

Australia's Future Air Combat Aircraft

Introduction

- 6.1 The formal debate over which future air combat aircraft/force mixture will best ensure that the Australian Defence Force maintains regional air superiority began in 2000 with the release of the *Defence 2000 – Our Future Defence Force* and the subsequent establishment of the AIR 6000 project (NACC). The Government's decision in 2002 to support the current future Air Force air combat plan did not quell that debate. Many submissions made to this inquiry contend that the Government's decision was not the right one.
- 6.2 This Committee examined the issue in its *Review of the Defence Annual Report 2002-03*. In Chapter 5 of that report there is a section titled 'The comparative capability of the F-35 [JSF]'. This section outlined the JSF's expected capabilities and compared them to air combat platforms, such as the Raptor, and other proposed force structures.
- 6.3 As noted in the first chapter, Recommendation 3 of that report has resulted in this inquiry being referred from the Senate. Once again, the Committee has undertaken to examine the question of which future air combat aircraft/force mixture best addresses Australia's needs with particular attention being paid to the comparative merits of the JSF and the Raptor.
- 6.4 Dr Kopp, Mr Goon and others contended that the JSF alone will not satisfy Australia's air combat capability needs. They propose a force

mixture of upgraded F-111s and Raptors.¹ Defence and other private commentators believe that the Raptor, while a superior fighter in most ways is not multi-role and therefore is not as suited to Australia's needs as the JSF.² Other points were raised in relation to both aircraft. This chapter will summarise these discussions using three headings:

- capabilities;
- cost; and
- availability.

Capabilities

6.5 Amongst the many capabilities of the JSF and the Raptor, three particular ones were brought to the attention of the Committee and discussed in some detail by witnesses. They were:

- stealth;
- range; and
- networking.

6.6 In reviewing this evidence, the Committee has remained cognisant of the need to consider capability issues in conjunction with the strategic concepts noted in Chapter 2.

Stealth

Rating

6.7 In 2005, the US Department of Defence publicly released a PowerPoint presentation which noted that the JSF had low observable stealth characteristics. This terminology represented a change in the JSF's stealth characteristics from what had previously been described as very low observable. This shift raised concern in Australia about the stealth capabilities of the JSF.³

1 A complete discussion on the F-111s can be found in Chapter 3.

2 Brian Weston, *Submission No. 24, Sub. Vol. 2*, p. 275.

3 Sydney Morning Herald, *Not so stealthy: the \$15b fighters*, 14 March 2006.

- 6.8 The Committee sought to clarify the meaning of any change in the stealth capability of the JSF, noting that one of the JSF's selling points was its stealth capability and that a stealth downgrade would have negative implications.⁴ When asked for comment on this issue, Professor Babbage advised the Committee that there had been no real downgrade in stealth capability at all and, in fact, what had occurred was simply a change in terminology.⁵
- 6.9 Defence corroborated Professor Babbage's comments and advised the Committee that:
- ... just this week the JSF Project Office changed the public releasable slide ... There was a change in the terminology on one slide of the publicly released PowerPoint presentation. There was no change to the capability of the aircraft.⁶
- 6.10 Clarification of this point provided an opportunity for the Committee to discuss issues of stealth capability on the JSF and the Raptor.

Comparative capability

- 6.11 The most comprehensive comparison between the JSF and the Raptor was written by Air Marshal Angus Houston and published by ASPI in 2004. In the report, titled *Is the JSF good enough?*, Air Marshal Houston notes that the 'F/A-22 sets new levels in stealth without having to compromise its aerodynamic performance.'⁷
- 6.12 Dr Kopp and Mr Goon's submission agrees. It notes that although the JSF is stealthy, its level of stealth has been compromised for a variety of factors and therefore does not compare to the high stealth capability of the Raptor.⁸
- 6.13 It is worth noting, however, that the JSF will not have to face the Raptor in battle. Air Marshal Houston points out that:

... we only have to do battle against F/A-22s in training exercises. Against 4th generation adversaries, the JSF has the decisive advantages of stealth and comprehensive situation

4 Committee, *Transcript 31 March 2006*, p. 35.

5 Professor Ross Babbage, *Transcript 31 March 2006*, p. 35.

6 Air Commodore John Harvey, *Transcript 31 March 2006*, p. 48.

7 Strategic Insights: ASPI, *Is the JSF good enough?*, August 2004, p. 6.

8 Air Power Australia, *Submission No. 20, Sub. Vol. 1*, p. 204.

awareness, both from its onboard sensors and through the network.⁹

- 6.14 While the JSF doesn't match the Raptors' overall stealth capability, the JSF has considerable stealth capability. For example, it is 'very stealthy on top'¹⁰ and is able to carry two 2,000 pound bombs in a stealth configuration.¹¹ Its stealth capability is therefore an advantage when compared to current 4th generation aircraft.
- 6.15 Dr Kopp and Mr Goon note that in regards to their proposed Evolved F-111, the JSF has an advantage in stealth.¹² As is the case when the JSF is compared with the Russian Sukhoi Su-30 or Su-35 series of aircraft.¹³
- 6.16 The JSF may have, on paper, superior stealth capability to most air combat aircraft currently in service. But what of the future? Dr Jensen MP posed a fundamental question to the Committee: 'What happens when the threat aircraft are stealthy as well?' He suggests that in such a case the JSF would be forced to engage the aircraft within visual range. The question then becomes, how well can the JSF perform in this circumstance?¹⁴
- 6.17 This is the fundamental question concerning those who are opposed to a future air capability structure based solely on JSFs.

Committee comment

- 6.18 Australia must ensure that its next air combat aircraft purchase has comparable stealth capability to other combat aircraft in the region.

Range

- 6.19 The range of an aircraft raises several inter-related points which need to be taken into consideration when choosing the best air combat aircraft option for Australia. For example:
- short range aircraft require refuelling and refuelling is done by tankers;

9 Strategic Insights: ASPI, *Is the JSF good enough?*, August 2004, p. 8.

10 Professor Ross Babbage, *Transcript 31 March 2006*, p. 31.

11 Dr Alan Stephens, *Transcript 31 March 2006*, p. 21.

12 Air Power Australia, *Submission No. 20, Sub. Vol. 1*, p. 199.

13 Air Power Australia, *Submission No. 20, Sub. Vol. 1*, p. 193.

14 Dr Dennis Jensen MP, *Submission No. 21, Sub. Vol. 2*, p. 249.

- tankers need combat air patrols to protect them and those aircraft will need refuelling as well;
 - if the strike aircraft cannot adequately protect themselves, then further combat patrol aircraft will be required; and
 - the further the target, the further tankers, strike aircraft and combat patrol aircraft will have to push out and this has the effect of stretching network support such as the AEW&C aircraft.
- 6.20 The Committee was advised that both future aircraft options discussed during the inquiry – the JSF and the Raptor – are, when compared to the F-111, short-ranged.¹⁵ Should the F-111 be retired as planned, either replacement, be it the JSF or Raptor would require tanker support at long range.
- 6.21 Dr Jensen MP believes that Australian geography demands a longer-range aircraft,¹⁶ but Defence pointed out that even though the F-111s have superior range, it is still forced to send its tankers far afield because the Hornets, which are currently used to protect the F-111s, need refuelling.¹⁷
- 6.22 Like the Hornets, the JSF will need refuelling. Dr Jensen MP is concerned that the JSF's short range will have a negative multiplying effect:
- A shorter range fighter requires that the tankers get closer to the target. This puts them into a more vulnerable position, requiring a larger [combat air patrol], which necessitates the need for more tankers.¹⁸
- 6.23 Dr Kopp and Mr Goon are concerned that the JSF will not be able to provide the necessary tanker protection. They believe that as the JSF goes farther a field with tanker support, the JSF's air-to-air combat capability limits the protection it can afford itself and the tankers and therefore more would be required.¹⁹
- 6.24 They maintain that their upgraded F-111/ Raptor proposal is better suited to the task. While the Raptor would need refuelling, its greater

15 Dr Carlo Kopp, *Transcript 31 March 2006*, p. 17.

16 Dr Dennis Jensen MP, *Submission No. 21, Sub. Vol. 2*, p. 250.

17 Air Marshal Geoff Shepherd, *Transcript 31 March 2006*, p. 60.

18 Dr Dennis Jensen MP, *Submission No. 21, Sub. Vol. 2*, p. 250.

19 Dr Carlo Kopp, *Transcript 31 March 2006*, p. 6.

combat effectiveness is such that fewer would be required to protect the F-111s and the tankers (as well as other aspects of the network).²⁰

- 6.25 Defence is confident that a 'fully networked system of systems', including the JSF will provide the necessary level of 'knowledge dominance in the air battle space,' which will enable Australian forces to 'see first, shoot first, kill first.'²¹

Networking

- 6.26 All participants of the inquiry, the Committee included, agreed that network-centric warfare is the way of the future.²² As such, the Committee sought to compare the relative networking capabilities of the JSF and the Raptor.

JSF

- 6.27 On paper, it would appear that the JSF is a superior networking aircraft. Professor Babbage has stated that 'no other aircraft has the ability to gather, process and share information that the JSF will have.'²³ This should be of little surprise, as the JSF has been designed from the ground up for network-centric operations.²⁴
- 6.28 The JSF is equipped with a wide range of advanced sensors, many of which are reprogrammable by software.²⁵ This will enable the JSF to adapt to a variety of contingencies and provide valuable surveillance capabilities – many of which we have not had in the past. For example, Professor Babbage noted that the JSF will be able to survey littoral environments with great clarity, simultaneously scanning for multiple items.
- 6.29 Mr David Connery expanded on the surveillance options the JSF will provide. He envisioned its use in disaster relief operations, noting that the JSF would be able to survey damage areas and quickly relay that information back to decision makers.²⁶

20 Dr Carlo Kopp, *Transcript 31 March 2006*, p. 17.

21 Air Marshal Geoff Shepherd, *Transcript 31 March 2006*, p. 60.

22 The Committee and Dr Carlo Kopp, *Transcript 31 March 2006*, p. 7.

23 Professor Ross Babbage, *Transcript 31 March 2006*, p. 24.

24 Dr Alan Stephens, *Transcript 31 March 2006*, p. 20.

25 Professor Ross Babbage, *Transcript 31 March 2006*, p. 27.

26 Mr David Connery, *Transcript 31 March 2006*, p. 32.

- 6.30 This type of flexibility reflects the multi-roled nature of the JSF. Defence used a cricket analogy to make this point:

[the JSF] is a very good all-rounder, a brilliant all rounder, across all the strategic tasks ... that we develop.²⁷

The Raptor

- 6.31 The Raptor's networking abilities were also discussed at the public hearing. Professor Babbage described the Raptor as a half-generation behind the JSF.²⁸ Dr Stephens believes that in the ISR (Intelligence, Surveillance, and Reconnaissance) domain, the Raptor is lacking. For example, the Raptor does not have a transmit-receive data link, only a receive data link.²⁹
- 6.32 The Committee asked Dr Stephens about the possibility of upgrading the Raptor's ISR capability and the potential cost of such an upgrade. Dr Stephens informed the Committee that the US has been upgrading the Raptor's ground attack capabilities in order to make the cost of the Raptor justifiable and that he expects such upgrades to continue. He also commented that the additional cost of an ISR upgrade to the Raptor would be 'very small.'³⁰

Committee comment

- 6.33 General discussion on the comparative networking ability of the JSF and the Raptor indicates that the JSF is superior in this regard. This is best epitomised by the fact that the Raptor's systems have been adapted and modified for the JSF.

Cost

- 6.34 There are many factors to be considered when examining the cost of the JSF. The US has established seven cumulative cost categories for the JSF described in the chart below:

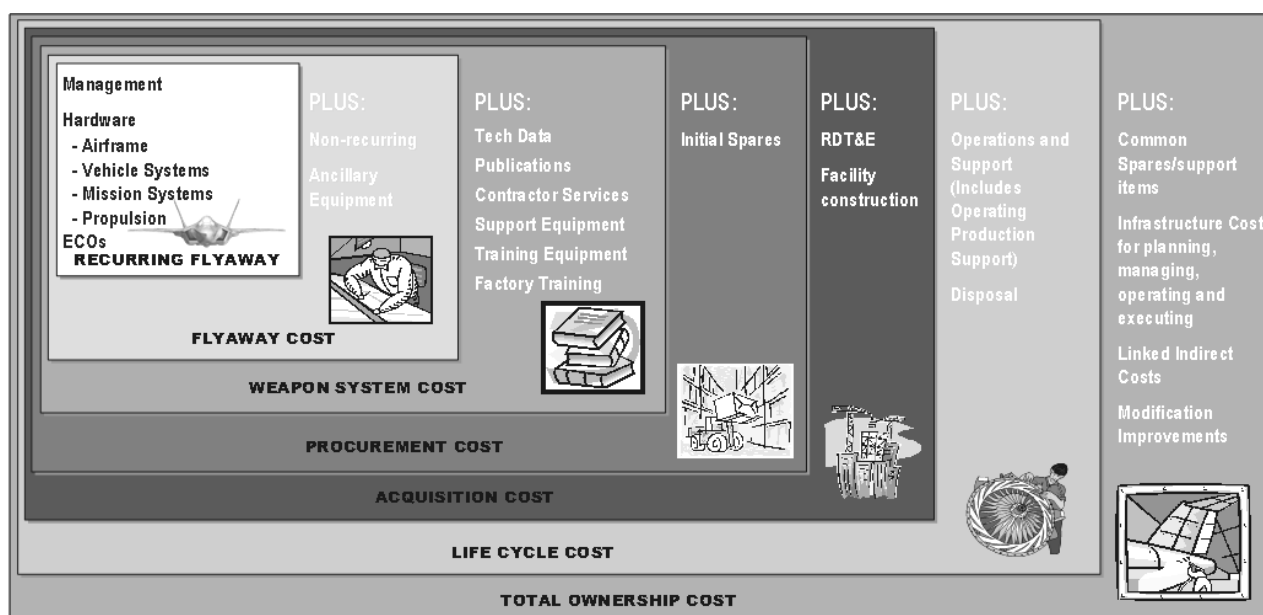
27 Mr Michael Pezzullo, *Transcript 31 March 2006*, p. 58.

28 Professor Ross Babbage, *Transcript 31 March 2006*, p. 30.

29 Dr Alan Stephens, *Transcript 31 March 2006*, p. 20.

30 Dr Alan Stephens, *Transcript 31 March 2006*, p. 24.

Figure 6.1 JSF cost definitions (US chart)



Source: Department of Defence, *Submission No. 27, Sub. Vol. 2, p. 299.*

- 6.35 Several different prices for the JSF have been quoted, each one based on a different cost definition. The Committee was particularly interested in the Average Unit Procurement Cost (AUPC) of the JSF which includes the average cost of the aircraft plus ancillary equipment, logistics support, training equipment and spares.
- 6.36 The Committee was advised by Defence that the JSF AUPC is approximately US\$67.3m per aircraft in 2005 prices (this is based on the average cost for all 3 variants of which the Australian variant (CTOL) is the cheapest). Defence noted that the quoted AUPC is based on the American model (shown in Figure 6.1) and is not an Australian unit projection cost, which would include specific Australian project requirements. It did note, however, that the above cost was 'indicative of the relative cost of the [JSF] system versus other systems.'³¹
- 6.37 Dr Kopp and Mr Goon provided their own costing in a submission to the Committee. They believe that, based on publicly available US Government documents, the AUPC of the CTOL variant of the JSF is US\$81.3m per aircraft in 2004 prices.³² When they included an annual

31 Department of Defence, *Submission No. 27, Sub. Vol. 2, p. 294.*

32 Air Power Australia, *Submission No. 20, Sub. Vol. 1, p. 105.*

inflation factor of between one and three percent, they believe that the JSF AUPC could be as high as US\$103m per aircraft in 2012.³³

- 6.38 Dr Kopp and Mr Goon further note that a 'de-escalation in costs can usually be achieved when an aircraft is in full rate production.'³⁴ Australia plans to purchase the JSF at the beginning of the production cycle or curve, when costs could potentially be higher than later in the production curve. As a result, they contend that the purchase of 100 Block 2 or 3 JSF could cost Australia somewhere between US\$112m and US\$120m per aircraft in 2012 dollars. When a projected exchange rate was added to this cost, they contend that the JSF could cost between A\$160m and A\$171.4m per aircraft in 2012 dollars.³⁵
- 6.39 Dr Kopp and Mr Goon contend that it would be cheaper for Australia to buy 55 Raptors in 2010 than 100 JSF in 2012. Their submission states that the cost of such a purchase would be US\$126m per aircraft in 2004 dollars.³⁶
- 6.40 Defence advised the Committee that the AUPC cost for the Raptor was US\$175m per aircraft in 2005 prices.³⁷ Dr Gumley of the Defence Materiel Organisation (DMO) further noted the potential update costs which could be attached to a Raptor purchase:

... we would be paying substantial update costs. The aeroplanes coming out now are already in need of update in some areas because they have been out for many years. There are FMS costs, which is the charge the US government charges Australia to process the orders. Sometimes they waive those fees; sometimes they do not. We have not had the discussion yet but there is always the question of: do we have to pay our share of the past research and development and bringing it into manufacture? What is our share of the amortisation? The Americans will have about 183 or 184 F22s by the time they finish their program. If we were to get 40 or 50 then we would be paying probably 20 per cent of the R&D costs of that aircraft. Maybe that will be waived it; maybe it will not be – we do not know – but that would add up to an extra \$100 million per aeroplane.³⁸

33 Air Power Australia, *Submission No. 20, Sub. Vol. 1*, p. 106.

34 Air Power Australia, *Submission No. 20, Sub. Vol. 1*, p. 106.

35 Air Power Australia, *Submission No. 20, Sub. Vol. 1*, p. 107.

36 Air Power Australia, *Submission No. 20, Sub. Vol. 1*, p. 115.

37 Department of Defence, *Submission No. 27, Sub. Vol. 2*, p. 294.

38 Dr Stephen Gumley, *Transcript 31 March 2006*, pp. 49–50.

- 6.41 Dr Gumley's sentiments were echoed in another submission which noted that 'the F-22 is not a multi-role aircraft. Australia would either have to sacrifice strike capability or somehow fund an enormously expensive strike capability enhancement program.'³⁹
- 6.42 Mr Goon also raised the issue of operational costs in his discussion with the Committee. He believes that because the JSF is a smaller fighter, it has a reduced payload and combat effect. As a result, Mr Goon contends that the ADF will require a greater amount of JSF and tanker support in order to achieve its goals and, as such, operational costs will be higher.⁴⁰ Both Dr Kopp and Mr Goon believe that a Raptor/F-111 force mix will have greater range and combat effect thereby reducing operational costs through greater efficiency.
- 6.43 Defence has stated that the JSF alone is the 'right choice' because it is a multi-role, fifth generation strike fighter capable of fulfilling the Australia's needs 'at a cost that will allow the balanced development for the ADF of a broad range of capabilities in all environments.'⁴¹
- 6.44 The Committee was advised in a separate submission that new aircraft types, such as the JSF, are increasingly flexible (multi-role) and reflect the need 'to reduce the expensive logistic and support costs involved in operating two fleets of RAAF combat aircraft:
- Rationalisation of two such support systems into one means that more of Australia's defence dollar can be spent on acquiring a credible number of operational platforms.⁴²

Committee comment

- 6.45 The above cost debate highlights the relative nature of aircraft cost analysis, as each analysis can be based on a series of different strategic and tactical considerations.
- 6.46 Current price comparisons between the JSF and the Raptor reveal that the JSF is the cheaper product. The Committee recognises that the cost of the JSF may fluctuate; however, operational costs and multiple fleet maintenance costs must also be taken into account.

39 Mr Brian Weston, *Submission No. 24, Sub. Vol. 1*, p. 275.

40 Mr Peter Goon, *Transcript 31 March 2006*, p. 15.

41 Air Marshal Geoff Shepherd, *Transcript 31 March 2006*, p. 39.

42 Mr Brian Weston, *Submission No. 24, Sub. Vol. 1*, p. 274.

Availability

Technology transfer

6.47 The issue of US technology transfers is of particular importance to Australia. Current US laws do not allow for the transfer of sensitive stealth technology to participating JSF program partners. Britain and Australia have been lobbying the US to change its technology transfer laws to ensure that both countries can independently operate and support their JSFs upon purchase.⁴³

6.48 Professor Babbage told the Committee that in his view, Australia must gain access to the capacity to modify and adapt the JSF for its particular needs.⁴⁴ He believes that there will be occasions when Australia will need to use the JSF in different ways to the US:

We need to be able to modify the sensor's software so that if we want it to look for something else or report in a different format to fit in with something else on one of our Wedgetail aircraft or something like that we can make it happen.⁴⁵

6.49 The Committee asked Defence to comment on its position in relation to this matter and was advised that:

Australia will not enter the MoU for the Production, Sustainment and Follow-on Development (PSFD) phase unless we are assured of necessary access to technology and data to operate and support the JSF aircraft.⁴⁶

Committee comment

6.50 The Committee notes that upon signing the PSFD MoU in December 2006, Defence stated that 'the MoU and associated documents also

43 *Britain in clash over US fighter secrets*, <<http://www.timesonline.co.uk/printFriendly/0,,1-2-2086523-2,00.html>> (Accessed 15 March 2006); and *The World Today – Strike Fighter purchase suffers setback*, <<http://www.abc.net.au/worldtoday/content/2006/s1592291.html>> (Accessed 16 March 2006).

44 Professor Ross Babbage, *Transcript 31 March 2006*, p. 34.

45 Professor Ross Babbage, *Transcript 31 March 2006*, p. 34.

46 Department of Defence, *Submission No. 27, Sub. Vol. 2*, p. 298.

guarantees Australia's access to the technology and data it needs to operate and support the JSF.⁴⁷

Is the Raptor for sale?

- 6.51 The Committee is not aware of a formal request from the Government to purchase the Raptor but notes that the United States is not allowed, by law, to pursue its sale with other countries.⁴⁸
- 6.52 At Senate Additional Estimates in February 2007, Defence confirmed that the US Deputy Defence Secretary, Gordon England wrote to the Australian Defence Minister, Brendan Nelson, confirming that the Raptor is not available for export sales.⁴⁹
- 6.53 Furthermore, Defence told the Committee that even if it was released by the US Government for export, it is not the preferred choice because it 'has limited ability in strike and even less utility and capability for offensive air support.'⁵⁰

Committee comment

- 6.54 This chapter summarises the debate heard by the Committee over the comparative merits of the JSF and Raptor. Each aircraft is unique and is designed to serve different purposes; therefore, comparisons can be problematic and often remain general in nature. The Committee notes Dr Kopp's belief that:

While the joint strike fighter is being marketed as a multi-role fighter, it is being developed mostly to hunt battlefield targets, with air defence as a secondary role. Otherwise the United States would not have built the F22 Raptor. As a result the joint strike fighter will have limited performance, limited agility and limited stealth compared to the F22. Put simply, it is too small and its performance and stealth will not be good enough.⁵¹

47 Minister for Defence Media Release 163/2006, *Australia Enters Next Phase of the JSF Program*, 13 December 2006.

48 Senate Standing Committee on Foreign Affairs, Defence and Trade, *Estimates, Estimates Hearing, Transcript 31 May 2006*, p. 32.

49 Senate Standing Committee on Foreign Affairs, Defence and Trade, *Estimates, Additional Estimates Hearing, Transcript 14 February 2007*, p. 24.

50 Air Marshal Geoff Shepherd, *Transcript 31 March 2006*, p. 39.

51 Dr Carlo Kopp, *Transcript 31 March 2006*, p. 2.

6.55 The Committee also notes Air Marshal Shepherd's comments regarding a potential Australian purchase of the Raptor:

... there is no doubt that it will be the world's best air superiority fighter. If we were living in a hypothetical world and it was available, which it is not, and we could afford it, which we can but it would distort the budget, the F22 and the JSF would give us a better air superiority capability in the air-to-air role. There is no doubt about that. But at what cost? What cost to government in distorting other government programs, what cost to Defence in distorting our own capability budget and a balanced ADF ... [the Raptor] comes at a cost – of maintenance people, different aircrew et cetera. So it becomes a logistics, training and engineering cost to what is by world standards a moderate sized but First World capable air force.⁵²

6.56 Notwithstanding the availability, or otherwise, of the Raptor for sale, the Committee notes Defence is firmly of the view that the JSF provides the best capability versus cost whilst maintaining a balanced ADF.

Senator Marise Payne
Chair
15 August 2007

52 Air Marshal Geoff Shepherd, *Transcript 31 March 2006*, p. 60.

