



## The F-35 (Joint Strike Fighter) Project: progress and issues for Australia

The need for new aircraft to replace the ageing F/A-18 and F-111 was formally identified in the Defence 2000 White Paper. At that time, the Australian Government foreshadowed that about 100 new aircraft would be purchased and should be in service in 2012.<sup>1</sup> Since then, the estimated cost of the purchase, designated Project AIR6000, has increased from about \$10.5 billion to between \$12 billion and \$15.5 billion.<sup>2</sup> The uncertainty about future growth in the final cost of the aircraft makes it difficult to gauge the total budgetary impact of this project.

The decision to purchase new aircraft raised two major questions: what to purchase and how much to pay. Initially, the Government set up a competitive evaluation process to examine its options. In June 2002, it dispensed with this aspect of Project AIR6000 and signed up to the developmental phase of the United States-led Joint Strike Fighter (JSF) program, at a cost of \$195 million.<sup>3</sup> The F-35 JSF is a new-generation stealth aircraft—specifically designed to carry out both the fighter and strike aircraft roles—and thus able to replace both the F/A-18 and F-111 in those two respective roles.

It is expected that in late 2006 the Australian Government will sign the next memorandum of understanding in the JSF project, covering the multilateral production-development phase of the work, which should lead to a final purchase decision in 2008.<sup>4</sup> On signing the memorandum, the Government will give Lockheed a firm estimate of the numbers of aircraft to be ordered and the preferred delivery schedule, as well as \$180 million, to cover Australia's portion of the non-recurring costs of moving to full production.<sup>5</sup>

These decisions will be made in an environment where several questions remain about the overall wisdom of committing to the JSF so early in the project's development. Such questions focus on the eventual cost of the aircraft and whether it represents value for money, whether advances in unmanned systems will make it obsolete before it enters into service, and whether the multinational partnership underpinning the large number to be built—which lowers the price per unit—will endure.

This Research Note summarises the current status of these arguments in the period leading to the Australian Government's proposed signature to the production-development phase of the JSF project.

### Australian industry involvement

Latest reports indicate that some 15 Australian firms have gained over \$100 million worth of contracts for work on the JSF project, ranging from engineering drawing to the manufacture of engine stands and composite panels.<sup>6</sup> However, such industry participation during the system development and demonstration phase is in the lower end of value-adding for the project as a whole and does not guarantee similar success in winning contracts for the much larger production and support phases of the project, even if Australia does proceed to acquire the aircraft.

### Current project issues

#### Access to the source code

While earlier problems such as aircraft weight and range have apparently been solved, questions about the release of the computer source code that makes the aircraft so unique have emerged as a potential showstopper for international clients. The source code in question refers to the millions of lines of computer code that allow this 21st-century aircraft to fly and to fight. Without complete access to this source code, Australia will be unable to modify or even maintain the aircraft independently—as it has done so successfully for many years with the F-111.

The question about the release of the source code to Australia has not been confirmed publicly. It is understood that maintenance of the JSF will be undertaken in a regional logistics and maintenance centre run by Lockheed Martin. Without access to the source code, Australia may in coming decades be put in the invidious position of having no option but to pay whatever Lockheed Martin asks during future contract negotiations for the ongoing maintenance of Australia's strike fighters.

#### Cost implications of wavering participation

Recent reports indicate that the United Kingdom is considering opting out of the JSF project due to source-code release issues and because of the threatened cancellation of a second (British) version of the JSF engine.<sup>7</sup> By having an alternative engine design available, aircraft manufacturers can keep prices down through competition while at the same time encouraging further development. In this case, however, the second engine is threatened because of the need to reduce overall project costs.

The UK vacillation with regards to the JSF has a major implication for Australia. The UK is expected to be the

largest overseas purchaser of the JSF, and a major client for the Short Take-Off and Vertical Landing (STOVL) version. Should the UK choose not to buy the aircraft, then the unit cost for other overseas purchasers would very likely climb significantly. The price could then escalate further if the higher cost resulted in other overseas purchasers also reconsidering their acquisition decisions.

The JSF project is already comfortably the largest defence acquisition in Australia's history. Yet, even at the currently estimated \$15.5 billion price tag, there are real questions about how many airframes can be bought at the price. A significant price increase may either cause a significant blow-out in the budget, or reduce the number of aircraft bought to a number too low to be operationally effective.

### How much stealth will it provide?

In short, 'stealth' is not a fungible concept. The stealth capacity of the JSF has been marketed as one of its major drawcards, but it is worth remembering that the Australian JSF will have only a 'third tier' stealth capability. The American F-22 Raptor has the highest stealth configuration, followed by the US version of the JSF, and then the JSF version sold to countries such as the UK and Australia.<sup>8</sup>

Technical commentary indicates that the JSF stealth design appears to be optimised against a narrow set of radar types. These are known as narrowband X-band and Ku/K/Ka-band. These radars are found in other fighter aircraft and battlefield air defence weapon systems. However, the JSF stealth design may be less capable against so-called L-band and S-band radars, which are used in static or semi-mobile early warning radars, as well as on Airborne Early Warning and Control (AEW&C) aircraft similar to the Wedgetail aircraft currently being acquired by Australia.<sup>9</sup> These capabilities are widespread in the region where, for example, both India and China operate A-50 Mainstay AEW&C aircraft. Air power analyst Dr Carlo Kopp notes that, given the availability of Russian beyond-visual-range missiles with advanced infrared seekers:

If an Su-30 can be positioned close enough, [through, for example, vectoring by an AEW&C aircraft (ed.)] it can engage the JSF regardless of stealth, and with a kinematic and missile performance advantage the odds are unlikely to favour the JSF.<sup>10</sup>

Although the limited stealth capability of the Australian JSF is worth something, its value may be confined to circumstances where the adversary air defence capabilities are not supported by AEW&C aircraft or equivalent ground-based installations.<sup>11</sup> However, such capabilities are already widespread in the region and will be even more so by the time the JSF enters service with the RAAF sometime after 2012.

### The US 'Quadrennial Defense Review'

Every four years, the US Department of Defense conducts a congressionally mandated review of defence strategy, programs and policies, a practice without an exact

equivalent in Australia.<sup>12</sup> The Quadrennial Defense Review (QDR) aims to keep strategy, forces and budgets in some sort of agreement. It differs from Australia's Defence White Paper series in that the White Paper has a direct relationship with the government's defence budget, while the QDR must be negotiated between the Administration and the Congress as part of the normal budget cycle. Nevertheless, it provides a useful guide to the overall direction of defence expenditure in the United States.

Prior to the release of the latest QDR on 3 February 2006, it was widely expected that the review would include a significant cut to the number of JSF airframes to be acquired.<sup>13</sup> However, references to the JSF are conspicuous for their absence, and it would be wrong to read this as an endorsement of the project as it currently stands. As Steve Kosiak, from the U.S. Center for Strategic and Budgetary Assessments, notes:

Moreover, some of the proposed shifts in priorities—such as the accelerated fielding of a new long-range strike aircraft—are likely to be dependent, for their implementation, on the willingness and ability of a future administration to make offsetting cuts in other DoD priorities. The QDR has, for the most part, deferred these difficult choices.<sup>14</sup>

Even an endorsement of a reduced number of airframes would remain an endorsement of the project. One interpretation of the QDR's silence about the JSF is that even such a limited endorsement could not be negotiated, and that hard decisions on this, and other projects, may have been left for future administrations.

### How many for how much?

While the Australian Government's original statements indicated an intention to purchase about 100 aircraft, a [recent paper](#) from the Kokoda Foundation set out the arguments for various purchase numbers ranging from as few as 75 aircraft up to more than 120 aircraft.<sup>15</sup> However, it should be noted that this study made assumptions about the number of aircraft that would be allocated to each JSF squadron. If other arrangements were made—for example, the number of airframes per squadron was reduced—even fewer aircraft would be required.

After being in development for nine years, the JSF program is still to fly its first test aircraft.<sup>16</sup> Therefore, it is unsurprising that many questions remain about the eventual cost of the aircraft and its ongoing support. While the budget allocated to the project in Australia has grown significantly over the past few years (from \$12 billion to \$15.5 billion), the current 'fly away' cost per aircraft—currently expected to be \$100 million—may grow larger still as the project matures.<sup>17</sup> This is because considerable development work still remains to be done, including:

- fully maturing seven of the eight critical technologies
- completing the designs and releasing the engineering drawings of all three variants
- manufacturing and delivering 15 flight test aircraft and seven ground test articles

- developing 19 million lines of software code, and
- completing a seven-year, 12,000-hour flight-test program.<sup>18</sup>

Other factors likely to affect the ‘through-life’ price will be the overall number of airframes produced, and whether Australia is given access to the entire source code, just as the UK is currently demanding.

While a smaller-sized fleet structured around three squadrons is attractive because of its affordability, maintaining or increasing the current number of combat squadrons would open the way for consideration of relocating one or two squadrons to Western Australia (either to RAAF Pearce near Perth, or further north to an upgraded RAAF Gin Gin), so as to provide a local air defence capability for the navy ships based at Fremantle.

Should the eventual cost of the JSF become—politically or objectively—unaffordable, then it is reasonable to ask what alternatives would then be considered. The demise of the competitive evaluation aspects of Project AIR6000 means that there is no ‘order of merit’ for alternatives to the JSF. Nevertheless, arguments in the media and elsewhere have raised the prospect of the F-22 Raptor being a suitable next-generation alternative.<sup>19</sup> Others suggest that the ongoing development of current-generation aircraft like the F-15 might yet provide a suitable alternative, albeit missing the crucial element of stealth design.<sup>20</sup>

### **Conventional or STOVL?**

Project AIR6000 currently envisions that Australia will acquire the conventional version of the JSF. This version is the cheapest, and has the longest range as well as the largest bomb-carrying capacity. However, with the Navy planning to acquire very large amphibious vessels—roughly twice the size of the old HMAS Melbourne aircraft carrier, and capable of hosting significant aviation assets—it is understood that some quarters within the ADF are suggesting that Australia purchase several of the STOVL version of the JSF so that they may be deployed on, and operated from, the amphibious ships, thus providing dedicated air combat capabilities to their embarked forces.<sup>21</sup>

While such a purchase might complicate the maintenance of the aircraft due to there being two versions, the seaborne deployment of the JSF would answer one significant strategic question, that is, how Australia can maintain an expeditionary strategy—in an era of ‘coalitions of the willing’—when forward bases may be unavailable or too vulnerable to enemy use of weapons of mass destruction.

### **Should Australia look at the F-22?**

With the US having decided to keep producing the F-22 at least until 2010, the question of whether to forgo the JSF in favour of the F-22 has resurfaced. However, three fundamental problems stand in the way of any serious consideration of the F-22 as an Australian option.

First, the F-22 is an air-superiority fighter with some—limited—ground-attack capability, whereas the JSF is a purpose-designed strike platform. Given that it is now more than half a century since Australian combat aircraft were engaged in air-to-air combat, it would seem that a focus on strike might better meet Australia’s strategic requirements.

Second, the F-22 is undoubtedly the ‘crown jewel’ in the USAF armoury. While some recent reports suggest that an ‘export version’ of the F-22 might be possible for selected allies, a deep concern remains within US military circles about the potential of a security breach around the F-22’s unique electronic architecture, stealth aspects and next-generation data links.<sup>22</sup>

Third, the price of the F-22 is unlikely to drop much below double that of the JSF. With a relatively small budget, Australia could afford only a limited number of aircraft. In addition, as the production process is already established, Australia would forgo the benefits arising from Australian industry participation and in-country maintenance facilities that make the JSF such an attractive proposition.

### **What about a current aircraft like the F-15?**

A number of countries such as Singapore and South Korea have recently faced the same questions as Australia in terms of air defence needs, and have decided that the JSF is not the only possible alternative.<sup>23</sup> For example, South Korea chose a variant of the strike-version of the F-15 (known as the F-15K). This is an upgrade of the venerable F-15E Strike Eagle with an option for up-to-date Active Electronically Scanned Array (AESA) radars and sensors, networking capability, able to carry the latest stand-off weapons and with an impressive range.<sup>24</sup>

In recent days, Boeing has demonstrated the ability to link a tactical fighter in flight—in this case its F-15E1 technology demonstrator—to the Global Information Grid. Using intelligent agent software, the aircraft systems were able to ‘pull’ data relevant to the aircraft’s simulated mission off the network and datalink it to the fighter. This is one of the aspects of what is termed ‘network-centric warfare’ that is a key selling point for the JSF.

Furthermore, as can be seen with the introduction of AESA radars to the F-15 and other current-generation fighter aircraft like the F/A-18 EF, it is likely that market forces will ensure that all the key features of the JSF—except its stealth design—will eventually be introduced into current generation fighters well before the JSF achieves operational status.<sup>25</sup>

### **Unmanned Combat Air Vehicles (UCAVs)**

The global War on Terror has significantly increased the speed of developments in both unmanned reconnaissance and strike air vehicles. Both have the ability to loiter for extended periods over the battlefield—critical in a network-centric warfare context—and their loss to enemy action would not have the same political impact as the loss of a manned aircraft. While the tension between unmanned

combat air vehicles and the JSF has long been apparent, it is only recently that serious questions have been posed about the long-term suitability of a(ny) manned platform in the long-range strike role.<sup>26</sup>

It is increasingly apparent that the US will use the F-22 and a new unmanned long-range strike platform, which is due in service by 2018, to achieve/maintain air supremacy.<sup>27</sup> Such developments would leave little room in the US armoury for the JSF. When considered in this context, it is an open question whether the JSF will actually be built at all in the numbers envisioned, or whether it will be cancelled before its in-service date, as was the RAH-66 Comanche stealth helicopter, which was cancelled in 2004, two years before achieving operational status.<sup>28</sup>

## Conclusion

The project schedule for the JSF is forcing the Australian government to make significant decisions about its ongoing participation in the project at a time when the options available for the maintenance of air superiority in the region are both clouded and changing rapidly. It is clear that the JSF will most likely become much more costly by the time it is delivered and fully effective, while its only next-generation contender, the F-22, is already in operational service and will likely reduce in price—though not necessarily to the level of the JSF—over the coming years.

In the meantime, aircraft like the F-15 are available today and have no developmental costs attached. Furthermore, commercial imperatives will most likely see the inclusion of the latest-generation radars, sensors and other components into current-generation aircraft well before the JSF achieves operational status. Given the ongoing costs and airworthiness issues surrounding the F-111 and F/A-18, this option may be both the safest and cheapest in an environment where the real growth in defence budgets cannot be guaranteed.

Finally, the day of the unmanned combat aircraft is dawning faster than most experts could ever have anticipated. As stated above, the US will field an unmanned long-range strike aircraft by 2018 or earlier, given the current pace of developments in the field. It may be that, in choosing the JSF, the Australian Government is essentially buying the last of the manned fighters. Like the last of the propeller-driven fighter planes, the JSF's day may pass before the aircraft even soars into the sky in RAAF livery.

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