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***AUSTRALIA'S FUTURE JOINT
STRIKE FIGHTER FLEET:
HOW MUCH IS TOO LITTLE?***

Peter Nicholson and David Connery
The Kokoda Foundation

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Researching Australia's Security Challenges

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Executive Summary

In 2008 the Australian Government will decide whether or not to acquire the F-35 Joint Strike Fighter as the Royal Australian Air Force's (RAAF) New Air Combat Capability, replacing the F-111C and F/A-18 aircraft.¹ This will be the largest defence capability purchase in Australia's history—but there is debate within Defence circles about how many JSF Australia should purchase. As a result, the Kokoda Foundation initiated this project to identify the strategic utility and risks associated with three different JSF fleets.

The investigation was conducted using three workshops that examined the strategic guidance provided by the Government; the changing nature of threats, operational concepts and air power roles; and the way JSF could be used in two credible scenarios. Participants in the workshops were subject matter experts in the areas under discussion and came from several Government departments and agencies, academia and industry.

The consensus of opinion was that the Government wanted freedom of action in its military response to a range of strategic circumstances. The interpretation of declarative and 'operational' strategic policy was that the Government would want the option to simultaneously mount one large and one medium-sized operation in different areas while retaining the ability to conduct strike operations.

The major contributions of the air combat capability to these military options were control of the

¹ This study assumes that the Australian Government will choose an all-JSF solution for Project *AIR 6000*, the New Air Combat Capability. However, Defence is also considering systems such as Uninhabited Combat Air Vehicles (UCAV) to complement the JSF in the strike role as part of Phase 2C of Project *AIR 6000*.

air, strike and support of ground and naval forces. However, the sensors, data fusion and networking capabilities of the JSF will also allow this aircraft to make a substantial and unprecedented contribution to the role of 'battlespace awareness'.

Two scenarios were developed to evaluate the possible strategic utility of three different JSF fleets. The fleet sizes chosen were three, four or five squadrons of sixteen aircraft, plus the necessary additional aircraft for maintenance, attrition and a training unit. In each case the force mix option drew on the planned fleets of six airborne early warning and control (AEW&C) and five multi-role tanker transport (MRTT) aircraft so that the 'total' air combat capability for 2015 could be considered.

One scenario reflected a strategic policy 'style' where the principal force structure determinant was local interests, primarily the defence of Australia and regional security. In this style, the ADF was optimised for deterring or defeating conventional attacks against Australia. The ADF would also be capable of projecting force into the region, with its networked forces having an edge over potential regional adversaries.

The other scenario reflected a future policy style where protecting or advancing Australia's global interests would be the primary determinant of force structure. In this policy style, the defence of Australia was based on detecting and responding to unconventional threats such as illegal incursions and terrorism. The major role, and therefore force structuring priority, was conducting expeditionary operations as part of international efforts to ensure a stable global security environment.

The smallest JSF force considered (three combat squadrons) severely limits Government options in any strategic policy setting. An offensive

posture would be necessary in the Defence of Australia scenario because the small force size would not allow protracted defensive counter-air operations. This would pose considerable strategic risk because defensive operations would not be sustainable for long and there would be no fallback if these operations were not decisive within a short period of time. In the global interests scenario the Government would have the option of contributing to coalition operations offshore, but these could not be sustained for very long because of an inability to rotate squadrons. In either scenario, this force structure option is very vulnerable to even minimal attrition. Hence, three squadrons are unlikely to provide the Australian Government with either sufficient strategic options or strategic weight in either policy style.

The median force structure considered (four combat squadrons) will increase the strategic options available to Government by providing a greater capacity for defensive counter air operations while concurrently providing some strike capability. This allows a greater freedom of strategic choice and reduces risk by allowing either offensive or defensive postures. However, the response is still constrained to operations in a single theatre, the sustainability of round-the-clock operations would be limited and there is only a limited capacity for rotation of forces. The capacity for offshore operations increases in the second scenario but the ability to swing between defensive and offensive counter air operations would remain limited. The four-squadron force structure better accommodates a small number of JSF losses. However, the small size of the AEW&C or MRTT aircraft fleets means that any loss here would have significant strategic and operational consequences. Hence, the median force structure of four JSF squadrons is marginally viable in meeting

Government requirements for strategic options and strategic weight.

The largest force structure discussed in this report (five combat squadrons) not surprisingly provides the greatest degree of flexibility. This option allows a mix of offensive and defensive action in the first scenario, with the duration determined as much by AEW&C and MRTT sustainability as the JSF force structure. In particular, the five-squadron force allows a sustained air defence posture in the defence of Australia scenario, while retaining a substantial capacity for strike that acts as a powerful deterrent. This force structure allows two substantial contributions to overseas operations in the other scenario while also maintaining an ability to conduct unexpected homeland security tasks. Hence, a five squadron force structure is the minimum required to provide the Government the freedom of action derived from both declarative and actual policy.

About the Authors

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Lockheed Martin F-35 Joint Strike Fighter

The JSF is a multinational project led by the United States and an international consortium including the United Kingdom, Italy, the Netherlands, Canada, Turkey, Australia, Denmark and Norway.

The JSF is being developed as a stealthy, supersonic multi-role fighter that comes in three variants: the F-35A, a conventional take-off and landing variant (CTOL); the F-35B, a short take-off and vertical landing variant (STOVL); and the F-35C, a carrier variant (CV).

The JSF will perform a range of combat roles, including air defence, ground attack and battlespace awareness. In order to perform these roles, the JSF will carry a range of sensors that include:

- Multi-function radar (This radar is able to act—simultaneously or near simultaneously—as an air-to-ground and air-to-air detection and identification radar, as a threat emissions sensor and for electronic attack);
- Infrared sensor thermal imaging system;
- Electronic warfare system for broad band detection of threat emitters; and
- Electro-optical targeting system (a long-range infra-red search and track for air targets, long range ground target detection, laser range finder and laser target designator).

The weapons planned for integration on the JSF include the Joint Direct Attack Munition (JDAM), Joint Stand-Off Weapon (JSOW), AIM-120C AMRAAM air-to-air missile, Joint Air-to-Surface Standoff Missile (JASSM), AIM-9X Sidewinder missile and Small Diameter Bomb. The RAAF is currently investigating options for a stand-off maritime strike missile as well.

For information on JSF weapons, see: <http://www.af.mil/factsheets/>

Airbus A-330 Multi Role Tanker-Transport (MRTT)

The Airbus A330 is both a tanker aircraft, and a cargo and personnel transport aircraft. In its tanking capacity, the MRTT can fly 1000 nm from base, remain on station for two hours and offload 143 000 lbs of fuel—enough to support around eight fighter aircraft at a time. It can also carry 272 passengers and has three large cargo compartments.



Australia has contracted to purchase five MRTT and has options for another three. An initial operational capability is expected by late 2008-early 2009.

Boeing 737-700IGW and Northrop-Grummond ES3 Airborne Early Warning and Control

Australia has contracted to purchase six Boeing 737-700IGW AEW&C aircraft. The main role of the AEW&C is airspace surveillance and air defence, although it has the ability to contribute to force coordination, fleet support and some civil support tasks.



The first aircraft will be delivered around January 2007, and the RAAF expects to achieve an initial operational capability by early 2008.

Photos: RAAF

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- A. Strategic Policy Styles
- B. Scenarios

About the Kokoda Foundation

Abbreviations

Abbreviation	Definition	Abbreviation	Definition
ADF	Australian Defence Force	ISR	intelligence, surveillance and reconnaissance
AD	Air defence	JSF	Joint Strike Fighter
AEW&C	airborne early warning and control	MRTT	Multi-role tanker transport
AJOC	Australian Joint Operations Concept	NACC	New Air Combat Capability
AWD	Air Warfare Destroyer	NATO	North Atlantic Treaty Organization
CAIRS	close air support	NCW	Network Centric Warfare
CAP	combat air patrol	nm	Nautical mile
CSAR	combat search and rescue	RAAF	Royal Australian Air Force
Defence 2000	Defence 2000: Our Future Defence Force	RSC	regional support centre
Defence Update 2003	Australia's National Security: A Defence Update 2003	SEAD	suppression of enemy air defences
FMC	Fully Mission Capable	sqn	squadron
EAW	Expeditionary Air Wing	UAV	uninhabited aerial vehicle
GBAD	Ground-based air defence	UN	United Nations
GDP	gross domestic product	US	United States

Select Glossary

Air power (aerospace power): The ability to project force in the third dimension.

Air combat capability: Includes fighter squadrons and their force multipliers, bases, logistic support and command and control. Air combat capability is only created when these forces are able and competent to perform their roles at an acceptable level of risk.

Fighter: A high-performance military aircraft designed (in most cases) for air-to-air and/or air-to-ground combat missions. The F/A-18 is a multi-role fighter aircraft because it performs both missions.

Force multiplier: A capability (such as AEW&C, MRTT or ground-based radar), whose presence in the battlespace allows other capabilities and units to achieve their mission with greater effect and ease.

Sensor: The collective term for units and equipment that gather information for the network. Examples of sensors include radar, electronic intercept, patrol boats and maritime patrol aircraft.

Spectrum of Conflict: Describes the complete range of military operations from nuclear war, to conventional war, low-intensity conflict and peacetime tasks.

Strategic utility: The extent to which a capability contributes to the government's strategic options and strategic weight.

Strategic options: The range of means available to achieve policy goals.

Strategic weight: The ability to contribute to international stability at or above a level that enhances national credibility.

Strike (Strategic strike): Offensive actions designed to effect the progressive destruction and disintegration of the enemy's ability or will to wage war. The F-111 is a strategic strike and reconnaissance aircraft.

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AUSTRALIA'S FUTURE JOINT STRIKE FIGHTER FLEET: HOW MUCH IS TOO LITTLE?

Introduction

Air combat: a vital capability

Recent events have shown that air combat capability is both vital to promoting national security and necessary to successful operations, whether those operations actually involve force or not. One need look no further than to the way the Royal Australian Air Force (RAAF) has supported Australia's commitment to its alliances, and promoted security at home in times of heightened security concern, to see how air combat capability can be useful in a wide range of combat and non-combat situations.

The utility of air combat capability in conflict was clearly demonstrated by the support provided by fourteen RAAF F/A-18 Hornet aircraft to the Special Forces operations in western Iraq in 2003. The combination of information, firepower and speed—employed by well-trained people—ensured that a small force was able to punch well above its weight and make a significant political and tactical contribution to the coalition operation. Australians should expect to see the nation's air combat capability used again in future campaigns like this because Prime Minister Howard has said that the 'ability to project armed force will remain a key instrument in the war on terror'.²

²Prime Minister John Howard, *Australia in the World: Address to the Lowy Institute*, 31 March 2005, available at www.lowyinstitute.org accessed 30 May 2005.

Of course, Australian strategic policy-makers have long held that air power is critical to national security. This has been highlighted by the significant proportion of Australian defence spending devoted to updating and improving the air combat capability in past budgets. In *Defence 2000: Our Future Defence Force*, for example, the Australian Government earmarked around A\$15 billion to acquire 'up to 100' new combat aircraft that were technologically superior to others in the region.³ In addition, the Government also invested A\$4.8 billion in airborne early warning and control (AEW&C) and multi-role tanker transport (MRTT) aircraft to support the existing and future air combat capability.

Defence is currently planning for the introduction of its new fighter in 2012 under Project *AIR 6000*.⁴ As this report is written, the aircraft most likely to be chosen will be the F-35A Joint Strike Fighter (JSF). Indeed, the Government has made its intentions clear by committing US\$150 million to the System Development and Demonstration phase for JSF, effectively closing the market to other contenders.

While this decision has been widely supported there is debate in defence circles about how many JSF should be purchased. Given the cost of the project and the importance of air combat to

³Department of Defence, *Defence 2000: Our Future Defence Force*, Commonwealth of Australia, Canberra, 2000, paragraph 8.48. The planning budget for *AIR 6000* was stated later as A\$12.5 to A\$16.5 billion in the 2004 *Defence Capability Plan*; and the Minister for Defence has recently suggested the *AIR 6000* budget would total around A\$12 billion.

⁴A recent report by the US Government Accounting Office has raised some doubts about the ability for JSF to be 'in service' by 2012: this is strategically important for Australia and has implications for the management of the F/A 18 fleet. Since such a change alone should not effect the total numbers of JSF that Australia buys, this report will still assume a 2012 delivery date.

Australia's national security, the Kokoda Foundation decided to examine the strategic utility and risks of three options for the size of the future JSF fleet.

To do this, Part 1 of this report considers three major factors—strategic policy style; threats, operational concepts and roles; and the logistics of air power—and their implications for the size of the JSF fleet. Given the importance of strategic policy to the eventual outcome, Part 2 examines the strategic utility and risks of three different JSF fleets (based on three, four and five combat squadrons of sixteen aircraft) in two different scenarios. This method shows what the different fleets can and cannot do in each scenario to illustrate the factors and risks to be considered when the Government is considering how many JSF to buy.

Main findings

This report highlights a number of factors that will influence the size of the future JSF fleet. These factors range from ensuring that the JSF fleet is large enough to cope with potential change in strategic policy, while retaining a high degree of strategic utility against conventional and unconventional threats.

This utility is underscored by the ability of JSF to capture, process and distribute information, which is like no other aircraft or capability that the ADF has seen before. When these new information capabilities are matched with the aircraft's stealth, speed, reach and precision, the JSF will be in high demand—and it may become an 'indispensable weapon' for operations across the spectrum of conflict.

The analysis found that Australia would be taking a significant risk if the air combat capability was based on a fleet of three JSF squadrons. These risks included constrained strategic options, an inability to cover the range of tasks that the government wants the ADF to perform concurrently, a low potential to

support for maritime and land operations and an inability to rotate forces. These limitations decreased as the fourth and fifth squadron were added to the fleet, particularly as a larger force is better placed to defend the nation and allow Australia to play a modest, but still significant role in maintaining international stability.

Given the likely strong demand for its services, it would make sense to ensure that the JSF fleet is supported by a sustainable fleet of force multipliers, including AEW&C and airborne refuelling aircraft. Other supporting factors to be considered include ensuring that Australia has enough of the right people to crew and maintain the aircraft, making sure organisational structures are suited to get the most from the JSF's capabilities and thinking carefully about how the aircraft will be supported to ensure sufficient self-reliance. Maximising the benefits from the JSF will also require innovative thinking in the way this aircraft is integrated into the networked ADF.

When these factors are considered together, it is evident that the multi-role JSF is going to provide Australia with a world-class fighter. As a result, the main decision about the future JSF fleet is not 'how much is enough' but 'how much is too little'.

Method

The findings of this report were developed through three workshops held between March and May 2005. The participants of these workshops were invited from government departments, think tanks, academia and industry because they had particular subject matter expertise in the area. All contributed on the understanding they were expressing private views under Chatham House rules.

PART 1: FACTORS INFLUENCING THE SIZE OF THE JSF FLEET

Deciding on the numbers of military platforms—such as aircraft, ships or vehicles—to buy is a complex task because a range of sometimes-contradictory strategic, operational and even tactical factors must be evaluated. The difficulty of this complex task is then magnified when theoretical preferences for the ‘best possible’ military force come up against real-world political, financial and human resource considerations. Australia is highly unlikely to be able to afford a large air force and compromises will have to be made. As a result, the Federal Cabinet’s forthcoming decision about the size of the future JSF fleet will involve real questions of opportunity cost, budget balances and Australia’s value as an alliance partner.

Because this decision is mainly about the Government’s estimation of risk, the sources of that risk and the implications of different decisions are worth identifying. To assist this process, Part 1 explains how three main factors—the emerging differences in Australian strategic policy, expanding threats and emerging operational concepts, and the logistics of air combat capability—will influence the size of the future JSF fleet. This part will establish the parameters for a detailed examination of the strategic utility and risks of three different JSF fleets in Part 2.

Emerging differences in Australian strategic policy

This section compares the two current statements of government strategic policy, *Defence 2000: Our Future Defence Force (Defence 2000)* and *Australia’s National Security: A Defence Update 2003*

(*Defence Update 2003*).⁵ The comparison shows that, although the ADF's likely tasks are consistent between the two documents, the descriptions of emerging threats are significantly different. This section argues that differences are emerging between 'declaratory' and 'operational' policy. This means that the future ADF—and therefore the future JSF fleet—must be prepared for future changes in strategic priorities. The comparison also provides an understanding of the Australian Government's force sizing guidance, the increasing importance of conventional and unconventional threats, and the importance of air combat forces for high-intensity coalition operations.

Defence 2000: strategic tasks and capability guidance

Defence 2000 described four strategic tasks for the ADF, the first and most important of which was to *Defend Australia*.⁶ This task involved defending the approaches to Australia, based on the principles of self-reliance, a maritime strategy and proactive operations. The main focus was defeating an attack by conventional (or special) forces that approached or lodged themselves on Australian territory. In air combat terms, the threat would be from regional air and naval forces approaching from the north.

The second strategic task of *Contributing to the Security of our Immediate Neighbourhood* included helping neighbours to resist aggression, participating in (and possibly leading) United Nations sanctioned operations, and conducting activities such as humanitarian missions and disaster relief. Importantly, ADF preparedness would be influenced

⁵Department of Defence, *Australia's National Security: A Defence Update*, Commonwealth of Australia, Canberra, 2003, pp. 23-25.

⁶ *Defence 2000*, Chapter 6.

by the greater likelihood of these operations, and the potential to conduct more than one operation at a time. This task would be challenging for the existing fighter force because it is hampered by relatively short operating ranges. Conversely, it showed the importance of the long-range F-111 for conducting strike and reconnaissance far from Australia.

The third strategic task required the ADF to be ready, again using forces prepared for defending Australia, to *Support the Nation's Wider Interests*. Since the Government assumed that Australia would always participate in such operations within a multinational coalition, *Defence 2000* placed a high priority on forces that could work closely with the United States and adequately with other coalition partners.

The fourth strategic task required the ADF to conduct *Peacetime National Tasks* such as counterterrorism, disaster response, support to major events (which might include providing security) and sovereignty protection tasks such as fisheries patrols. As *Peacetime National Tasks* would not be a force structure priority, the ADF would perform them using existing resources.

But what type of forces would the ADF need to perform these tasks? *Defence 2000* identified two key sets of capabilities. The first set comprised sea and air forces that could defend Australia by denying the maritime approaches to a credible hostile force. Land forces, together with supporting air and naval forces, formed the second key set of capabilities. The role of this joint force would be to control the approaches to Australia and respond effectively to any armed incursion. Both sets would also contribute to regional stability and provide forces for coalition operations. But in a notable difference, the air and naval forces would be capable of coalition operations

in higher-intensity conflicts, while the land forces would be prepared for low-intensity conflicts.⁷

Further guidance was provided through capability development priorities for the land, maritime, air, strike and information capabilities. The first priority was having air and naval units to defend Australia by denying the air and sea approaches to any 'credible hostile forces'.⁸ Particular reference was also made to how air combat was 'the single most important capability for the defence of Australia'.⁹ This priority was matched with a plan for significant investment in air combat forces, including orders for AEW&C and MRTT aircraft, and improved communications and control systems. The Government also decided to upgrade tactical data links, electronic self-protection and air-to-air weapons for the F/A-18 fleet to ensure that Australia retained a technological edge over others in the region. *Defence 2000* also stated that strike forces would remain important for the defence of Australia. This capability is sometimes described as the 'war-ender', as the ability to strike far from home can deter or coerce, as well as inflict significant damage on an adversary's military capability and will to fight.

Second, *Defence 2000* discarded the idea of a warning time for emerging threats and demanded fully-developed capability: gone was the 'fitted for but not with' approach of previous years. This change would see the 'per unit' cost of equipment increase over time, but it would deliver a force better prepared for short notice tasks and available for a greater range of contingencies.

Third, *Defence 2000* provided guidance about the size of the ADF in relation to concurrency

⁷ *Defence 2000*, paragraphs 6.30 and 6.31.

⁸ *Defence 2000*, paragraph 6.30.

⁹ *Defence 2000*, paragraph 8.37.

requirements. The Government decided that the ADF needed land forces, together with supporting air and maritime units, that could both respond to any lodgement on Australian territory and conduct the more likely types of operations in Australia's 'immediate neighbourhood'. This goal was later specified as being able to sustain a brigade on operations, while having a battalion group available for deployment elsewhere.¹⁰ These requirements provide an indication of the level of 'strategic concurrency' required by the Government, which this report will use later as an important guide for the tasks required of the JSF fleet.

Defence Update 2003: new threats, new tasks?

The most recent public expression of strategic policy, *Defence Update 2003*, noted that Australia's national interests could be affected by events outside the immediate neighbourhood. It also noted that the ADF was highly likely to be involved in coalition operations further afield. *Defence Update 2003* downgraded the priority of the threat of conventional force attacks on Australia and increased the priority of three others: terrorism, the proliferation of weapons of mass destruction and the threat of failed states to regional stability. There was also explicit support for the US-led 'war on terror' because of its importance to Australia's alliance relationship and because the threat of terrorist attack within Australia had increased.

As a result, *Defence Update 2003* contained a subtle change from the task/capability force structure priorities outlines in *Defence 2000* to threat/capabilities based priorities. Consequently, the summary judgement of *Defence Update 2003* was that, while the principles of *Defence 2000* remained

¹⁰*Defence 2000*, paragraphs 8.10 and 8.14.

sound, 'some rebalancing of capability and expenditure' was necessary to emphasise mobility, readiness, interoperability. It would also be important to enhance new capabilities—such as missile defence, counter-terrorism and consequence management.¹¹ However, the extent of the required 'rebalancing' remains unclear.

Operational and declaratory policy: emerging differences?

It is clear, however, that there are emerging differences between the original guidance of *Defence 2000* and *Defence Update 2003*. The first difference has emerged between the forces developed for the defence of Australia—the declared force structuring priority—and the forces required for the tasks on which the ADF has actually been employed. The potential for such a 'gap' and its effects have been fiercely debated. On the one side, some believe forces prepared for the defence of Australia have been adequate (with minor modification) for other tasks.¹² Others take a different view. They argue that structuring for defending Australia has constrained the Government's options on important occasions and operational success has largely been determined by the individual expertise of ADF personnel. According to this argument critical military capabilities, such as firepower, protection and logistic support for deployed forces have fallen behind those of other states; and Australia's ability to contribute to international coalitions has become overly reliant upon a few, small force elements.

Another emerging difference is between the capabilities required to counter threats that Australia

¹¹*Defence Update 2003*, pp. 23-25.

¹²Paul Dibb, 'Tinker with defence policy and risk attack', *The Australian*, 30 October 2001.

is most likely to face and the force structure that is actually being developed. In *Defence 2000*, the ADF was 'to maintain the capability to defend Australia from credible attack'. While this priority was qualified, conventional threats were the focus of capability planning. Indeed, *Defence 2000* set a benchmark for the level of threat as the conventional forces of regional states. The increased priority given to non-conventional threats in *Defence Update 2003* means that a different benchmark may be required.

Implications for the future JSF fleet

The first implication of strategic policy for the future JSF fleet is that air combat capability must remain an essential element of Australia's force structure. Any notion of eliminating air combat capability, or of 'outsourcing' it to allies, risks jeopardising Australia's sovereignty. The absence of a credible air combat capability would pose significant operational risks because deployed forces could not operate free of the threat of attack from the air. Australia would also lose an important deterrent if the strike capability were not maintained.

Next, the ADF needs to be sufficiently flexible to cope with changes in strategic policy during the next decade—especially since policy can change faster than force structure.¹³ This makes multi-role capabilities, such as the JSF, even more important. It might also mean that high-technology elements will be in greater demand because they are attractive and effective options for coalition contributions.

¹³In an address to the ADF's Future Warfighting Conference on 21 April 2005, Air Vice-Marshal Kerry Clarke, AO noted that the ADF can only change one-third of its force structure every ten years given the current level of funding and desire to get the most out of each purchase.

While it is impossible to predict the exact shape of future policy, it would be wise for the ADF to prepare for two broad policy 'styles': one that places a priority on the defence of Australia and operations in the region, and a second that emphasises an Australian role in international coalitions and operations within the region. The two possible styles will be described, in more detail, later in this report.

The increased priority given to the threat from violent non-state actors, such as terrorists and irregular forces, encourages a re-think about what the 'defence of Australia' means today and what the ADF will contribute to that task. If the defence of Australia is recast in terms of sovereignty rather than having to defeat conventional air and maritime forces in war, then different tasks for the ADF arise. Given the modest capabilities of the unconventional threats (that rely mainly on secrecy and speed) and the relatively low risk of confrontation with a well-armed adversary in this setting, the ADF's contribution to protecting national sovereignty should be focused on information, pre-emption if needed and response.

Air combat capability is one force element that combines information, speed, firepower and reach to respond to threats that use the air or sea to enter Australia, or as a medium for terrorist attacks. The JSF combines: information capability to locate a threat; communication capability to share that information with others and enable command and control; and precision fire power to apply force, all in the same platform. A key feature of combining such capabilities in a single platform is that it minimises the response time from detection to destruction, which is essential for so-called 'time critical targets'. And while much is said about potential enemies using asymmetric methods against even advanced conventional forces, it is often forgotten that capabilities such as the JSF represent a major

asymmetric advantage against unconventional forces that cannot employ such sophisticated capabilities.

Recognising the importance of both conventional and unconventional threat as priorities does not necessarily create an 'either/or' proposition for force structuring. Instead, the ADF must prepare to deter, coerce or defeat all forms of threat at home, in the region and internationally. This broadened threat concept means that the JSF must prove its value by demonstrating its usefulness in a range of operations across the spectrum of conflict.

Participation in international coalitions will always remain an important part of Australian strategic policy. Consequently, Australia's air combat capability can provide a useful 'niche' contribution to international and US-led warfighting coalitions if it is interoperable with US forces.

Implications of strategic policy for the future JSF fleet

The JSF fleet must be able to cope with changes in strategic policy.

The JSF fleet must be large enough to conduct one large mission, one moderately-sized mission and strike simultaneously. The fleet size must also provide for training, maintenance and 'attrition'.

The JSF fleet must be useful against conventional and unconventional adversaries across the spectrum of conflict.

The JSF fleet must be able to 'plug and fight' in a US-led warfighting coalition against adversaries using advanced technology.

In with the old, in with the new: expanding threats and emerging operational concepts

The previous section highlighted how the priority of threats has changed in the time between the publication of *Defence 2000* and the Australian Government's most recent statement on strategic policy. This section examines how the expanded notion of threat and a change in priority away from the defence of Australia against conventional threats will influence Australian operational concepts, the required roles of the air combat capability and ultimately the size of the JSF fleet.

The first broad type of threat (described below as 'conventional') covers state-based actors who employ military power to threaten Australian interests. In contrast, 'unconventional threats' are usually posed by non-state actors employing technology and tactics in asymmetric ways that pose a significant threat to national interests. Of course, this categorisation is not complete because states might apply unconventional methods while non-state actors could develop capabilities that resemble traditional military forces. Thus changes in the strategic environment have not made one threat 'disappear'. A key conclusion is that the JSF fleet must be useful against both conventional and unconventional threats.

Conventional threats

While it is difficult to predict the course of political change in the region, it is possible to see how some states could come into conflict—particularly over disputed territory. Deeper factors, such as changes in the regional balance of power, might also cause instability. In addition, some states could attract regional anger if they are unable to control the activities of non-state actors within their borders or fail to keep international agreements over nuclear,

chemical or biological weapons. As a result, the clear priority of *Defence 2000* was protecting Australia from conventional military threats. Part of the ADF's requirement to achieve this involved maintaining air combat aircraft that were 'at least comparable qualitatively to any in the region'.¹⁴

However, an examination of capability development trends in Asia shows that a number of regional air forces are likely to become significantly more sophisticated over the next fifteen to twenty years. These forces are expected to improve training standards and introduce new fighters, advanced weapons and sensors, and force multipliers like AEW&C aircraft.

Improvement outside the major regional states is likely to be narrowly-based. This may involve cases where forces raise a small element to an 'advanced' level, or acquire one or two weapon systems that either create a significant advantage or negate a specific threat. These trends are significant for Australia because improvements in regional air forces will negate or reduce Australia's present qualitative advantage. It will therefore be important to invest in an air combat capability that ensures Australia remains ahead of other states.

Unconventional threats

Focusing on state-based actors and high-technology weapons would lead to a very narrow defence policy in today's world. *Defence Update 2003* avoided this when it recognised the need to protect Australia against unconventional threats from two related sources.

¹⁴*Defence 2000*, paragraph 8.39.

The first source is the result of technology that can be used in 'asymmetric' or unexpected ways, such as terrorist groups that have adopted internet and mobile communications technology. Other groups can be expected to follow similar patterns in the future, including in situations where other non-state actors acquire the 'trappings' of advanced military forces.

The second source concerns how determined people achieve their goals. Unconventional adversaries respond to the competence of their state-based adversaries by avoiding conventional forces, and aim their attacks at the state's physical and psychological vulnerabilities instead. There are also a number of regional and international non-state actors who are prepared to use technology without scruple and sometimes without an *immediate* political objective in mind.

Because of these diffuse threats, states such as Australia are going to have to rely on the agility of their forces. Agility will be obtained, in part, by deploying multi-role platforms and a wide range of supporting capabilities. Agility will also require well-trained people and flexible operational concepts.

ADF operational concepts

The future ADF will be founded on a family of nested operational and functional concepts that aspire to create an effects-based, networked and seamlessly integrated force.¹⁵ This aspiration is being developed into an *Australian Joint Operations Concept* that can 'configure in agile, task-oriented mission groups, with the freedom of action to synchronise effects throughout the mission space and with the capability

¹⁵Department of Defence, *Force 2020: Our Future Defence Force*, Commonwealth of Australia, Canberra, 2003.

of exploiting opportunities that arise'.¹⁶ This concept also describes a number of tenets for future concepts, which include complexity, cooperation with national and international partners, technology, networking and the fundamentally human nature of conflict.

While the Australian Joint Operations Concept is still in its early stages of development, Defence thinkers are beginning to consider new ways of organising forces for combat. In particular, today's organisational constructs (such as squadrons) may not actually deploy on operations. Instead, packages of aircraft (what we will later call Expeditionary Air Wings or EAW) may be brought together to perform a certain mission. For example, Australia might choose to commit an Expeditionary Air Wing consisting of fighters, AEW&C, MRTT and maritime patrol aircraft as part of a coalition task force.

Implications of threats and operational concepts for the JSF

The dynamic nature of the operational and threat environments means that flexible, multi-role platforms can help to create a broader range of options for Government against both conventional and unconventional threats. However, achieving real flexibility requires attention to the way information is used and to how the force is organised.

The ability to use information to achieve flexibly can be seen in the way that the JSF can cue other weapons, pass targeting information and provide interactive assessments of the unfolding situation. But the current method of passing information to filtering headquarters before providing it

¹⁶Air Commodore Mark Lax, 'Australian Joint Operations Concept', *Presentation to the ADF Future Joint Warfighting Conference*, Canberra, 20-21 April 2005.

to combat units is unlikely to help the force generate tempo, achieve surprise or exploit the opportunities that information from the JSF can provide. Therefore new organisational concepts, supported by training and doctrine, are needed so information can be passed directly to where it can best be used.

The Australian Joint Operations Concept also creates more specific demands for the JSF and aerospace power in general. These demands can be seen when the JSF is considered against the future joint force's desired attributes:

- *Expeditionary.* The JSF will be able, with appropriate bases, to form part of a joint or coalition task force. One of its key features will be its interoperability with Australia's major coalition partners, especially in terms of information and logistics. This means a JSF squadron could 'plug and fight' into a US-led coalition with a reduced level of support from Australia.
- *Agile.* The JSF's agility will be derived from its ability to conduct more than one role at a time. For example, the JSF could be gathering information for the joint task force and strategic command as it attacks targets that are of intimate concern to the ground force commander. The JSF will also assist others achieve agility by protecting manoeuvre forces as they change task, thereby increasing the joint force's overall tempo.
- *Lethal.* The stealthy JSF, with or without standoff weapons, will provide the capability to reach deep into the adversary's territory and its leaders' minds by applying force to achieve direct or indirect effects. JSF will need the

widest range of weaponry available to provide options across the spectrum of conflict.

- *Networked.* The JSF's ability to exchange information with other forces will be fundamental to the network. The JSF will also be a crucial contributor to Network Centric Warfare because it is both its own sensor and shooter, and a key component of the broader grid.¹⁷
- *Survivable.* The JSF will use stealth, speed, manoeuvrability, enhanced situation awareness and firepower to protect itself while achieving its task.

While the JSF displays all of these characteristics, to be fully effective the JSF must be considered as part of a total 'system' that includes protected bases, air-to-air refuelling, AEW&C aircraft and other off-board information sources and weapons from other platforms. This level of teamwork will enhance the JSF's survivability in the contemporary battlespace.

New historical roles?

At present, the primary roles of air combat capability are air defence and strike. The capabilities required to carry out these roles also allow the JSF to conduct a range of support missions that include suppression and destruction of enemy air defences, offensive air support for land and maritime forces and combat search and rescue. While these primary roles and missions will remain valid into the future, the JSF's suite of sensors, processors and communications links are likely to make *battlespace awareness* a major role for this fighter aircraft.

¹⁷The ADF's NCW concept is described in *ADDP-D 3.1 Enabling Future Warfighting: Network Centric Warfare*, Commonwealth of Australia, Canberra, 2004.

Defence 2000 stated that the essential role of the air combat capability was defending Australia from conventional air attack.¹⁸ The threat was broadened after the events of 11 September 2001 to include the use of civil aircraft by terrorists. Now it is common to deploy fighter aircraft to protect major international events and important visits by international leaders. Fighter aircraft have also been employed extensively in recent years to establish blockade-style 'no fly' zones. These types of tasks extend air defence by emphasizing its psychological impact, which effectively takes the concept beyond its usual focus on warfighting.

Strike also remains a primary role for air combat capability, especially since improvements in precision and 'reach' allow contemporary planners to affect enemy decision-makers without destroying their forces or economic infrastructure. This does not mean that war will become any less chaotic, violent or dangerous. However, there is clearly a greater ability for well-informed forces, conducting well-planned attacks, to strike targets that produce a nerve-shattering effect on enemy leaders. In addition, the ability to limit collateral and unintended damage and deaths can support political messages in conflict. The potential to strike against time-sensitive targets can also be improved, based on the ability to reduce the gap between detection, decision and action.¹⁹ These

¹⁸*Defence 2000*, paragraphs 6.30 and 8.39.

¹⁹It is essential to minimise the time from target detection to target destruction in cases where those targets can move quickly. Long-range standoff weapons can be useful for fixed targets but are of little use when the flight time of the weapon is longer than the time it takes to relocate the target or longer than the window of opportunity to attack the target. Hence one of the requirements of the US Air Force for the JSF was the concept of 'loitering stealth'—the ability to persist and survive over the battlefield and available to deliver weapons when there is only a limited window of availability.

improvements highlight the ability of modern air power to increase the options available to fight—even in cities which modern militaries try to avoid—and raise the prospect of creating cognitive, rather than only physical, effects through strike.

The utility of airpower in its less-emphasised historical role of combat support has also been enhanced by technology and operating concepts. For example, air combat forces show their flexibility by using precision weapons in urban combat, employing their sensors and jamming capabilities in support of ground forces, and applying their speed and range in Combat Search and Rescue. Supporting roles such as these are only likely to expand in the future as sensor and weapon capabilities continue to improve. It might therefore be timely, given the types of sensors and communications links planned for the JSF, to consider battlespace awareness as a primary (as opposed to a supporting) role for the JSF.

Winning the battle for information dominance is the first task in much modern military thinking. While this assertion has not been conclusively proven, it is worthwhile considering the possible contributions of the JSF to this task:

- The JSF will collect and analyse electronic signals during routine missions, which will locate and identify any threats that are emitting such signals;
- It will have a synthetic aperture radar (SAR) that can produce high resolution maps of the ground in all weather and at considerable stand-off ranges;
- It will have a Ground Moving Target Indicator (GMTI) overlaid on the SAR image;

- It will have an on-board electro-optical system and infra-red sensors that will provide a day and night reconnaissance capability;
- It will have the ability to pass 'video' pictures in real time;
- The information gained from these sources can be passed to other forces through data link capabilities; and
- It will be piloted by a highly-trained officer who can make on-the-spot decisions about what he or she sees.

All of these sensors will provide the JSF with the ability to locate and identify enemy forces in real time regardless of cloud, rain or light. This will allow the pilot to engage targets as they present themselves and to forward collected information to improve the joint force's ability to understand the situation and take action. This will, in turn, help create the common operating picture that is fundamental to Network Centric Warfare. The improved functionality will also be useful in non-warfighting situations too.

The use of combat aircraft for battlespace awareness is already influencing operations. Recent experience from Iraq has shown that sensors on-board coalition fighter aircraft are providing highly useful information, which is increasing the demand for air support by land forces. One source estimates that only 10 per cent of missions in Iraq now involve 'kinetic' attacks. The other 90 per cent of missions involving fighters and other specialised surveillance and reconnaissance aircraft gather information or provide 'non-kinetic support' (such as jamming) for land forces. This has also required a significant increase in resources for analysing data (both in-theatre and in remote locations) and organisational innovations such as the 'intelligence fusion cell' in the

Combined Air Operations Centre.²⁰ This increased demand for both information and 'non-kinetic' support could place upward pressure on JSF numbers.

JSF: agility, awareness, interoperability

The relationship between threat, operational concepts and the roles for the JSF can be expressed through the recurring themes of agility, the information potential of the JSF and its utility in joint and coalition operations.

Agility is essential because Australia faces both conventional and unconventional threats. But making the most of the JSF's agility will require more than additional sensors and weapons: agility will also require new thinking about roles, organisations and competencies. So while smarter sensors and non-kinetic or non-lethal weapons will be important, re-conceiving the JSF as an information platform will also help to underscore the flexibility and utility of this capability.

The JSF's potential as a source and user of information will change the way we perceive air power roles in Australia and make platforms such as the JSF indispensable to future operational concepts. However, this advantage will only be realised if:

- The ADF can develop a global view of its information sources, flows and users (or its information architecture) so that the JSF's unique contribution to the information battle

²⁰David A. Fulghum, 'Sensing Conflict, Networking Peace', *Aviation Week and Space Technology*, 23 May 2005, p. 50. Another estimation of the ratio of 'kinetic' to ISR missions flown by fighter aircraft in Iraq was '50:50', although this source acknowledged that ISR was often being conducted on the way to and from attack missions. Both estimates show the increasing use of fighter aircraft in the battlespace awareness role, and the contribution of air power to coalition operations in Iraq.

can be identified. This knowledge will also be fundamental to making the most other assets such as the AEW&C and Air Warfare Destroyers. It will also be critical to implementing Network Centric Warfare.

- ADF intelligence, surveillance and reconnaissance (ISR) development is made more coherent. Unifying the effort under a single capability manager would be a good start.
- A clear and agreed concept of the joint network's standards and design is developed. It was suggested in one workshop that the JSF could be reference point for the ADF's joint network, but it is not clear whether such a proposal would have wide support. This potential for disagreement highlights the concern about data standards, as there does not seem at present to be an agreed data strategy for linking ADF platforms within the joint force or with Australia's major coalition partners. There is also some concern about the robustness of any network that Australia could field. This concern stems from the small numbers of Australian platforms and the potential to have different standards of 'networking capability' both within the force and between coalition partners.
- A better process for passing information from the JSF to users is developed. At present, information from the JSF will probably be analysed at RAAF ground-stations or at one of Defence's intelligence agencies. This process is sure to increase the time taken to get potentially 'perishable' information to field commanders. Defence should therefore consider alternative structures, such as

deployable information teams that are attached to combat units.

The choice of future air combat platforms, including the supporting AEW&C and MRTT aircraft, also provides a significant advantage in terms of interoperability with Australia's major coalition partners. The JSF will not only be welcomed as a useful contribution: it will be actively sought for US-led and regional coalitions because of its ability to 'plug and fight' and to provide a technologically-superior warfighting capability. But this will only be achieved if the JSF fleet is well resourced and supported.

In with the old, in with the new

Australia's qualitative advantage in air power will be reduced over the next two decades unless the F/A-18 and F-111 fleets are replaced.

The ADF needs lethal and non-lethal options to counter asymmetric threats.

Networking will increase ADF effectiveness: by how much?

'Battlespace awareness' will become a new major role for the JSF, meaning that demand for JSF support will exceed that for existing fighter aircraft.

Organisational change is needed to make the most of the JSF's abilities.

The logistics of air combat capability

The final group of factors concerns the logistics of air combat capability: how national resources are assigned, how capability is maintained over time, and how the RAAF and Defence in general develops the people required to make the JSF effective. None of these issues are straight-forward and all of them require significant thought before contracts are signed.

Reality cheque

The Australian Government's *Intergenerational Report* of 2002 shows that, if current trends in spending persist, a gap between spending and revenue will widen around 2015. By 2041-42, the gap is projected to grow to near 5 per cent of Gross Domestic Product (GDP). In addition, this report predicts that GDP growth will slow from an average of 3.1 per cent per annum in this decade, to 2.3 per cent in the 2010s and 2.0 per cent in the 2020s.²¹

If these predictions are accurate, the competition for budget dollars will intensify over the next ten to twenty years. As a result, the promised 3 per cent real increase per annum for the Defence budget could cease early in the next decade. Furthermore, Defence should be ready to adapt to a decline in real spending beyond that unless the strategic environment demands more.

If the amount of money available to Defence declines during this period, it is not a great leap of logic to see expensive military capabilities as candidates for budget cuts. Consequently, Defence will need to reconcile competing pressures within its own allocation, regardless of whether or not there

²¹The Hon. Peter Costello, MP, *Intergenerational Report 2002-2003*, Budget Paper No. 5, Commonwealth of Australia, Canberra, 2002; available at www.budget.gov.au, accessed 4 August 2005.

is a decline in the total size of the appropriation. And if there are continuing concerns about terrorism, crime and illegal immigration, then Defence capabilities for warfighting are likely to face competition from other priorities, particularly from those that seem to promote the immediate security of Australians.

This makes it essential to ensure the public is well-informed about the importance of high-technology military capability. Defence needs to argue that technology saves friendly lives and allows the allocation of scarce and valuable human resources more efficiently and with less risk. Military technology is therefore not a 'luxury', but essential in any conflict.

Support and sovereignty

Through-life support for the JSF will be accomplished by a unique arrangement called the Global Sustainment System that treats all aircraft as part of a large pool with no distinction between different nations. However, this system does not allow for local variations in use of the aircraft or for national support requirements. Hence, the Global Sustainment System model also includes a National Sustainment Integrator. While the JSF Program Office in the US will manage most aspects of the aircraft fleet as part of a large pool, the National Sustainment Integrator will manage those unique to each nation or required for the purposes of national sovereignty.

Each nation that buys the JSF will have different requirements. In the case of Australia, these include the capability to maintain RAAF aircraft at remote locations, and to reprogram the electronic warfare suite and off-board mission support for mission planning and analysis. Satisfying these national requirements will require a transfer of technology and intellectual property from the United States to Australia. Because these are sensitive technologies, the requirements will need to be very

carefully defined and detailed negotiations will be necessary before the Government commits to purchasing the aircraft.

People powered

The combination of technologies used in the JSF should ensure that Australia's air combat capability maintains a qualitative superiority in the region until the middle of the twenty-first century. However, there are important questions surrounding Defence's ability to recruit, train and retain sufficient people to exploit the JSF's full potential. Consequently, people issues will be a significant influence on the size of the JSF fleet and Australia needs to start addressing such issues today.

It is questionable whether the RAAF could actually train and retain enough air and ground crew numbers to sustain a large JSF fleet. The RAAF has experienced pilot shortages in the past—to the point where it had more operational aircraft than pilots.²² The JSF could widen any existing gap in two ways.

Firstly, the JSF should be able to fly more sorties per day than the current F/A-18 and F-111 aircraft.²³ If this assumption holds, the RAAF will need more pilots per aircraft in order to get the maximum benefit from the JSF. Indeed, the *AIR 6000* Project Office already recognises this and is working on a figure of 1.8 pilots per aircraft – up from the long-term average of 1.0 for the current fleets.

Secondly, the wider defence force will find it increasingly difficult to attract new recruits and retain

²²See Australian National Audit Office, *Tactical Fighter Operations*, Commonwealth of Australia, Canberra, 2000, Chapter 3. The current situation has not been publicly stated by the RAAF.

²³This figure was provided in an industry brief by Lieutenant Colonel Ed Conart, USAF at Russell Offices, Canberra, 22 March 2005. The F/A-18 flies 2 sorties per day at the moment.

serving members.²⁴ These supply-side restrictions are only likely to compound the demand side difficulties and place significant pressure on the RAAF to recruit and retain sufficient pilots.

In addition to needing additional skilled people to fly and service aircraft, the ADF will also need a range of other specialists to support the future air combat force. For example, the huge volume of new information to be produced by the JSF and AEW&C aircraft will demand a commensurate increase in the number of information analysts. How these analysts will be trained, and where they will be employed, are questions that require further consideration. Issues arising from organisational changes, particularly those designed to facilitate the flow of information, will also need to be addressed.

Talking logistics

Continued investment in high technology capability is essential.

The JSF support plan must not constrain Australia's future options, and must save money over the long term.

At a minimum, Australia should ensure that all routine repairs on JSF can be conducted in Australia, by Australians.

The RAAF must develop their people strategy for the JSF now, and begin to implement it.

²⁴Dr Thomas Schindlmayr, *Defence Personnel Environment Scan*, Defence Personnel Executive, Commonwealth of Australia, Canberra, August 2001, pp. 110-11.

PART 2: HOW MANY JSF SQUADRONS DOES AUSTRALIA NEED?

Method for Part 2

Focal Question

Part 1 identified a number of issues relevant to the ultimate size and employment of the future JSF fleet:

- The emerging divergences between *Defence 2000* and *Defence Update 2003* show that the future JSF fleet must be able to cope with policy changes.
- The analysis also identified the guidance of 'one major, one moderately-sized and a strike operation' for force structuring, and highlighted the importance of being able to make credible contributions to high-intensity, coalition operations.
- The potential for the JSF to create an information advantage for the ADF, in operations across the spectrum of conflict, also stood out as a driver for future force numbers.
- When this information potential was combined with stealth, precision, speed and variable effects, it became clear that the JSF would be useful against conventional and unconventional threats in some situations where the F/A-18 or F-111 aircraft are not.
- At the same time, the availability of necessary people, the power of networking, potential questions about maintenance and support and the need to adopt organisational changes were also essential to thinking about the future JSF fleet.

This part uses the conclusions reached in Part 1 to tackle the ultimate aim of this report, which is to understand the strategic utility of differently-sized JSF fleets and recommend an optimum fleet size. This will be achieved by considering the following focal question, which is drawn from the strategic guidance described in *Defence 2000*:

The future air combat force needs to perform one major operation, one moderately-sized operation and one strike operation simultaneously. The future air combat force must also have aircraft available for training, maintenance and attrition.

Given three different force mixes, what is the strategic utility of the future air combat capability in each strategic policy style? What are the risks associated with each force mix?

This part starts by describing the method used to identify the strategic utility of each force mix, before moving to the analysis of their utility in the two contrasting policy scenarios. The part concludes with a discussion of the total JSF force sizes needed to support each option.

Scenario Discussions

'Scenario discussions' offer one way to compare different force mix options by bringing together the different strategic policy, threat, operational concept and role issues. The method used in this report involves:

- identifying two strategic policy styles, to account for the possibility that Australia's strategic policy might change over the next 20-30 years (the styles are sketched in Annex A);

- developing a different scenario for each policy style to illustrate the types of strategic tasks that the JSF may be required to undertake (the scenarios are described in Annex B);
- developing three JSF fleets (based on three, four or five combat squadrons) and supporting AEW&C and MRTT aircraft (Table 1);²⁵
- identifying the key tasks that the JSF would be expected to perform in each scenario;
- identifying strategic performance measures for air combat in each scenario (Tables 3 and 6);
- describing the strategic utility of each fleet against a series of performance measures (Tables 5 and 7); before
- providing an estimate of the total number of JSF that would be needed for an operational fleet (Table 8).

Developing a range of performance measures for each strategic policy style is essential but potentially controversial, because measures can be difficult to describe with accuracy and even more difficult to apply objectively. Recognising these limitations, the performance measures have been based (in part) on the 'capability goals' described in Chapter 8 of *Defence 2000* and the ratings are justified in the narrative for each force mix option.

²⁵Force Mix Option 3 is probably unachievable within the current budget of A\$12.5 to A\$16.5 billion. The discussion of this option therefore becomes the way to compare what an increased investment in the JSF could deliver.

Table 1: Force mixes studied

Force Mix Option	F-35 JSF (Number of Combat Squadrons)	Airborne Early Warning and Control (AEW&C) (on line)	Multi-Role Tanker Transport (MRTT) (on line)
1	3	4	4
2	4	4	4
3	5	4	4

Assumptions:

1. For the sake of analysis a squadron is assumed to comprise sixteen aircraft. (Note: this is relatively small. For example, the US Air Force is planning on 24 aircraft JSF squadrons).
2. A JSF squadron of sixteen aircraft is required to provide twelve Fully Mission Capable (FMC) aircraft, the remainder of aircraft being in either planned or unplanned maintenance.
3. Twelve FMC aircraft are required to maintain a combat air patrol for 18 hours a day, 7 days a week for an extended period. (This is referred to as a 18/7 CAP)
4. The JSF force will also include a training unit of 12-18 aircraft. While suitable for operational tasks, these aircraft are not factored in to the scenario discussions. But they do represent a reserve or surge capacity in all scenarios. Their use, however, would be a 'one shot' capability requiring considerable time to recover, particularly to regenerate the training capability.
5. The total AEW&C fleet will be six aircraft of which four can be expected to be available at any one time.
6. The total MRTT fleet is assumed to be five aircraft of which four are available at any one time.

Scenario A: Local interests

Policy style tested

Scenario A depicts a future strategic policy 'style' where local interests, primarily the defence of Australia and regional security, are the ADF's principal force structure determinants. In this style, the ADF will be optimised for deterring or defeating conventional attacks against Australia. The ADF will also be capable of projecting force into the region and its networked forces—particularly the air combat capability (including Jindalee and Project Vigilare), submarines, Air Warfare Destroyers and land forces—have a technological edge over potential adversaries.

Scenario description

In Scenario A, Australia is threatened by a regional state that is supported by a major global power. The regional state wants Australia to surrender the North West Shelf and cease supporting another regional state. In terms of air combat capability, the opponent has a total fleet of twenty 4th generation Su-30 fighters, thirty 3rd generation F-16 fighters and a relatively 'unintegrated' command, control and ISR system.²⁶

Sensing possible conflict, the Government raises the ADF's alert status, deploys the air defence assets listed in Table 2, and activates two Forward Operating Bases. An Expeditionary Air Wing (EAW), which includes JSF and AEW&C aircraft, also deploys offshore as part of a small joint task force.²⁷

²⁶Scenario A assumes that the Su-30 is armed with Beyond Visual Range Air-to-Air Missiles but it will be qualitatively inferior to the JSF in all situations except for 'dog fighting'.

²⁷The EAW task illustrates the 'moderately-sized' mission described in the focal question.

Sukhoi Su 30

The Russian Sukhoi Su-30 is a two-seat, twin-engine multi-role fighter aircraft. The Su-30 can outperform most Western fighter aircraft in close-in air combat.



Photo: Sinodefense.com

F-16A Fighting Falcon

The General Dynamics F-16A 'Fighting Falcon' is a single-engine, single seat fighter. It can be equipped for air-to-air missions, and can conduct air-to-ground missions with cannon, missiles and bombs. It can also carry drop-tanks, targeting pods and electronic warfare pods.



Photo: F-16 in 'aggressor' livery (USAF)

Other RAAF Force Multipliers

Jindalee Over The Horizon Radar (OHTR). The Jindalee OHTR 'bounces' high-frequency waves off the ionosphere to detect air and maritime targets at significant distances from Australia. Radar sites are at Alice Springs (Northern Territory), Laverton (Western Australia) and Longreach (Queensland).

Project 'Vigilante': This project will provide the command and control infrastructure to connect ground based, air defence assets into a single integrated system for the RAAF and ADF.

Table 2: Likely ADF Active Air Defence Assets, 2015

Force Mix	RAAF	RAN	ARMY
Option 1	2 sqn Air Defence (AD) 1 sqn Strike/AD	3 x Air Warfare Destroyers (AWD) (one AWD protects one area with a 250 nm radius)	6 x RBS 70 Missile Troops (RBS 70 is a Very-low level ground-based AD weapon system. One RBS 70 troop of five launchers protects one small asset)
Option 2	3 sqn Air Defence 1 sqn Strike/AD	6 x ANZAC Frigates (one ANZAC frigate protects itself. It could also give limited protection to one small sea-based asset)	
Option 3	4 sqn Air Defence 1 sqn Strike/AD		

In this scenario, the future air combat force will be essential to:

- deter aggression,
- reassure neighbours that Australia has the capability and will to resist aggression,
- defend Australian assets,
- win the information battle,
- protect and support land and maritime forces, and
- conduct strategic strike.

The priority for tasking in this scenario will be determined by the Government's preferred posture.

- If the posture is defensive, the priority will likely be given to defensive counter-air operations, primarily combat air patrols (CAP) over key assets or areas.²⁸ Even though the posture is defensive, the option for strike operations would be retained.
- If the posture is offensive—possibly including pre-emptive strikes—the priority will go to strike and offensive counter-air operations. This allows the JSF, and other assets, to neutralise the threat through proactive operations.

Regardless of the posture, Australia will always need some ability to conduct strike operations because of Australia's large area, relatively small forces and dependence on stability for trade and economic well-being.

Performance measures for Scenario A

Table 3 describes the performance measures used to assess the strategic utility of each force mix in Scenario A. These judgements will be tabulated in a 'traffic light' matrix in Table 5. A number of

²⁸ A combat air patrol (CAP) is a defensive task that involves two or four aircraft defending a particular area, asset or activity. It is a flexible task and fighters, AEW&C and MRTT aircraft could be combined in any number of ways to achieve the desired result. In addition, the ability to sustain CAP is influenced by the task's distance from home base, whether the aircraft need to be airborne or on 'strip alert', how many hours per day the CAP is needed, how many crews are available (and their recent flying programs), and how many aircraft are available. This study has assumed that the task is 300 nautical miles (nm) from the base and that the aircraft must be airborne due to the threat of attack (that is, not on 'strip alert'). Some experts question whether the JSF will need to fly CAP, as it is known today, given the more complete information about the air battle that will become available to the ADF. While the authors recognise this point it is not yet proven, so a conservative approach had been adopted and the current CAP concept is used in this report.

assumptions have been made to support these judgements and these are explained in the narratives describing each force mix.

Option 1 (three JSF combat squadrons)

The strategic utility of a force of three combat JSF squadrons will be low. This option would have trouble successfully adopting a defensive posture because no more than two (or at a stretch, three) areas could be protected at once. This limited coverage would allow the adversary to strike undefended areas at times of their choosing. An offensive posture would therefore be preferred because such a small force would need to use its qualitative superiority early to strike the opposing air force before the latter becomes engaged.

The strategic limitations of Option 1 are highlighted by the grave political and military risks of adopting an offensive posture. The political risks include the potential for international condemnation and that 'pre-emptive strikes' might encourage the great power to assist its regional protégé. On the military side, an unsuccessful 'first strike' risks forcing the ADF onto the defensive, particularly in the air battle. This defensive posture would consume all the JSF, AEW&C and MRTT aircraft, it may be inadequate for the task and it would leave few, if any, aircraft for further strike missions. The worst case outcome would be a situation where Australia escalated the conflict by employing an offensive strategic posture: but lacked the air power 'punch' to finish the fight.

Table 3: Air combat performance measures for Scenario A

MEASURE	RANGE	DESCRIPTION
Flexible strategic posture	<i>(none-limited-flexible)</i>	The government has the flexibility to adopt either a defensive or offensive strategic posture.
Conduct air defence	<i>(limited-most-many)</i>	The air combat capability is able to protect all relevant high-priority assets from hostile air attack and air reconnaissance and to control the air approaches to ensure effective operations against any hostile forces approaching Australia.
Conduct strike	<i>(poor-marginal-good)</i>	The air combat capability is able to attack military targets within a wide radius of Australia, against credible levels of air defence, at an acceptably low level of risk to aircraft and crew.
Conduct battlespace awareness	<i>(poor-marginal-good)</i>	The force is able to provide forces to perform the battlespace awareness role in support of one major operation and one minor operation.
Conduct combat support tasks	<i>(poor-marginal-good)</i>	The force is able to conduct combat support tasks, such as close air support, battlespace awareness and combat search and rescue.
Sustain the JSF	<i>(poor-marginal-good)</i>	The JSF force is able to sustain operations for the likely duration of the campaign.
Sustain AEW&C aircraft	<i>(poor-marginal-good)</i>	The AEW&C force is able to sustain operations for the likely duration of the campaign.
Sustain MRTT aircraft	<i>(poor-marginal-good)</i>	The MRTT force is able to sustain operations for the likely duration of the campaign.
Effect of attrition on the mission	<i>(high risk-acceptable-low risk)</i>	Aircraft losses do not jeopardise the strategic mission.

Adopting a *defensive* posture from the outset also has risks. With three squadrons in total, the future air combat force could use two squadrons to conduct two 18/7²⁹ CAP for thirty days, and split the third squadron between the Expeditionary Air Wing, strike tasks and the reserve. So while the ADF's air defence assets—JSF, Air Warfare Destroyer and ground-based air defence (GBAD)—protect the North West Shelf, offshore territories, major airbases and Darwin, other major centres and installations in the top-end as well as East Timor will be forced to rely on passive defensive measures (see Table 4). There would be inherent strategic and political risks because the inhabitants of towns, mines and other important facilities in this region would remain undefended and would question the Australian Government's priorities or commitments.

Having such a limited duration of operations each day is another significant problem. If 24/7 operations were required for more than 30 days, the JSF training squadron would need to be mobilised, lest the number of tasks possible with this force mix fall to one plus the Expeditionary Air Wing. This limited ability to sustain operations presents a significant risk for Option 1 in this scenario.

Given this limitation, the enemy could be encouraged to prolong the conflict. This would be highly detrimental to air combat effectiveness, because Option 1 would not provide rotation forces. As a result, the rate of effort for each aircraft will go from around three sorties per day in the first week, to one or possibly two per day after 30 days. Pilots would also likely be diverted from training and staff duties—including command and control duties—to keep aircraft in the air. Such a redistribution of

²⁹ '18/7' describes the number of hours per day on task for 7 days.

resources would have a detrimental effect upon long-term effectiveness and sustainability.

Success with Option 1 in Scenario A will involve spreading the existing air defence assets very thinly, thus relying on the command and ISR system to create significant economy of effort with AEW&C aircraft and JSF flying hours. Even providing extra MRTT aircraft for the force does not appear to be particularly helpful in this scenario, because the few available fighters would be unable to exploit the full fuel delivery potential of the Airbus A330, although an increased number of MRTT aircraft would allow for a greater dispersion of tasks.

There would be few fighters available to conduct dedicated combat support or battlespace awareness sorties in support of the other Services, although the JSF may be able to provide some support while it is conducting air defence missions. This could expose the land and maritime forces to higher levels of risk and present a significant constraint to Australia seizing the initiative in the campaign.

With a force mix of this size, the loss of even a few JSF or a single AEW&C or MRTT aircraft would have an immediate and significant operational impact.³⁰ Such a loss would probably have a substantial impact upon public confidence too.

While noting the risks, a three-squadron JSF force would need to adopt an offensive posture to avoid a prolonged conflict. If Australia were forced into a drawn-out defensive battle, this force mix would be exhausted quickly and have to draw on its training

³⁰It should be noted that AEW&C and MRTT aircraft are unlikely to be attacked by enemy fighters when our forces maintain a good understanding of the air environment. Losses due to mechanical failure or ground attack are possible but probably not highly likely either.

capability—there would be no reserve capacity. As a result, Australia would probably need significant support from its allies. The inability to support East Timor, for example—without undue risk in other areas—may also reflect poorly on Australia's ability to keep its regional obligations. These factors may, in turn, influence international perceptions of Australia's strategic weight.

Further, the inability to protect more than two areas in high-tempo operations would allow the adversary to attack unprotected assets. This would have immediate, negative domestic implications and probably operational implications as well. However, other ADF assets could be spread thinly to deter such action or cause attrition in less-than-optimal defences. Adopting a defensive posture in a prolonged campaign to defend Australia would be a near-run thing and failure is possible. Clearly, a future air combat capability based on three JSF squadrons poses a significant strategic risk.

Option 2 (four JSF combat squadrons)

Option 2, with four JSF squadrons, increases the Government's strategic options by providing the ability to protect more assets while maintaining some strike capability. However, while both offensive and defensive postures would be viable in this scenario, this would not be the case if the campaign is prolonged. In summary, Option 2 will only provide the ability to conduct operations in one theatre at a time and make it difficult to sustain 24/7 operations without using the training squadron. This option would also not offer rotation forces.

**Table 4:
Possible air defence priorities in Scenario A**

(Note: This allocation illustrates ADF capabilities in a defensive posture: it cannot portray all of the options available to Australian planners; nor does it provide a definitive statement of how the Scenario A campaign should be fought.)

Asset	Active air defence allocation	Can be achieved with which force mixes?
Darwin	1 X JSF sqn, 1 x RBS 70 troop	All
Cocos Islands (Expeditionary Air Wing)	½ JSF sqn, 1 x AWD, 1 x RBS 70 troop	All
North West Shelf	1 x AWD, 2 x ANZAC Ships	All
RAAF Tindal	1 x JSF sqn , 1 x RBS 70 troop	All
RAAF Curtin	1 x JSF sqn, 1 x RBS 70 troop	Option 2 Option 3
Timor Sea oilfields	1 x JSF sqn, 1 x AWD, 1 x ANZAC Ship	Option 3
Pilbara region	1 x RBS 70 troop	None
Komoro Airfield (East Timor)	nil	None
Christmas Island	nil	None

If the air combat force has four combat squadrons, the Expeditionary Air Wing and strike tasks could be given to one squadron (at the expense of a dedicated reserve), leaving three squadrons available for 18/7 CAP tasks. More tankers would be useful with this force mix, as they would extend the fighters' range from base, increase the time on station for each CAP task to 24/7, and make it easier to balance strike and CAP tasks.

Table 4 above presents one allocation of assets to tasks in a situation where the government decides to adopt a defensive posture in Scenario A. Once again, more areas could be defended using other ADF air defence assets with a four-squadron force. This could allow the ADF to develop a thin air defence screen over a limited number of major national assets from Learmonth through the offshore territories to northern Queensland.

There would be ability to provide support to the other Services with this force mix but any decision to divert forces from the air defence battle would be a risk. If such a risk were taken, the JSF's ability to acquire targets and then attack would have an important impact upon the information, land and maritime battles.

While the effect of attrition of a few JSF aircraft would not have the same impact in this force mix option, the loss of any AEW&C or MRTT aircraft would always have a significant impact and be a major operational and strategic concern.

Importantly, the Australian Government would have an opportunity to adopt a defensive posture using this mix. While this would avoid the negative repercussions of striking first, it would be of small comfort given the risk of failure due to the limited ability to rotate and sustain the air combat capability. Further, the increased number of tasks for both

AEW&C and MRTT aircraft would probably exhaust them quicker, or reduce the amount of time that each could spend in the air. The likely need to draw pilots from training and staff positions during a prolonged conflict would also remain with this force mix but the need to do so would not be as great as that envisaged in Option 1.

Option 3 (five JSF combat squadrons)

Option 3, which is based on five JSF squadrons, not surprisingly offers the greatest flexibility of all the options. This flexibility provides a choice of adopting either an offensive or defensive posture. It enables a greater number of assets to be defended simultaneously, provides the ability to employ larger strike packages and can provide limited rotation of forces. While this option is probably beyond the funding presently allocated, it provides a worthwhile discussion of what extra investment could achieve.

The five squadrons of Option 3 would provide one squadron for strike/air defence, one for the Expeditionary Air Wing (with some capacity to provide a reserve) and three for 18/7 CAP tasks. Reducing the size of the strike squadron and the expeditionary task may allow three CAP tasks to stretch to 24/7 coverage, provide some extended rest for pilots and aircraft, or release some JSF aircraft for dedicated combat support to the land and maritime forces.

Option 3 would therefore make a defensive strategic posture more viable because the JSF squadrons would protect major assets for longer daily periods and sustain this level of activity. This last point is essential to maintaining capability in a protracted conflict. It may even force the adversary to reconsider his strategy if the ability to conduct strike operations is evident and if rotation allows the ADF to

sustain its operations over a long period of time. Of course, having a force of this size means that JSF losses would not take the same toll on overall capacity, although the loss of even one AEW&C or MRTT aircraft would still be serious.

A force of this size would also offer an option of conducting a significant pre-emptive strike and re-strike capacity. If desired, more than 48 separate military targets could be struck in one attack while retaining a significant number of fighters in defensive positions to prevent an immediate counter-strike.³¹

If the tempo of strike operations was low or predictable, Option 3 would allow forces to undertake battlespace awareness tasks, close air support for land operations and maritime strike with a minimum of risk to the air defence task. This type of tasking would significantly enhance the offensive potential and survivability of both land and maritime forces, particularly were precision air power directed against exposed enemy forces. The threat of conducting close air support or maritime strike would also help to reduce the effectiveness of enemy operations, because they must divert more effort to protective measures.

Even a five squadron force could not protect 'everything' and any forces required to protect assets in southeast Australia would need to come from the training squadron, or be diverted from tasks in the north. Similarly, a force of five JSF squadrons would not allow fighter squadrons to be overseas during such a scenario. The small force of four on-line

³¹The estimate of 48 targets is based on four MRTT aircraft supporting four eight-ship sorties, with each aircraft striking a very conservative two targets in the same sortie. Early briefings on the JSF indicate that each aircraft may be able to hit at least four different targets with precision weapons on a single sortie where fuel allows.

AEW&C and four on-line MRTT aircraft could be a significant limiting factor for this fleet. In addition to the sustainment issue mentioned in Options 1 and 2, both of these supporting fleets would have a limited ability to operate from more than two areas at a high rate of effort. While extra crews might be of use in the other options, the small number of AEW&C and MRTT airframes would be a constraint were five JSF squadrons available.

Table 5: Strategic utility of JSF force sizes in Scenario A

Force Mix	1 (3 combat squadrons)	2 (4 combat squadrons)	3 (5 combat squadrons)
Flexible strategic posture <i>(none-limited-flexible)</i>	Limited	Flexible	Flexible
Conduct air defence <i>(limited-most-many)</i>	Limited	Most	Many
Conduct strike <i>(poor-marginal-good)</i>	Poor	Marginal	Good
Conduct battlespace awareness <i>(poor-marginal-good)</i>	Poor	Marginal	Marginal
Conduct combat support tasks <i>(poor-marginal-good)</i>	Poor	Marginal	Marginal
Sustain the JSF <i>(poor-marginal-good)</i>	Poor	Marginal	Good
Sustain AEW&C aircraft <i>(poor-marginal-good)</i>	Poor	Poor	Poor
Sustain MRTT aircraft <i>(poor-marginal-good)</i>	Marginal	Poor	Poor
Effect of attrition on the mission <i>(high risk-acceptable-low risk)</i>	High risk	Acceptable	Acceptable

Scenario B: Global interests

Policy style tested

Scenario B illustrates a future policy style where protecting or advancing Australia's global interests is the primary force structure determinant for the ADF (see Annex A for more detail). In this policy style, the defence of Australia is reconceptualised as 'detecting and responding' to unconventional threats such as illegal incursions and terrorism, rather than a maritime strategy that aims to control the northern approaches and halt conventional forces.³² The other major expected role is conducting expeditionary operations, both in the region and further afield, as part of international efforts to ensure a stable global security environment. This role requires forces that are deployable, interoperable with allies and other coalition partners and survivable in potentially high-level warfighting operations. In contingencies closer to Australia, the ADF should be able to lead a regional coalition in peace enforcement and peace keeping operations. Strike would remain an important task because the force might be needed to attack adversary bases as a pre-emptive measure or to remove the possibility of a safe haven.³³

Scenario description

In Scenario B, a US-led coalition is set to restore order in a country in the Horn of Africa as part of the 'war on terror'. This operation aims to disrupt terrorist safe-havens within the still unstable region and set the conditions for the United Nations to restore long-term stability. The Government intends to

³²The maritime strategy is described in *Defence 2000*, p. 47.

³³This task should be read in the context of international cooperative efforts to strike terrorist bases. It does not imply that unilateral Australian strikes would be part of any policy.

commit a small joint task force, including a JSF squadron with supporting elements, for a period of up to two years.

However, a regional power occupies disputed islands in North East Asia just as the Horn of Africa operation starts. This clear breach of international law is met by strong condemnation and the United States prepares to lead another coalition to restore the *status quo ante*. The Australian Government wants to make a major contribution to this additional operation, including deploying at least a squadron of JSF, while maintaining its commitment to Africa.³⁴ There is concern that this conflict may escalate and threaten Australia itself and the Government has made it clear that it is prepared to redeploy forces to meet such a threat if it arises. The Government would also expect the JSF fleet to meet small-scale tasks, such as a CAP over a city or a strike against a terrorist base camp in the near region, without disrupting other operations.

In this scenario, the future air combat capability is an essential element of:

- contributing to international order and stability;
- reassuring neighbours that Australia has the capability and will to resist aggression;

³⁴Given the ability to 'package' air power as an EAW, it would be possible to send a small number of JSF (say six), one AEW&C, one MRTT and other aircraft to a contingency. While this approach is possible, such a commitment is unlikely to be visible, and even less likely to be militarily significant. As a result, a contribution based on a small EAW could lead to perceptions of 'token commitments' and have a negative political effect. As a result, the following analysis assumes that a sixteen-ship squadron is the minimum sized JSF force that the Australian Government would commit to a coalition, particularly where it wants to demonstrate 'strategic weight'.

- winning the information battle and supporting coalition land and maritime forces in two contingencies;
- promoting the required agility to respond to an unexpected conventional threat; and
- defending Australian interests, assets and airspace against an unconventional threat from within Australia or the region.

The priority for tasking of the air combat capability would be more difficult to predict in this scenario, and probably would depend upon the urgency given to ejecting the regional power as well as the international 'division of labour' within and between the two operations. For example, the Australian Government might be willing to leave a land presence in the Horn of Africa and divert air and maritime forces to the regional conflict; or it may focus on the Horn of Africa and avoid confronting the regional power. It could also choose a commitment somewhere between these options. As a result, Scenario B will discuss the force mixes in terms of the broad options that the Government has for employing them in each overseas contingency.

Performance measures for Scenario B

The performance measures for this scenario are shown below in Table 6, while the strategic utility of the force mix options is summarised Table 7. The issue of attrition is not discussed, as the effects are similar to those for each force mix in Scenario A.

Option 1 (three JSF combat squadrons)

The Government would have viable strategic options in Scenario B with three JSF squadrons but a force of this size would be unable to make concurrent contributions to both operations *and* sustain or rotate the force. There would also be risks concerning the

Table 6: Air combat capability performance measures for Scenario B

MEASURE	RANGE	DESCRIPTION
Conduct all expeditionary tasks	<i>(limited-most-many)</i>	The air combat capability is able to perform one major operation and one moderately-sized operation simultaneously.
Meet the strike and homeland security task	<i>(poor-marginal-good)</i>	The air combat capability is able to meet the strike and minor homeland security tasks without disrupting other commitments.
Flexible strategic posture	<i>(none-limited-flexible)</i>	The air combat capability provides government with a range of options to meet strategic needs.
Sustain the JSF	<i>(poor-marginal-good)</i>	The JSF force can be sustained for the duration of all operations.
Sustain AEW&C aircraft	<i>(poor-marginal-good)</i>	The AEW&C force can be sustained for the duration of all operations.
Sustain MRTT aircraft	<i>(poor-marginal-good)</i>	The MRTT force can be sustained for the duration of all operations.
Reliance on coalition support	<i>(high-medium-low)</i>	The level of support required from coalition partners when deployed.
Effect of attrition on the mission	<i>(high risk-acceptable-low risk)</i>	Aircraft losses do not jeopardise the strategic mission.

ability to conduct unexpected homeland security tasks and strike with this option.

Assuming that the operational tempo could be managed, Option 1 offers an ability to have one squadron on operations, one squadron recovering from operations and one preparing for deployment. This pattern could be maintained for a reasonable length of time—certainly for the two years envisaged for the Horn of Africa operation. However that tasking meets only part of the requirement of this scenario. Clearly, this pattern would be disrupted if a second squadron were committed to the regional contingency. Two deployed squadrons would leave only one for rotation, meaning that one deployed squadron would need to be withdrawn completely (and not replaced for a considerable period of time) after about 6-12 months. All returning squadrons would need a period to recuperate before resuming operational duties, which would create gaps in both of Australia's commitments.

Beyond this weakness, it is highly likely that two concurrent activities could pose dilemmas for the Government. For instance, does the JSF contingent stay in the Horn of Africa, or instead return to sustain the regional commitment? Another could arise if two squadrons were deployed overseas when a short-notice homeland security task emerges, such as a CAP over an international event or an increased need for border surveillance. Again, should the government redeploy some forces to Australia, or mobilise the training capability to perform such tasks—and damage long-term viability?

The 'two overseas contingency scenario' would be challenging for the ADF. What if the scenario was changed so that the second contingency became a non-warfighting task closer to Australia, such as an evacuation or response to a

terrorist threat? In this situation, it is likely that one of the two squadrons in work-up or re-fit could be tasked on a short-duration support to the non-warfighting task without jeopardising the operational sustainment plan. As a result, Option 1 limits Australia's strategic flexibility because, while it provides 'one shot' options for the overseas contingencies, it would not be large enough to rotate both contingents. Having two squadrons deployed overseas would also pose significant strategic risks if either a strike task or a minor homeland security task arose.

Hence, in the two overseas contingency scenario, there are serious doubts about whether the JSF would be sustainable at a reasonable operational tempo for a six-month period. In the case of the supporting AEW&C and MRTT aircraft there can be no such doubts; the force would be unable to sustain the pace of the requirements. For instance, each of the four AEW&C aircraft in the Horn of Africa would only fly one sortie every three days after an initial thirty-day period, unless the number of crews was increased significantly. Consequently, keeping even one AEW&C aircraft in the air for ten hours a day after the first month would require the commitment of the entire fleet and an increased number of crews. This would leave no aircraft for other contingencies, including any emergency requirements in Australia. Such a gap may be politically unacceptable.

However, given the 'package' nature of many coalition commitments, having capable AEW&C and MRTT aircraft may provide the Government with an option for a commitment without deploying the JSF. This 'support' package, particularly if mixed with ISR and transport support, may provide the Government with a low-profile, and highly useful, combat support option for one contingency.

Option 2 (four JSF combat squadrons)

Option 2 will begin to redress the shortcomings identified in Option 1 because four JSF squadrons can sustain one long-duration task overseas and still provide a squadron for the second contingency. However, the squadron deployed on the second contingency would need supplementation from the training squadron if it is to be rotated. As with Option 1, the aircraft for homeland security tasks or strike would need to come from the squadron undertaking deployment work-up, which should be possible unless the timing was particularly adverse. So while the ability to sustain two long-duration overseas contingencies would be limited, this force mix would provide the ability to at least make significant contributions early in a crisis.

The problem with sustaining the AEW&C and MRTT aircraft would remain in this option, while it would also be difficult to leave tankers at home for unexpected tasks. These limitations may be acceptable in Scenario B if other coalition partners were able to cover the gaps but given recent experience, the demand for AEW&C aircraft and tankers would always outstrip supply.

Option 3 (five JSF combat squadrons)

As expected, Option 3 would offer significant strategic utility in Scenario B because the ADF would have sufficient aircraft and pilots to sustain two separate operations for extended periods. Option 3 would offer the government significant flexibility and provide Australia with strategic weight, despite the limitations posed by the small numbers of AEW&C and MRTT aircraft. This option would also provide some spare capacity to undertake short-duration homeland defence tasks and strike. Nevertheless, the

ability to sustain both commitments for two years would remain limited in this option.

Once again, the present AEW&C and MRTT fleets would be adequate for only one commitment. As a result, the ADF could not send *and then rotate* a self-contained package consisting of a squadron of fighters, four AEW&C and four MRTT aircraft.

Table 7: Strategic utility in Scenario B, by force mix option

Force Mix	1 (3 combat squadrons)	2 (4 combat squadrons)	3 (5 combat squadrons)
Conduct all expeditionary tasks <i>(limited-most-many)</i>	Limited	Most	Many
Meet the strike & minor homeland security task <i>(poor-marginal-good)</i>	Poor	Marginal	Good
Flexible strategic posture <i>(none-limited-flexible)</i>	Limited	Flexible	Flexible
Sustain the JSF <i>(poor-marginal-good)</i>	Poor	Marginal	Good
Sustain AEW&C aircraft <i>(poor-marginal-good)</i>	Poor	Poor	Poor
Sustain MRTT aircraft <i>(poor-marginal-good)</i>	Marginal	Marginal	Marginal
Reliance on coalition support <i>(high-medium-low)</i>	High	Medium	Medium
Effect of attrition on the mission <i>(high risk-acceptable-low risk)</i>	High risk	Acceptable	Acceptable

Risks and numbers

Not surprisingly, this analysis shows that the Government's options increase, and the strategic risks decrease, as the number of JSF squadrons rise from three to five. In Scenario A, the risks of a three squadron fleet include: leaving key assets, population centres and allies undefended; being forced into a potentially dangerous offensive posture; encouraging the adversary to prolong operations; and being unable to provide air combat support to maritime and land forces. These risks decrease as a fourth and fifth squadron is added to the air combat capability but the risks associated with the relatively small MRTT and AEW&C fleets remain a concern.

In Scenario B, the risks of a three-squadron fleet include the inability to sustain two simultaneous overseas operations, and not having enough squadrons to conduct both unit rotation and homeland security tasks. Of course, Australia could send a smaller force to one or both commitments but sending 'token' forces risks damage to Australia's alliance relationships and perception of its strategic weight. Yet again, the small MRTT and AEW&C fleets are of concern because of their inability to sustain high-tempo operations and to cover two operations simultaneously or be available to support homeland security and strike operations.

Identifying these risks is useful to policy and decision-makers as they consider the difficult question of deciding how much national treasure to invest in the JSF. But what is the total number of JSF required to create three, four or five combat squadrons? One answer to this 'A\$16.5 billion question' is outlined in Table 8 and explained below.

Table 8: F-35 JSF Fleet Sizes

Force Mix	Number of Combat Squadrons	Number of aircraft in combat squadrons	Number of fighters in Enabling Force		Total Fleet Size
			Training Squadron	25% attrition and maintenance	
1	3	48	12	15	75
2	4	64	14	19	97
3	5	80	16	24	120

Since some of the facts that will help to make this judgement are classified or unknown at this stage, the fleet sizes presented in Table 8 are based on a number of assumptions about the best kind of organisation for a force that employs JSF, and about Project *AIR 6000* itself. Together, these assumptions create five significant sensitivities for the total fleet sizes described above.

Firstly, these figures assume that a combat squadron size of 16 (12 aircraft on-line with 4 aircraft undergoing planned and unplanned maintenance) will remain optimal. This number is expected to be large enough to allow for autonomous, sustained operations but still allow flexible 'packaging' to create such entities as Expeditionary Air Wings. More knowledge about the capabilities of the JSF may lead to a change in the number of aircraft required to conduct a specific mission—up or down—but this understanding will only come with ongoing analysis and experience.

Reduced maintenance requirements are a second source of sensitivity for the numbers of aircraft required. It is possible that the advertised higher reliability of the JSF might allow operating with fewer aircraft off-line, and a pool of approximately 25 per cent in the enabling fleet might not be required to achieve twelve on-line aircraft in each squadron and a

full training capacity. This uncertainty will only be clarified with experience gained in flight testing and support in service.

The size of the 'enabling force' for training, maintenance and attrition is a third source of sensitivity for this analysis. The size of the training squadron (the Operational Conversion Unit), will be driven largely by the number of pilots that need to be trained each year and the number of flying hours that pilots need to complete the conversion training to the JSF. As the discussion about personnel in Part 1 explained the pilot-to-aircraft ratio is expected to be higher for the JSF than current aircraft. The increasing sophistication of simulators, however, should mean that trainee pilots and squadron pilots need less time in the air to gain or retain proficiency. This should reduce the number of hours that the fleet flies each year, potentially reducing the number of training aircraft and number of attrition aircraft required. Clearly, these factors could create either upward or downward pressure on the required numbers of JSF.

The fourth source of sensitivity relates to Phase 2C of Project *AIR 6000*, which is the acquisition of the final tranche of capability. Phases 2A and 2B are together expected to comprise three squadrons of Conventional Take Off and Landing JSF and the necessary training and attrition aircraft as well as support, integration and facilities requirements. Phase 2C (set to be in-service in 2018-2020) could comprise additional JSF aircraft or some form of 'complementary' system, such as an uninhabited aerial combat vehicle (UCAV), to augment the strike capability. Phase 2C could also include enhanced weapons such as cruise missiles launched from several platforms including the JSF and transport aircraft. Acquisition of such complementary systems under Phase 2C could therefore reduce the total

numbers of JSF acquired—at a cost of acquiring specialised capabilities that reduce the overall flexibility of the air combat force.

The Government has recently advised that with the current budget Australia could acquire up to 100 JSF, as originally proposed in *Defence 2000*. Any increase in JSF price would put pressure on the budget and hence pressure on the number of JSF that are eventually acquired. Such cost increases could be driven by increased development costs, or occur as different countries reduce the size of their orders for the finished aircraft. The issue of funds available and unit costs is therefore a fifth, and very practical, influence on the size of the future JSF fleet.

CONCLUSIONS

This report has covered a broad range of factors that should be taken into account when the Australian Government decides how many JSF it will eventually buy for the future air combat capability. Much of the analysis in this report has been based upon an interpretation of declarative and emerging strategic policy, particularly guidance from *Defence 2000* where the Government wants the option to simultaneously mount one large and one medium sized operation in different areas, while retaining the ability to conduct strike operations.

Based on this guidance, a small JSF fleet provides the *ability* to conduct a range of tasks but its limited *capacity* provides very restricted strategic options. Not surprisingly, a larger fleet provides choice between strategic postures, sustains extended operations, absorbs losses limited without jeopardising operations and is more likely to cope with unexpected challenges.

The smallest force structure considered in this report (Option 1, three combat squadrons) severely limits Government options in any strategic policy setting. In Scenario A (the Defence of Australia) an offensive posture would be necessary because the small force size would not allow protracted defensive counter-air operations. This would pose considerable strategic risk because defensive operations would not be sustainable for long and there would be no fallback if these operations were not decisive within a short period of time. In Scenario B, the Government would have the option of contributing to allied or coalition operations offshore but with the constraint that it could only be sustained for a very short period because of an inability to rotate squadrons in both contingencies—unless the size of the force committed was very small. In any scenario, this force structure

option is very vulnerable to even minimal attrition. The conclusion is that three squadrons are unlikely to provide the Australian Government with either sufficient strategic options or strategic weight in either of the policy styles outlined in this report.

The median force structure considered (Option 2, four combat squadrons) would increase the strategic options available to Government by providing a greater capacity for defensive counter air operations while providing some concurrent strike capability. This allows the Government a greater freedom of strategic choice and reduces risk by allowing the option of either offensive or defensive postures. However, operations would still be limited to a single theatre, the sustainability of round-the-clock operations would be limited and there would only be a limited capacity for rotation of forces. Capacity increases for offshore operations in Scenario B, compared with the smallest force size, but sustaining those commitments still remains problematic. The four-squadron force structure better accommodates limited attrition of the JSF force but it is still sensitive to the loss of even a single AEW&C or MRTT aircraft. The conclusion is that the median force structure of four JSF squadrons is marginally viable in meeting Government requirements for strategic options and strategic weight.

The largest force structure discussed in this report (Option 3, five combat squadrons) provides the greatest degree of flexibility for the Government in terms of strategic options. This option allows a mix of offensive and defensive action and it is sustainable over an adequate period—although the duration of operations would be determined as much by AEW&C and MRTT support as the JSF force structure itself. In particular, the five squadron force structure would allow a sustained air defence posture in Scenario A, while retaining a substantial capacity for strike that

would act as a powerful deterrent. In different circumstances, this capability would allow the Government to make two substantial contributions to overseas operations in Scenario B—albeit with only a limited rotation capability—while maintaining an ability to conduct unexpected homeland security tasks. While the analysis shows that a five squadron force structure is the minimum required to provide the Government the freedom of action it desires, the authors acknowledge that the outlay required for this sized fleet does not fit within the current budget for Project *AIR 6000* and may not be supported in today's fiscal and strategic environment.

Strategic weight—which is another crucial measure—is the product of options, credible forces and sustainability. While the technology to be acquired for JSF meets the credibility condition, the JSF fleet must be large enough to rotate and sustain deployed forces. Without an ability to rotate, an adversary could prolong a conflict or force Australia to adopt a potentially unsuitable strategic posture.

This issue is compounded by the fact that in many cases the AEW&C and MRTT fleets, as currently planned, are unlikely to sustain high-tempo operations beyond 30 days. In consequence, the Government should review the resources it intends to devote to AEW&C and MRTT—including aircrew, logistic support and ultimately the number of these aircraft that it intends to buy.

Organisational issues will also need serious consideration if the ADF is to get the most from the JSF. In particular, the RAAF should discuss the transfer of information with the other Services so that old organisational concepts do not limit the JSF's value. One organisational area that was not covered in detail in this report was the way ADF capabilities such as Special Forces, air warfare destroyer,

ground-based air defence and information operations also contribute to 'air combat capability'. Understanding how these would systems work with JSF is essential to understanding the duplication and gaps within the ADF's combat capability.

A range of logistic issues will also influence the size of the JSF fleet. Of these, the number of available personnel would be a key determinant of fleet sustainability. Given Australia's recent shortfalls in pilot numbers, the ADF must place a high priority on obtaining enough quality personnel to get the most out of its eventual JSF investment.

Force structure discussions generally revolve around two questions. The first, 'what do you need?' involves looking at the options for achieving the Government's desired strategic objectives and then matching capabilities to those objectives. Given the continued need to control the air, to conduct strike and to support ground and naval forces, it is clear that the JSF is one system that the ADF will need into the future. But the sensors, data fusion and networking capabilities that the JSF brings means that it can do much more than these traditional air combat tasks—filling other capability gaps and providing Government with new options.

The second question 'how much is enough?' is essentially one of balance. Given the realistic expectation that defence forces will never get everything they want, identifying a suitable balance of forces within a finite budget is a tough but essential business. With the Defence budget in competition with other demands on the Government and the air combat capability in competition with other defence capabilities, there is a clear upper limit to the number of JSF that the Australian Government will choose to buy. The 2000 White Paper identified that upper limit as 100 aircraft. This report has looked at options up to

five combat squadrons, which is clearly above this. However, the new capabilities that the JSF will bring to the ADF will increase the demand for its services, and so place upward pressure on the number of JSF that the ADF will need to perform its missions in future operations. This means the operative question will become 'how much is too few?' once the ADF thinks deeply about the broad range of capabilities that the JSF will contribute to joint operations.

Annexes:

- A. Strategic Policy Styles
- B. Scenarios

STRATEGIC POLICY STYLES

A 'policy style' describes a particular approach to defining Australia's strategic posture, with the implication that different styles are likely to require distinctly different force structures. This concept is well illustrated by the differences between 'Forward Defence' and the 'Defence of Australia 1987'. The two styles present different views of Australia's national priorities and had significantly different implications for force structure, interoperability and basing.

Some argue that Australia still retains options to pursue different strategic policy styles in the twenty-first century. One option, represented by Style A, emphasises national survival, conventional threats and force projection into the region. This style approximates the policy described in *Defence 2000: Our Future Defence Force*. The second style emphasises national sovereignty, conventional and unconventional threats, and the ability to protect global and regional interests. It has been floated, but not developed, by analysts such as Alan Dupont and Michael Evans.

Readers are reminded that these styles are analytical tools, not actual policy options. The Kokoda Foundation does not recommend or prefer either style.

Table A1: Strategic Policy Styles

Style A: Local Interests <i>(Focused on Defence of Australia with projection into the region)</i>	Policy Styles	Style B: Global Interests <i>(Focused on projection into region and coalition contributions)</i>
<ul style="list-style-type: none"> National survival Regional stability Collective security 	Aims	<ul style="list-style-type: none"> Regional stability Collective security Protect sovereignty
<ul style="list-style-type: none"> Defend Aust by denying air and sea approaches against adversaries, protect key Australian assets and bases Conduct limited peace and stability operations offshore Support to global security 	Strategy	<ul style="list-style-type: none"> Lead peace and stability operations offshore. Provide niche contributions to coalition ops in line with interests Detect and respond to threats to sovereignty.
<ul style="list-style-type: none"> Conventional threats in the northern approaches Asymmetric threats (such as terrorism and crime) Militias in region 	Threat Priority	<ul style="list-style-type: none"> Asymmetric threats—Australia and worldwide Militias in region Conventional opponents (near Aust. and global)
Joint warfighting	Op Concept	Coalition warfighting
Australian lead	C2	Coalition (US) lead
Long duration (sustainment)	Duration	Short-variable (rotation)
Australia-near region	Location	Near region-global
Joint	Interoperability	Coalition
Balanced force for defence against conventional threats	Force structure aim	Joint task force for regional contingencies and niche contributions elsewhere
Home/fixed, able to deploy to region	Bases	Expeditionary, Coalition
<ul style="list-style-type: none"> Mainly Australian sources Fully deployable to region Some international support 	Logistics	<ul style="list-style-type: none"> Coalition and host nation Fully deployable to region and coalition operations
<ul style="list-style-type: none"> High priority on national collection and analysis 	Intelligence	<ul style="list-style-type: none"> Reliance on allied collection beyond region High priority on analysis

SCENARIOS

Scenario A—Local Interests 2015

The country of 'Blue', buoyed by their recent alliance with a major regional power, has threatened to attack Australian oil platforms in the Indian Ocean and Timor Sea unless Australia agrees to stop aiding East Timor and renounce its claim to the North West Shelf. In recent days, air probes have intensified against Australia's offshore territories, while commercial vessels have been harassed by Blue's air force and navy.

The Blue main strike force consists of one SU-30 squadron and two F-16 squadrons. They have access to satellite imagery. The major regional power is unlikely to provide forces—at least initially—but will provide training, logistic and intelligence support to Blue. The Blue air force squadrons are well trained and capable of 24 hour operations. They have some stand-off weapons with a range of around 120 nm.

A Blue Special Forces company is also operating in Australia. Their assumed aim is to disrupt ADF operations, create alarm in Australia and sabotage Australian energy export ports.

Australia anticipated the possible contingency and positioned an Expeditionary Air Wing (EAW) on Cocos Islands. The EAW includes 8 x JSF, 2 x MRTT aircraft, 1 x RBS 70 Troop, 2 x infantry companies, 1 x AWD, 1 x ANZAC Frigate and a logistic support element. APC-3 Orion maritime patrol aircraft and High Altitude-Long Endurance UAV have also been staging out of the base. Other ADF units have been on high alert for the past two weeks.

Australia is unlikely to receive support from United States or Japanese combat forces unless the major regional power commits combat forces.

Scenario B—Global Interests 2015

The 'Global War on Terror' is ongoing but the locus has moved to Eastern Africa. A US-led coalition is preparing to invade the Horn of Africa in order to destroy terrorist base camps and set the conditions for a UN trusteeship. Australia has agreed to contribute combat forces. The commitment should be required for twelve months.

At the same time, a major regional power threatens to invade a neighbouring country and then launches a campaign to seize a group of contested islands in northeast Asia. Another US-led force is tasked to eject the major regional power. The campaign is expected to last for weeks, not months; but there will be an ongoing patrolling requirement until a permanent solution is found.

The Kokoda Foundation

The Kokoda Foundation has been established as an independent, not-for-profit think tank to research, and foster innovative thinking on, Australia's future security challenges. The foundation's priorities are:

- To conduct quality research on security issues commissioned by public and private sector organisations.
- To foster innovative thinking on Australia's future security challenges.
- To publish quality papers (*The Kokoda Papers*) on issues relevant to Australia's security challenges.
- To develop *Security Challenges* as the leading refereed journal in the field.
- To encourage and, where appropriate, mentor a new generation of advanced strategic thinkers.
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