF) and the US Navy (USN)—but it means that when non-Western air forces consider exploitable vulnerabilities, tankers are an obvious weakness.

In our region, the People's Liberation Army Air Force (PLAAF) envisages using fighters to seek out and destroy a hostile force's tankers in time of conflict. This tactic is feasible because modern PLAAF aircraft are longer ranged than Western fighters. The USAF accordingly has growing interest in developing tankers that will be more survivable in a contested air environment than the current large modified airliners. While this is technically a challenge, the Commander of the USAF Air Mobility Command observes that discussing possible future survivable tanker options 'quickly gets into the classified world, but I think there's capabilities out there.' The USN has gone down another path, developing unmanned tankers that *in extremis* are expendable—and much more easily replaced than a lost manned aircraft and crew.

AEW&C aircraft would also generally accompany the strike package, providing invaluable support through greatly improving overall situational awareness. In a perfect world, with AEW&C the package won't be surprised and can be quickly repositioned to avoid or attack hostile defenders. Others have perceived AEW&C aircraft, like tankers, as a vulnerability to be exploited. Long-range air-to-air and surface-to-air missiles have been developed, including some able to home on the radar energy that AEW&C aircraft emit. The PLAAF has gone one better in developing a new stealth fighter, the J-20, seemingly optimised to attack AEW&C aircraft.

Unsurprisingly, the USAF, in looking at replacing its equivalent E-3 AWACS fleet, is investigating the 'combat cloud' concept, in which a group of highly survivable fighters (like F-35As) exchange information over datalink and provide their own wide-area, big-picture radar coverage. This may be more of a snapshot rather than the long duration picture of an area's air activity that an AEW&C can build up. Even so, with AEW&C aircraft survivability doubtful, it's a reasonable fallback option.

In our hypothetical mission and assuming air-to-air refuelling was successful, our F-35A strikers would now approach hostile defended airspace. Penetrating that airspace is actually the most worrying issue.

Stealth aircraft have been in service for almost 40 years. Unsurprisingly, air forces have tried both to emulate this technology—as China has—and to develop ways to counter it, in which the Russians have been particularly active. The result has been networked batteries of shoot-and-scoot mobile surface-to-air missile (SAM) systems that are now being sold worldwide. The USAF recently undertook a study into what this ongoing improvement in

ground-based air defence systems means in practice. The Air Superiority 2030 study determined that USAF F-35As (and F-22s) will be unable to penetrate hostile airspace beyond 2030, not just in near-peer conflicts but anywhere advanced SAMs are deployed.[4]

Some warn that the 2030 date may be misleading, asserting that 'Integrated Air Defence Systems covering areas in the Western Pacific and along NATO's eastern front may now be able to deny access to all but the stealthiest of aircraft.'[5] The 'but the stealthiest' phrase is the key. While the F-35A is only now entering service, it's probably the last of its kind, as air combat aircraft with vertical tails are unlikely to be built for the USAF or USN again—at least while stealth remains a 'must have'. The tail is an Achilles heel that advanced radars and SAMs can detect.[6] Accordingly, the USAF's new B-21 bomber, and probably its proposed 'penetrating combat aircraft' (which will replace the F-35A for strike missions), will be flying-wing designs without pronounced vertical tails, giving them all-aspect broadband stealth characteristics.

Given the F-35's post-2030 vulnerability to hostile SAMs, it may seem fortuitous that Australia has acquired the Growler, which is able to seek out and destroy such systems. The USAF study considered such approaches beyond 2030 but determined that they were unappealing because they take a long time to roll back defences. Even with Growler support, F-35As penetrating the SAM barrier remained problematic—and so the USAF is now going down a different path, as discussed below.

If the F-35A beyond 2030 is no longer able to strike deep, fitting Tomahawk cruise missiles to surface warships and the new submarines may appear attractive. However, advanced air defences remain an issue. A recent study postulated an attack against a high-value target area with layered SAM defences. Some 40 Tomahawks would be needed to ensure one strike on an aimpoint (with a 95% confidence level).[7] SAMs can shoot down cruise missiles as well as aircraft—a point that naval warship proponents have of course been making for many years. Forty Tomahawks, though, are almost the full missile load that the new air warfare destroyers or the planned Shortfin Barracudas (if land attack were to become a submarine mission) could take to sea. Destroying a single air base with dispersed facilities and aircraft might take a considerable time, given that the vessels would need to return each time to re-arm.[8]

In the next decade, China's new South China Sea islands might become capable of hosting a variety of SAMs similar to that in the study, which undoubtedly took an optimistic view of the defender's capabilities. Even so, the fundamental issue remains: missile attacks on well-defended targets now require large salvos to have a high probability of causing the desired damage.[9]

Reliably achieving air superiority by offensive means is becoming problematic. Accordingly, the defensive counter-air alternative needs examination, similarly focusing on issues of concern.

DEFENDING OUR AIRSPACE

If Australia is getting stealth jets, so are others. The Chinese are the most advanced: the J-20 fighter is reportedly in service and the FC-31 is under development, perhaps for export. Russia's Su-57 will reportedly enter service in 2019, although it may be delayed for technical or budgetary reasons. In addition, both nations also have stealthy strategic bombers under development, although the Russian project may be more aspirational than realistic. In January 2017, the USAF Air Combat Command chief observed that the new Chinese and Russian aircraft already flying have stealth characteristics comparable to those of the F-22 and F-35A: 'I think they're here now … I don't think it's a futuristic discussion.'[10]

When F-117 stealth aircraft first entered USAF service, they were very hard for the Soviet radars of the time to detect. With its radars blind, the integrated air defence system covering Eastern Europe and the USSR was rendered vulnerable to F-117 precision-guided munition attack. Potentially, the same could happen to our air defence system. The development of Chinese and Russian stealth aircraft raises uncomfortable questions. If our air defence radars can't 'see' hostile stealth aircraft, what use are those radars? Conversely, if our air defence radars can 'see' stealth aircraft, what use are our stealth aircraft? Stealth now cuts both ways.

Before embracing stealth technology, others adopted a more brute force approach to penetrating Western air defences. Their main solution wasn't to mimic the Western practice of large manned aircraft strike packages but rather to build sizeable ballistic rocket forces. The more important non-Western militaries today generally have dedicated rocket forces employing a diverse array of rockets of varying ranges, payload types and warhead weights.

Such weapons are considered able to readily penetrate Western air defences and attack high-value targets, in particular air bases. Such rocket systems have a secondary advantage in that, being road-mobile, they can be hidden from Western strike aircraft. Initially, such rockets had poor accuracy and were best suited for area attacks using cluster munitions or nuclear warheads. Over time, their accuracy has substantially improved, allowing their use today against buried and hardened targets.

In the past decade, ballistic rocket capabilities have been complemented with cruise missiles. While rockets are difficult to engage because of their speed, they're readily detectable at long range because they fly a ballistic trajectory. In contrast, cruise missiles are much slower but can be programmed to fly complex, low-altitude flight paths that use terrain masking to help them avoid detection until they near the target. A particularly worrying scenario is a 'joint anti-air raid campaign' in which ballistic rockets, cruise missiles and manned strike aircraft attack in a closely timed sequence, overwhelming defences.

Western air superiority is also being challenged at the irregular warfare end of the conflict spectrum. The availability of low-cost, small, commercial-off-the-shelf drones means that armed non-state actors can now operate miniature air forces, as the Islamic State of Iraq and Syria (ISIS) has demonstrated. Air defence is now an issue for intra-state conflicts as well as inter-state wars.

Hobbyist drones' first major use in reconnaissance and attack roles was in the 2016–17 battle for Mosul. While their attacks caused only limited damage, persistent harassment by so-called 'killer bees' damaged morale. At one point, the offensive to retake the city almost stalled. US Special Operations Command's General Raymond Thomas noted that the 'most daunting problem was [that ISIS] … for a time, enjoyed tactical superiority in the airspace under our conventional air superiority in the form of commercially available drones'.[11]

In the Mosul battle, ISIS attacked tactical targets. In the future, however, in-theatre air bases may be subjected to surveillance by drones and possibly strikes. Such surveillance could make hostile ground force attacks much more effective (as ISIS did in capturing a Syrian air base in Raqqah), while drone strikes using even small weapons could disable parked aircraft. And drones are becoming both autonomous and capable of swarming. Massed attacks using autonomous drones would be hard to defeat.

WHAT SHOULD WE DO?

The broad trendlines are clear: the skies are becoming increasingly contested. Given this emerging air superiority future, there are various strategic, doctrinal and technological responses that Australia could embrace.

There may be doubts about whether the ADF needs friendly air superiority. Indeed, in some circumstances, ADF units won't be subject to air attack, which makes air superiority moot—although ISIS's drones suggest otherwise.

Without air superiority providing force protection, larger ADF losses should be expected. Fielding a larger ADF and simply accepting higher attrition might overcome those increased losses. Traditionally, however, Australia has sought to use technology to reduce casualties. Reversing this and advocating accepting greater costs in blood would be a hard sell to those involved and to the Australian people. Indeed, the ultimate value of air superiority might be seen in the steps others have taken to build air superiority capabilities as effective as ours. They clearly believe that not having air superiority, whether for deterrence or war fighting, is untenable.

Australia's future air superiority plans were explained in the 2016 DWP and Defence Integrated Investment Plan. Defence white papers have traditionally declared the defence of Australia as the ADF's primary force structure determinant. The 2016 DWP is the first to be more expansive and add maritime Southeast Asia and the world beyond.

The 2016 DWP lays out an adequate force for air superiority in terms of the defence of Australia. Operating from Australia, the ADF has little ability to penetrate hostile airspace, if only because of the great ranges involved; any F-35A shortcomings are then moot. Even China's new island air bases in the South China Sea are a considerable distance from Australia. Moreover, in the reverse air defence case of protecting Australia, even in a hypothetical long-range cruise missile attack from, say, Chinese H-6M/K bombers, the numbers of missiles would seem manageable with the limited capacity air and missile defence system that Australia is acquiring. This assessment assumes that this would be defence of a single area (say, Darwin), that the RAN's air warfare destroyers and future frigates would be involved and that current plans to acquire medium-range SAM systems proceed. It also accepts that attacks by DF-26 intermediate-range ballistic missiles couldn't be intercepted (for that, we'd need the US's Terminal High Altitude Area Defense system or perhaps SM-3 anti-ballistic missiles.)

Problems arise if the ADF goes further afield. As discussed, worrying threats are emerging from tanker and AEW&C vulnerability, advanced SAM proliferation, stealth fighter technology diffusion, long-range ballistic rockets, long-range cruise missiles and even hobbyist drones. The ADF, under current force structure plans, seems unlikely to be able to manage such diverse threats alone. Over time, the ADF appears set to become increasingly reliant upon others to provide air superiority for any forces deployed beyond Australia.

This casts doubt on our contribution to the Five Power Defence Arrangements (FPDA). In the Southeast Asian area, potential future air superiority threats appear significantly greater than those faced in northern Australia. Our involvement in the FPDA seems likely to become more for training than for preparing for any realistic war-fighting role. We seem set to abandon Southeast Asia if serious hostilities in which air superiority is contested break out.

Beyond 2030, when the F-35A force has trouble penetrating hostile defences, it seems we'll be forced into a 'Fortress Australia' strategy, relying on the US to provide any offensive air capabilities necessary. Although for different reasons, Stephan Frühling has already foreseen this future. In a recent paper, he envisages the ADF's primary task becoming defending the Australian base area, providing an unsinkable aircraft carrier for US air and naval forces to operate out of.[12]

Strategically, while our current plans are forcing us into a defence of Australia approach, this is effectively burden-shifting offensive air operations onto our American ally. While we would contribute by proving a safe base area in a serious conflict, such involvement is unlikely to give us much influence on overall allied strategy and war termination negotiations. Our current air superiority plans look likely to doom us to being a bit player.

The current plans, however, could be changed. If so, there are again two distinct alternative paths: defending our airspace versus penetrating others' airspace.

AN AIR DEFENCE HEAVY OPTION

If defending our air space is given priority, the ADF force structure balance would shift to emphasising air defence at the expense of some offensive capabilities. An initial start would include acquiring significant numbers of advanced SAMs and sensors to provide effective integrated air and missile defence, albeit with limited area coverage. If advanced SAMs are adequate to force the USAF to sharply constrain F-22 and F-35A operations beyond 2030, then they might meet our needs.

There's an ongoing debate about long-range versus short-range SAMs. The Western approach has generally been to develop medium- and long-range SAMs, such as the Patriot and SM-6. The difficulty is that these systems are expensive and have trouble handling moderate-to-large salvoes; they can be overwhelmed. An alternative is to acquire large numbers of individually lower cost short-range SAMs that engage close-in.

This long-range versus short-range dilemma is most evident in warships, where one long-range missile takes the same space in a vertical launching system cell as four short-range missiles. An air warfare destroyer with 48 cells can thus carry a maximum of 48 long-range missiles or 192 short-range missiles.

The long-range missiles have an advantage in that they can potentially engage an attacking aircraft before it launches anti-ship missiles; this is colloquially termed the 'shoot the archer, not the arrows' approach. However, there are several problems with this approach:

- It assumes that the ship can maintain track on the attacking aircraft for long enough until the missile strikes, even though the aircraft's electronic warfare equipment will warn the aircrew that they're being targeted.
- Multiple attacking aircraft approaching from multiple directions simultaneously may mean that only some can be targeted.
- Such a defence assumes that the attacking aircraft are held on the ship's sensors, but the attackers might use third-party targeting, launch below the ship's radar horizon and not be detected.
- The more distant the attacking aircraft is from the ship, the more effective hostile electronic warfare jamming may be.
- The greatest probability of a successful defence comes with the use of a supporting AEW&C aircraft, but it might be engaged or pushed aside.

In contrast, short-range missiles have an easier task, as the missiles can be readily and very accurately tracked and hostile electronic warfare will be less effective. On the other hand, attackers will try to saturate the defences by firing multiple missiles to arrive simultaneously. In such a salvo attack, there will be a premium on having many missiles available to launch quickly. The short-range missile system needs to have very fast reaction times, especially as fragments from an attacking missile exploding close to a ship may still cause damage. Australia's Anzac-class frigate upgrade with the CEAFAR Active Phased Array Radar matched with the Evolved Sea Sparrow is an example of such a system.

A solution to the short-range missile versus long-range missile dilemma isn't easy. A careful mix of missiles seems appropriate, with arguably a higher percentage of short-range missiles. The dilemma is made harder as ships must sail back to a major port to restock any missiles fired. Moreover, longer range SAMs might be inadequate for defending against emerging stealth aircraft and weapons, unless new advanced radars and innovative sensor systems can provide sufficiently accurate tracking data. An Australian approach heavy on air defence would need to address how a future area air picture, equivalent to the picture that Wedgetail provides today, can be generated. If new stealthy threat systems can't be reliably detected at long range, short-range SAM systems might be the only option.

Beyond SAMs, the F-35A upgrade plan would need to be changed to give priority to improving the aircraft's air defence capabilities. Most F-35A upgrades being planned or discussed for the next decade focus on improving strike capabilities. The upgrades include addressing known problems with the electro-optical targeting system, replacing the maxed-out data processor, improving communication capabilities, incorporating electronic warfare enhancements and integrating weapons either appropriate to today's irregular wars or requested by JSF-purchasing nations before they'll commit.

If the ADF were able to get this anticipated program revised, two areas important for air defence appear promising in the medium term. First, the F-35A could be fitted with an advanced infra-red search and track system, as the Super Hornet Block III upgrade proposes, to provide a counter-stealth capability. Second, in the USAF's view, the F-35A carries only a small number of air-to-air missiles that are now too short-ranged. The F-35A's Block 4.3 upgrade in the mid-2020s may integrate the British long-range Meteor missile on the aircraft and provide a viable alternative should the USAF's new air-to-air missile efforts falter. Carrying more missiles is more problematic, given that the F-35A has a small internal weapons bay. Missiles can be carried externally, but this both compromises stealth and affects the aerodynamics, raising engine fuel flows and increasing tanker requirements.

In some respects, however, adopting an air defence role for the F-35A plays nicely to the aircraft's strong data fusion capabilities. Those capabilities require a good knowledge of the electronic signatures of the various systems in use across the battlespace. This is much easier to obtain if F-35A use is constrained only to friendly or uncontested airspace.

Air bases should also be made more resilient. Hardening may be reaching its limit, as high-velocity rocket attacks can defeat most hardened shelters. Dispersal may be a more efficacious option, either around the air base area or between multiple air bases. However, a distributed basing approach is costly in terms of logistic support, including for the provision of consumables such as fuel and munitions across multiple locations. Such an approach would need to be carefully planned and well integrated with air- and sea-lift assets.

A strategic gain in going 'air defence heavy' is that the ADF may stay relevant to the FPDA, as the 2016 DWP arguably sought. This stance was reinforced in the *2017 Foreign Policy White Paper*, which declared that in the future, 'As competition for influence in the region grows, the government will increase Australia's efforts to ensure we are a leading security, economic and development partner for Southeast Asia … [In that regard] Close cooperation with Singapore and Malaysia through the Five Power Defence Arrangements is an essential part of our security engagement with Southeast Asia.'

However, the FPDA air environment is becoming increasingly demanding, especially given the proximity of multiple new Chinese island air bases. An ADF 'air defence heavy' structure would allow the FPDA nations to realistically consider adopting a denial deterrent strategy that can deter though being able to counter any plausible air offensive.

The major FPDA air bases would still be potential air offensive targets but would steadily wear down the attacking forces by being able to fight under pressure. The discussion above about 40 cruise missiles against a well-defended air base indicates what's theoretically possible: 40 missiles fired, with 39 engaged by defending SAM systems, all to achieve one impact, would quickly deplete an adversary's cruise missile stocks.

In this scenario, the friendly air base may still be a target that hostile forces consider worth attacking even if the hit per missile ratio appears unappealing. The ADF's Growler force—with F-35A support—could conceivably attack the adversary's SAMs at long range and occasionally score successes. While rollback may take a long time, it's again an ongoing attrition battle, trying to steadily change the relative force capabilities in a direction worrying to an adversary.

However, there are shortcomings in this 'fight the air base' strategy. The adversary isn't paying a price for their aggression. They can continue the fight as long as they wish; war termination is an option only they have. Moreover, we would need to keep a large stock of defensive missiles available. Air-base resupply under fire looks problematic and if there are coalition operations elsewhere they may have restock priority. Lastly, some argue cogently that our current acquisition processes are inadequate to develop the complicated 'system of systems' that integrated air and missile defence requires.[13] Creating an 'air defence heavy' force structure may be beyond us.

Strategically, the 'air defence heavy' approach would allow Australia to remain deeply engaged in the Southeast Asian region through being manifestly able to make a meaningful—perhaps decisive—contribution in times of serious conflict. Because this approach is less reliant on US support, it would reduce our dependency on the alliance and allow us to mount independent operations in an area critical to our future. This has some echoes with the later phase of the Pacific War, when the US left Australian forces to conduct their own operations in Borneo while it moved north to the Japanese home islands.

REBUILDING OUR STRIKE CAPABILITY

The most practical option to allow a strike capability to be retained into the future seems to be to follow the USAF's path. The alternative—adopting the non-Western approach of extensive use of long-range ballistic rockets—is impractical, given that Western arms manufacturers don't build such systems, at least partly because of arms limitation treaties.

The USAF is proposing a complicated multi-domain plan, but the broad parameters are straightforward. First, the USAF rather ambitiously aims to acquire a new penetrating combat aircraft (PCA) by 2030. With all-aspect broadband stealth and some other multi-domain enhancements, the PCA will, unlike the F-22 and F-35A, be able to penetrate and survive within the outer missile envelopes of hostile advanced SAM systems. While the PCA will be able to perform air-to-air and air-to-surface roles, its main function will be to collect timely intelligence, surveillance and reconnaissance data and input that into a digital 'combat cloud' for all to draw on in a manner similar to commercial cloud computing. Second, waiting in less hostile airspace will be less survivable platforms carrying long-range stand-off missiles, targeted through drawing on PCA-acquired 'combat cloud' data.

To be similarly capable, the ADF would need to acquire the PCA, albeit only in small numbers, given its primary targeting role.[14] Stand-off missiles would also need fitting to other platforms, among which the F-35A would be an obvious candidate. The ADF's Defence Integrated Investment Plan provides for possibly acquiring the 600-kilometre-range Norwegian Joint Strike Missile (JSM). Planned for inclusion in the F-35A's Block 4.4 software load, the JSM could be fielded by the RAAF around 2028, although it has some shortcomings for the air-base attack role. The JSM is principally an anti-ship missile optimised to attack smaller naval vessels with a modestly sized 125-kilogram warhead. Used in other roles, such as in attacks on air bases or port facilities, large numbers of missiles would need to be fired to inflict serious damage.

In contrast, the AGM-158 Joint Air-to-Surface Standoff Missile (JASSM) fitted to the classic Hornet fleet is designed to attack land targets and accordingly has a 450-kilogram warhead. Unfortunately, the JASSM leaves service with the classic Hornet around 2022. The longer ranged JASSM ER version has a range of some 950 kilometres and seems set to be the weapon that the USAF uses initially as its main stand-off weapon. The ADF's F-35As or F-18F Super Hornets could be modified to carry the JASSM ER, if only externally.

If the F-35A were chosen, the ADF would need to strongly advocate for the JASSM ER to be included in the still undefined Block 5 F-35A upgrade planned for the late 2020s. The Super Hornet integration is easier to schedule, as it's not part of a large multinational program, and, with USN approval, could be undertaken when the ADF funds it. In addition, to support PCA, F-35A, Super Hornet and Growler long-range operations in a contested environment, the ADF could also acquire a small number of new USN unmanned MQ-25 tankers.

However, it's uncertain whether the US would sell us such cutting-edge technology, in particular the PCA. Access to US technology isn't guaranteed. In the 1980s, the US denied the release of software information for the Hornets' radars and certain electronic warfare equipment. Clearly, this was important for US capabilities and Washington didn't wish to release them to even a close ally. Similarly, in the last decade the F-22 was denied to several allies, forcing them to acquire the F-35A instead.[15] The F-22's technology was again clearly important, whereas the F-35A's

was less so. Indeed, it appears that the F-35A's stealth abilities will diminish relative to adversaries' aircraft just about the time when it will (finally) enter service with several US allies. Its technology is now less crucial to US military superiority, making releases to others easier.

In addition to reconfiguring its strike capabilities, the ADF would still need to undertake some defensive enhancements. They wouldn't need to be of the same magnitude as the 'air defence heavy' option, as the refreshed strike capability would allow some of an adversary's attack systems to be engaged before they could be employed. However, there would still need to be a sizeable build-up of integrated air and missile defence systems and a base resiliency program, the aim of both being to limit the damage that ballistic rocket and cruise missile attacks might inflict.

Strategically, embracing the USAF option combined with some defensive improvements would allow current ambitions for greater strategic objectives than solely the defence of Australia to be achieved. This option also means less disruption to extant doctrinal and operational approaches. The major gain of this option is that the ADF would remain able to make a meaningful contribution to our US alliance in times of major conventional war. We'd be able to burden-share offensive air operations in any existential 'must win' major conflict that arose, rather than burden-shift, as in the defence of Australia alternative. There must, however, be some doubts that embracing this option is affordable—even if the US allows it.

CONCLUSION

The skies are becoming increasingly and deliberately contested. There's a diversity of threats emerging from tanker and AEW&C vulnerability, advanced SAM proliferation, stealth fighter technology diffusion, long-range ballistic rockets, long-range cruise missiles and even hobbyist drones. The post-Cold War strategic environment has changed, and so must our expectations of unchallenged Western air superiority.

For Australia, maintaining our current equipment plans suggests that our ambitions are being lowered to be simply the defence of the continent, providing a safe area for the USAF and USN to operate offensively from. The implication is that Southeast Asian nations will be abandoned to do the best they can as China rises and its sphere of influence expands.

We have two clear alternatives to the defence of Australia option, both of which would necessitate changing our current capability development plans:

- The first would stress air defence, allowing the ADF to adopt a denial deterrence strategy and make a meaningful contribution to the FPDA and the wider Southeast Asian region.
- The second would be to rebuild our strike capability to be effective in contested airspace, combined with limited investment in integrated air and missile defence.

In broad terms, the defence of Australia option implies burden shifting onto the US, the 'air defence heavy' approach implies a reduced dependency on the US, and the rebuilding of our strike capability implies sustaining burden sharing with the US in major 'must win' wars past 2030.

Air superiority may seem a narrowly technical field, but it can have a big impact on the range of strategies that can realistically be considered. It's time for a big air superiority rethink.

Further reading

Justin Bronk, *The future of air C2 and AEW: E-3 Sentry, threat technologies and future replacement options*, RUSI occasional paper, Royal United Services Institute for Defence and Security Studies, London, June 2017.

USAF Brig. Gen. Alex Grynkewich, *An operational imperative: the future of air superiority*, Mitchell Institute Policy Papers, Mitchell Institute, Washington DC, July 2017.

USAF (Ret.) Col. Matt Hurley, *Beyond the iron triad: the future of airborne C2ISR*, The Mitchell Institute for Aerospace Studies, Arlington, September 2017.

Peter Layton, *Fifth generation air warfare*, paper no. 43; RAAF Air Power Development Centre, Canberra, June 2017.

NOTES

1 Paul Dibb, Richard Brabin-Smith, *Australia's management of strategic risk in the new era*, ASPI, Canberra, November 2017, p. 1, online.

2 US Department of Defense, *Dictionary of military and associated terms*, joint publication 1-02, As at August 2017.

3 RAAF Air Marshal Angus Houston, *Is the JSF good enough? Can Australia's air combat requirements be met by the JSF, or do we need the F/A-22?*, ASPI, Canberra, August 2004, p. 3.

4 Enterprise Capability Collaboration Team, *Air Superiority 2030 Flight Plan*, US Air Force, Washington DC, May 2016. This paper assumes that USAF F-35As are comparable to RAAF F-35As. In this, it's important to note that the F-35A survivability concerns noted are USAF judgements. Others may judge differently; however, the USAF is arguably more cognisant of the F-35A's performance vis-à-vis threat systems than anyone else.

5 Mark Gunzinger, Bryan Clark, David E Johnson, Jesse Sloman, *Force planning for the era of great power competition*, Center for Strategic and Budgetary Assessments, Washington DC, 2017, p. 28, online.

6 USAF (Ret.) Maj. Gen. Mark Barrett, USAF (Ret.) Col. Mace Carpenter, *Survivability in the Digital Age: the imperative for stealth*, The Mitchell Institute for Aerospace Studies, Arlington, July 2017, pp. 21–22, online.

7 The study assumed defences comprising three HQ-9 long-range SAMs, four HQ-16 medium-range SAMs and four TD-2000 point-defence SAMs. Bryan Clark, Mark Gunzinger, Jesse Sloman, *Winning in the gray zone: using electromagnetic warfare to regain escalation dominance*, Center for Strategic and Budgetary Assessments, Washington DC, 2017, p. 12, online.

8 The recent successful Tomahawk attacks on parked Syrian aircraft may appear to refute this. In the Syrian case, the air base was not defended by advanced SAM systems, although the Russians certainly had some not that far away at the port of Tartus. SAM systems, however, can only kill what they can see. Tomahawk cruise missiles flying at low altitude at some distance from the SAM system can be below the horizon and be un-engageable (this was the logic behind the F-111's terrain-following capabilities). There are ways to attack undefended targets behind an advanced SAM barrier, but the problem is that the targets might not be that important to successfully concluding the conflict. An adversary's air bases are likely to be among its most important and well-defended targets.

9 Towards the end of the next decade, hypersonic land attack missiles may enter service. Because they'll reduce reaction times, effective defence will become more difficult. Countering this, some consider that directed energy weapons will be in service by then, making the defence considerably easier. Given this, the offence/defence equation may end up being similar to today's. An emerging issue with hypersonic missiles is that they may be denied to most nations. The quasi-governmental RAND think tank has proposed an arms control regime that would restrict hypersonic technology to the US, China and Russia; Australia and others would be excluded. Richard H Speier, George Nacouzi, Carrie Lee, Richard M Moore, *Hypersonic missile nonproliferation: hindering the spread of a new class of weapons*, RAND Corporation, Santa Monica, 2017, online.

10 John A Tirpak, 'Saving air superiority', *Air Force Magazine,* April 2017, 100(4).

11 David B. Larter, 'SOCOM Commander: Armed ISIS Drones Were 2016's 'Most Daunting Problem'', *defensenews.com*, May 2016, online.

12 Stephan Frühling, *Sovereign defence industry capabilities, independent operations and the future of Australian defence strategy*, ANU Strategic and Defence Studies Centre, Canberra, October 2017, pp. 6–8, online.

13 RAAF (Ret.) Air Vice-Marshal John Blackburn AO, *Integrated air and missile defence: the challenge of integrated force design*, Sir Richard Williams Foundation, Canberra, April 2017, online.

14 For a viable, sustainable force able to undertake its own conversion training onto type, some 20–24 PCAs would need to be acquired. However, improved simulation may lower flying training requirements and reduce that number by four or five.

15 The so-called Obey amendment passed by the US Congress aimed to 'to prohibit the sale of F-22 aircraft to any foreign government'. The repeal of the bill was postulated in 2009 when the sale of the F-22 to Japan was considered; a range of technology transfer issues were identified and the F-35A was offered as an alternative. Japan eventually acquired the F-35A. 'Obey Amendment', H.Amdt. 295 — 105th Congress (1997–1998), 1998, online. Christopher Bolkcom, Emma Chanlett-Avery, 'Potential F-22 Raptor export to Japan', Congressional Research Service, Washington DC, 11 March 2009, pp. 1, 3 and 5.

ACRONYMS AND ABBREVIATIONS

ADF	Australian Defence Force
AEW&C	airborne early warning and control
AWD	air warfare destroyer
2017 DWP	*2017 Defence White Paper*
FPDA	Five Power Defence Arrangements
ISIS	Islamic State of Iraq and Syria
JASSM	Joint Air-to-Surface Standoff Missile
JSF	Joint Strike Fighter
JSM	Joint Strike Missile
PCA	penetrating combat aircraft
PLAAF	People's Liberation Army Air Force
RAAF	Royal Australian Air Force
RAN	Royal Australian Navy
SAM	surface-to-air missile
USAF	US Air Force
USN	US Navy

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