RUMOUR CONTROL
Air 6000 – still awaiting the White Paper

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At the time of writing Australia's debate over whether to buy the F-35A Lightning 2 Joint Strike Fighter was expected to last well into 2009. Contrary to earlier expectations, the minister for defence, Joel Fitzgibbon, had not released Part B of the Air Combat Capability Review he commissioned back at the start of this year.

The delay in publishing it undoubtedly owes something to the Defence White Paper process that is currently under way. Releasing a report which endorses (or not, as the case may be) a significant component of the ADF's future force structure ahead of the White Paper itself would be unusual. Fitzgibbon and prime minister Kevin Rudd would probably prefer to present all the material on Australia's defence and security policies and priorities at the same time.

That said, there have been suggestions that the Federal government's long-awaited Security Statement could be released in October to provide an exterior framework for subsequent, more detailed examination of specific aspects in the Defence White Paper and other studies.

Be that as it may, the lingering uncertainty over Australia's air power planning should be ended with the release of the White Paper itself and the various so-called Companion Reviews accompanying it –presumably including Part B of the Air Combat Capability Review.

This document, which was completed by Deputy Secretary of Defence for Policy and Planning, Neil Orme, in April 2008, is intended to provide a definitive answer on the ADF's air combat capability needs, and the aircraft required to meet them, out to 2045. Part A, which he completed in March, endorsed the previous government's decision to acquire 24 F/A-18F Super Hornet Block 2s to bridge any potential air combat capability gap between the retirement of the F-111 in 2010 and the arrival of the F-35A in (or from) 2015.

Analysts and commentators are impatient to discover whether Part B endorses the F-35A as the RAAF's principal (and possibly sole) air combat platform beyond 2020, or believes the F-22A Raptor (or even the Super Hornet) should either supplement or replace the F-35A in the AF's force planning.

The long wait for Part B has created a vacuum which the Opposition has tried to fill with regular calls for Fitzgibbon to commit to the F-35A. And critics of the JSF have also tried to fill the vacuum by comparing the aircraft scathingly with the Su-27/30/35 family of fighters, promoting the F-22A and even mis-representing research carried out on behalf of the Pentagon by a respected US think tank, the RAND Corporation.

According to reports cited by Liberal MP Dr Dennis Jensen and reported by the ABC and other Australian news outlets, a RAND analysis pitting the F-35A against the Su-27 family found the F-35A couldn't out-climb, out-turn or out-run its adversary. The RAND Corporation angrily pointed out the inaccuracies in these reports, but poor kinetic performance is a common charge levelled against the F-35A by its detractors and Lockheed Martin's executive vice president of F-35 program integration, Tom Burbage, delivered a spirited response to another attack along similar lines in Jane's Defence Weekly from Washington analysts Pierre Sprey and Winslow Wheeler in early-September:

"The F-35 is a racehorse, not a "dog," as Wheeler/Sprey suggest," Burbage wrote. "In stealth combat configuration, the F-35 aerodynamically outperforms all other combat-configured 4th generation aircraft in top-end speed, loiter, subsonic acceleration and combat radius. This allows unprecedented "see/shoot first" and combat radius advantages.

"The high thrust-to-weight ratios of the lightweight fighter program Wheeler/Sprey recall from 30 years ago did not take into consideration combat-range fuel, sensors or armament, which dramatically alter wing loading, thrust-to-weight ratios and maneuverability. We do consider all of this in today's fighters.

"The F-35 has the most powerful engine ever installed in a fighter, with thrust equivalent to both engines today in Eurofighter or F/A-18 aircraft. The conventional version of the F-35 has 9g capability and matches the turn rates of the F-16 and F/A-18. More importantly, in a combat load, with all fuel, targeting sensor pods and weapons carried internally, the F-35's aerodynamic performance far exceeds all legacy aircraft equipped with a similar capability."

One thing has become clear to observers of the JSF program: regardless of any partisan leanings, there's still widespread ignorance (some of it not really excusable) on the part of some commentators.

Internal carriage of fuel and weapons has a marked effect upon drag, acceleration, top speed and combat persistence. It also makes a significant difference to the combat manoeuvrability of the aircraft. But many of the advantages this bestows really only become apparent after detailed examination and operational analysis in a wide range of operational scenarios. And some analysts also fail to take in to account the other enablers of combat proficiency: airborne early warning, the air force's wider command and control system and air-air refuelling.

The capabilities of the F-35 sensor suite enable a different set of combat tactics: the combination of helmet-mounted sights and high-speed, highly manoeuvrable missiles with a high off-boresight capability and imaging infra red seekers eliminates much of the advantage a highly agile fighter may have over a less-agile adversary at short range. Stealth doesn't make fighters invisible – it just makes it difficult or impossible for search

radars to locate and track them and then for fire control radars and missile RF seeker heads to get a decent lock on them. Even IR stealth is designed as much to enhance the effectiveness of counter-measures as it is to render the aircraft 'invisible' to IR guided missiles. And a radar that can jam an adversary while the pilot continues to receive an updated air picture via datalink from his wingman improves the odds considerably as well.

The point is, aircraft like the F-22A and F-35A are very different: many advocates of the F-22A simply don't realise how little they know about its performance; they compare its kinetic performance and stealth capabilities with those of legacy aircraft and believe they have its true measure. It is relatively easy to infer from the open literature that the F-22A can deliver so much more than even its supporters understand. And in selected areas the F-35A is designed to deliver even more than the F-22A.

In short, many air power analysts and commentators appear to have fallen into the trap of judging tomorrow's warfighting equipment on the basis of the tactics and technology used in yesterday's wars. This is very surprising, and disappointing.

All that said, and notwithstanding the fact that only two F-35s are in flight test as yet, the signs are that customers are becoming increasingly comfortable with the manufacturer's predictions of its combat capability. The issue for most of them, and specially for Australia, is when they will be delivered with the required level of combat capability, and how much they will cost.

The discussion on JSF costs is about to change gear; we discuss that issue below.

The schedule issue, however, is still fraught with technical challenges but Lockheed Martin vice president and recently appointed JSF program head George Standridge told Australian journalists in Ft Worth in early May that Lockheed Martin hasn't changed its master schedule for nearly two years and maintains it will deliver aircraft at the time and at the capability level promised.

As evidence of its ability to deliver on its promises, the second flight test aircraft being built under the System Development and Demonstration (SDD) program made its maiden fight in June; two ore aircraft are now in final assembly, or undergoing flight preparation prior to joining the flight test program early next year.

The SDD program will see 19 aircraft manufactured, six of them for ground test; by mid-2009 the first production-representative versions of each variant – the F-35A, -B and –C, designated AF-1, BF-1 and CF-1, respectively - will all have flown. The F-35A which made its maiden flight back in 2006 is designated AA-1.

Also, the Cooperative Avionics Testbed, or CATBird, will soon be flying with a full suite of F-35 avionics. The CATBird is a heavily modified Boeing 737 which carries a full set of F-35 avionics and sensors. Inside the main cabin is an F-35 cockpit and consoles for

over 20 software and systems engineers. The aircraft will be used to test and integrate in flight elements of the JSF mission system before they are flight tested in F-35s.

The CATBird has already completed testing of the F-35's Communications, Navigation and Identification (CNI) sub-system and was due to return to flight in September, equipped with the F-35's Northrop Grumman APG-79 radar, Electronic Warfare and Electro-Optical Targeting System (EOTS). It will test each of these systems separately, and then gradually integrate them; meanwhile the first flight of an F-35 with the full avionics and mission system capability is scheduled for 2009.

The big risk factor remains software development and integration. The avionics software is being developed in successive 'Blocks', leading to full combat capability in Block 3. The most basic Block, 0.1, is 100 per cent complete and displaying high levels of reliability and stability aboard both the CATBird and the AA-1 test aircraft. Block 0.5, which will provide the initial mission system capability, is due to fly in early 2009 and was slightly ahead of schedule by mid-2008 (60 per cent complete, as opposed to 58 per cent).

The first combat capable software version will be Block 2, which is scheduled for operational testing in 2011-12; the US Marine Corps plans to declare Initial Operational Capability (IOC) for its F-35Bs with Block 2 software in early-2012. The US Air Force plans to declare IOC with Block 3 software in 2013. This is a critical milestone for Australia and the other international JSF partners: until the Block 3 software (which is common to all three variants of the aircraft) completes Operational Test and Evaluation (OT&E) the F-35 won't be cleared for release to its export customers.

Furthermore, until OT&E is complete, the project will not have passed its Milestone C decision point under the US procurement system: Milestone C enables the Pentagon to authorise Multi-Year Procurement of the F-35, and so opens the way to Full-Rate Production (FRP). All of the aircraft built up to this point will be ordered as one of the Low-Rate Initial Production (LRIP) batches, including 27 for the RAAF.

So for Australia, the key risk lies in the platform, mission system and software flight test and integration program: problems here could severely delay deliveries of F-35As to the RAAF.

Lockheed Martin acknowledges the risks and points to the flight test record so far: flight testing and integration of the CNI system aboard the CATBird was scheduled to run for 12 flying hours and four sorties; it was completed after just two flights and six hours of uninterrupted stability.

The F-35A flight test aircraft, designated AA-1, had completed 40 flights and 48 flying hours by the time of Rumour Control's visit to Ft Worth in mid-2008. For a first flight test article, AA-1 has been very reliable, meeting almost all of its flight test goals on time and frequently achieving multiple sorties each day without requiring any rectification

between them. The two aircraft currently in flight test, AA-1 and BF-1, have shown remarkable software stability for early development aircraft.

However, the flight test program was delayed five months by an unexpected problem with an electrical control surface actuator during AA-1's 19th sortie early in 2007 – this encountered difficulties at high altitude and extremely low temperatures which hadn't shown up in ground testing and required the aircraft to be temporarily grounded while the parts in question were re-designed. Subsequent fight testing has shown the fix was successful.

This only highlights the fact that the JSF is still an experimental program with plenty of potential risks still to be uncovered and retired. Lockheed Martin is growing tired of fending off claims that it plans to cut down on the JSF test program. In total, the SDD flight test aircraft will fly as many test hours (approximately 9,000) as three of the legacy aircraft it will replace: the F-16, F/A-18A/B and the AV-8B. Of these, only the F/A-18A/B came close to the F-35's flight test program, with about 5,000 hours of testing for the US Navy and Marines.

Unlike these aircraft, which were used for all of their respective programs' avionics, sensor and mission system testing, the JSF program aims to mitigate much of the technical and schedule risk by using the CATBird to carry out as much as possible of the hardware and software integration and flight testing. Importantly, the CATBird is a much more engineer-friendly environment in which to trouble-shoot and 'tweak' software and hardware.

The risk of integration difficulties and program delays is still very much a factor in everybody's planning, hence defence minister Joel Fitzgibbon's reluctance to endorse the JSF program blindly and rush towards 2nd Pass Approval to acquire it.

However, Lockheed Martin emphasises the delivery schedule for Australia's aircraft remains as it was in early-2007: the first four will be delivered in 2013 as part of LRIP batch 5; eight will be delivered in 2014 and then 15 a year thereafter until 2020, when the last 13 out of the RAAF's currently planned purchase of 100 aircraft is delivered.

RAAF pilots and ground crews will undergo training at Eglin Air Force Base in Florida pending completion of Block 3 software OT&E and then transition back to Australia in 2014. The first RAAF F-35A squadron will be operational at Williamtown in 2015.

Meanwhile, the near-term difficulty for the RAAF and for Lockheed Martin is predicting what effect Australia's new Defence White Paper will have on its defence budget and force structure priorities.

The prime minister, Kevin Rudd, trailed his coat somewhat in September, suggesting that Australia needs to concentrate on protecting its sea lines of communication. His comments have been interpreted in almost every possible way: he might be preparing analysts and voters for a higher defence budget, a fourth Air Warfare Destroyer (AWD

and lots more submarines; or he might be setting the scene for a re-focussed ADF sticking to the currently-approved defence budget and relinquishing some lower-priority capabilities in order to focus on the things that really makes an adversary's eyes water. Does that include the F-35A? Analysts are uncertain: if Defence needs to reallocated resources, the only really big bucket it can draw from is the New Air Combat Capability (NACC) Project, Air 6000.

At least one analyst contacted by Rumour Control has argued for a reduction in the currently planned F-35A purchase from 100 aircraft to 75, or even less. This is based on the current expectation that buying 100 F-35As will cost close to the AUD$16 billion which is at the upper end of the price estimate for the relevant phases of Project Air 6000 in the 2006-16 Defence Capability Plan (DCP).

JSF costs – a new benchmark?

Lockheed Martin vice president George Standridge told Australian journalists at Ft Worth in May 2008 "[The JSF] is going to be the most affordable fighter out there for the future." But critics of the JSF project – both in Australia and in Washington - still maintain the aircraft is too expensive.

The problem is the way the Pentagon funds its military aircraft programs: these are funded on a year by year basis with production ramping up progressively. Despite this, the program overheads and fixed costs are very high, so SDD and Low-Rate Initial Production (LRIP) aircraft appear incredibly expensive as their prices must cover these expenses.

In the first four years of production, which actually started in 2007, Lockheed Martin has orders to build just 65 aircraft for five customers. The RAAF's timetable to replace its Hornet fighters means it will be forced to buy expensive, early production models. According to Andrew Davies at the Australian Strategic Policy Institute (ASPI), the first four aircraft ordered by the RAAF in 2011, for delivery in 2013, will cost US$100 million each (nearlyAUD$118 million at typical September 2008 exchange rates), and the average price for Australia's first 30 aircraft will be nearly US$90 million.

Protestations by the Department of Defence in Canberra, Lockheed Martin and the JSF Joint Program Office (JPO) in Washington that the JSF is actually much cheaper than this have been undermined by the JPO's own pricing methodology. The price of the aircraft has been quoted in 2002 dollars, which are meaningless to most people and lack credibility when set against the actual dollars the Pentagon plans to spend in 2008 or 2009 on aircraft such as the F-22A or Super Hornet.

Here in Australia, nobody understands or trusts the 2002 dollar figure: they want to know what the numbers on the cheque will be when the RAAF actually places its order.

The more aircraft built in a given year, the more efficient the assembly line, and the cheaper the aircraft become. But the program won't reach economic numbers until 2014

or 2015, at the earliest, when Lockheed Martin expects to deliver 118 and 132 aircraft, respectively - if customers like Australia don't delay their orders first.

The head of the DMO, Dr Steve Gumley, has warned that if foreign JSF partners rush to the 'back of the queue' and delay their orders to take advantage of that learning curve, the program as a whole will be destabilised and the price won't fall as quickly.

To overcome this problem, the international partners are proposing an innovative (for the US) solution. Gumley attended a meeting in the USA on 20-21 May of the procurement chiefs from all nine JSF partner nations. Chaired by US Undersecretary of Defense for Acquisition, Technology & Logistics, John Young Jr, the meeting explored the possibility of setting a 'Level Price' for 368 F-35s of all three types which the international partners plan to order between 2012 and 2016.

The Level Price agreement would set an agreed price for all the JSF variants ordered by the international partners over that five year period. Aircraft ordered between 2012 and 2016 would be delivered between 2014 and 2018 – this includes all but the first four of Australia's aircraft and the last 28, which will be delivered in 2019 and 2020.

The international partners, the JSF Joint Program Office and Lockheed Martin expect to come up with a draft pricing figure for the JSF, taking into account differences between the three variants, in October this year, with a firm figure expected to be agreed among the international partners by January 2009.

If they succeed in reaching an agreement, this would enable Gumley and the Air 6000 project team to present a solid business case, based on a firm price, to the Australian cabinet later in 2009 for the acquisition of the F-35A.

One of the eight international partners, Norway, has set a benchmark for the others' expectations of what that price will be.

In April the Royal Norwegian Air Force received a response to its Request for Binding Information (RBI) from Saab and the US government for the supply of 48 new fighters to replace its F-16As. The US offered the F-35A (slightly modified with a drogue 'chute for icy runways): Lockheed Martin is confident that its price is lower than that offered by Saab for the New Generation variant of its proven JAS-39 Gripen fighter.

Lockheed Martin's George Standridge refused to disclose to Rumour Control the price offered to Norway; and Norway hasn't yet selected an aircraft, nor signed a contract. But according to figures obtained by Rumour Control, Norway's F-35As would cost US$58.7 million each, with deliveries to begin in 2016. The deal includes an initial batch of spares, training and support worth a further US$668.2 million, giving a package price of US$3.486 billion, or about AUD$4.1 billion at current exchange rates (US$0.85 = AUD$1.00 for the purpose of this exercise).

However, the JSF program includes a global logistics support and training system and the Pentagon has reportedly quoted a life cycle support cost to Norway of US$2.27 billion, on top of the US$3.486 billion purchase price. So by that reckoning Norway's 48 JSFs would cost US$5.75 billion over a notional 25 years, or $120 million each including through-life support. This figure doesn't include the cost of weapons and consumables such as fuel and oil.

On these figures Norway's 48 JSFs would cost AUD$6.76 billion at current exchange rates, or AUD$270 million a year over 25 years, or about AUD$140 million each. That makes an interesting comparison with the $6.6 billion which the RAAF will pay for 24 F/A-18F Super Hornets. The Super Hornet price tag is fully inclusive, however: it covers the whole of capability, for the whole of its planned 10-year life, including fuel and an armoury of new weapons, as well as training and spares, so comparisons must be treated with caution.

Importantly, all but 16 of Norway's aircraft would be delivered during the period of the proposed Level Price purchase, setting a benchmark for other F-35As ordered an delivered at the same time. Lockheed Martin refuses to discuss details of either the Norway offer or the proposed Consortium Buy. But sources suggest the Consortium Price probably won't be much different from the package the Pentagon has offered to Norway, providing a benchmark against which the other JSF International Partners will calibrate their expectations.

However, Dr Gumley has pointed out that the price quoted to Norway is in 2008 dollars.

By the time Australia starts taking delivery of its aircraft, from 2013, inflation will have pushed this figure upwards, and other unforeseen cost increases can't be ruled out. The DMO estimates that in 2013 dollars Australia will pay between US$70 and 75 million per aircraft, or about AUD$82 to AUD$88 million each at September 2008 exchange rates.

The 2006-16 DCP currently allocates AUD$11.5 to AUD$15.5 billion to the purchase of up to 100 F-35As; at the purchase price suggested above, this would seem to be more than adequate. As for through-life costs, applying the same multiplier to Australia's 100 aircraft as that applied to Norway's 48 F-35As (about 2.05), we arrive at a rough whole of life cost of AUD$180.4 million per aircraft over a notional 25 years.

That's an approximate figure based on an arbitrary exchange rate, the convenient but probably false assumption that the F-35A will be in RAAF service for only a quarter of a century, an estimate of through-life support costs based on the offer to Norway, and doesn't include any investment in Australian facilities and other related non-project costs. But it sets an initial benchmark against which to track emerging estimates of the purchase and through-life costs of the F-35A.

As far as the reliability of these figures, and estimates of the JSF program schedule are concerned, Dr Gumley told Rumour Control only that he left the May conference at Palmdale a lot more confident than when he arrived there. In terms of the project

management metrics against which progress is being tracked, Dr Gumley said there had been no surprises where the project schedule was concerned, with software development actually tracking better against its schedule than 12 months previously.

Furthermore, he said, there was strong evidence of "good manufacturability" when he inspected Northrop Grumman's JSF facility at Palmdale, which augurs well for the ramp-up from Low-Rate Initial Production of two aircraft in 2008 to 118 aircraft in 2014 and then 205 in 2016. Any difficulties encountered in manufacturing aircraft in such volumes would have a significant effect on the program schedule and costs, he pointed out.

For the record, the current JSF build program will see 916 aircraft ordered between 2012 and 2016; 370 of these will be for non-US customers, including Australia and Norway.

Disclosure: Gregor Ferguson visited Ft Worth as a guest of Lockheed Martin

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