

Fighter programs face uncertain future



The first F/A-22A Raptor assigned to the 27th Fighter Squadron of the 1st Fighter Wing, Langley AFB, Virginia, the first operational unit to fly the F/A-22A, pictured over Fort Monroe, Virginia. At full strength the 27th FS will have twenty-six F/A-22A aircraft. (US Air Force)

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This year seems pivotal for key US fighter programs, with severe budgetary stress in the US in the aftermath of protracted campaigns in Iraq and Afghanistan impacting on US force structure. Inevitably, outcomes in the US will impact on Australia, as availability and pricing of key fighter platforms and weapon systems change.

The importance of current developments in the US should not be underestimated. Since 911, the US has confronted a very different world to that forecast in the mid-1990s. China's military capability and influence in the Asia-Pacific has grown considerably, and continues to grow. Advanced Russian and to a lesser extent EU military technology has proliferated globally, especially in the industrialised and increasingly wealthy Asia-Pacific region. Concurrently, the Third World and many Islamic nations face increased chaos and unrest, much of it a result of Islamist insurgencies and terrorist movements.

From a budgetary standpoint, 2005 is especially significant since critical pain threshold has been reached in the US, the result of cumulative military operational expenditures since 911.

Every four years the US conducts a Quadrennial

Defense Review (QDR), analogous to Australia's less frequent Defence White Paper documents. US QDRs are, however, far more detailed and rigorous than Defence White Papers: extensive battle simulations, war scenario analyses and mock campaign planning result in much more detailed policy and planning directives.

This year's QDR is destined to be the most important for decades as it will lead to significant restructuring of the US Air Force, Navy, Marines Corps and Army force structures, to better adapt to the developing environment. As a result, there has been a complete free-for-all debate in which advocates of increased funding for Army and Marine Corps ground forces fight for funding against the advocates of naval power and air power. The outcome of the QDR will be clearer later this year as more decisions about future capability are disclosed. What is clear, however, is that the current balance between funding for air, ground and maritime capabilities, largely a model retained from the Cold War era, will change.

It is in this context of changing force structures and global threats that any survey of current fighter programs relevant to Australia must be assessed.



First supersonic release of the 1,000 lb GBU-32 Joint Direct Attack Munition GPS aided smart bomb from an F/A-22A Raptor over the Mojave test range in July, 2005. (US Air Force)

Lockheed-Martin/Boeing F/A-22A Raptor

The F/A-22A is the pivotal asset for the future US Air Force, intended to provide critical air dominance, deep strike, Intelligence Surveillance Reconnaissance (ISR) and Suppression/Destruction of Enemy Air Defences (SEAD/DEAD) capabilities. The future of this program remains unclear, as mutually opposed factions in the US defence establishment battle over funds.

In terms of specific program developments, the F/A-22A has had an excellent year. The most important development has been the transition from Low Rate Initial Production to Full Rate Production earlier this year, following approvals by the Defence Acquisition Board and Congress. This milestone was to be reached during the 1990s but failed due to funding starvation and insistence by some in Congress that the design be bug-free before entering production. The result was almost a decade of delay, with commensurate increases in cumulative development costs over that time, and several iterations of avionic design as chips used in the aircraft's systems became obsolete.

While these delays have not been helpful to early deployment of the aircraft, they have resulted in a much more robust design, with numerous improvements in technology along the way.

The first operational unit to fly the F/A-22A, the 1st Fighter Wing based in Virginia, is receiving its complement of F/A-22A aircraft and progressively transitioning from the F-15C. It is expected that the unit will achieve Initial Operational Capability (IOC) in December this year.

Key recent F/A-22A program developments include:

- * Operational evaluations by the US Air Force and DoD released in February and March rated the F/A-22A as 'overwhelmingly effective' in its capabilities and performance, but some issues remained with lack of maturity in maintaining the aircraft on the ground.

- * The first supersonic drop of a GBU-32 1,000 lb

JDAM satellite aided, inertially guided bomb from the internal weapons bay. The supersonic release regime is of critical importance since the F/A-22A will penetrate to high value ground targets in supersonic cruise, and the combination of such speed and altitude will add considerably to the standoff range of the guided bomb. For many defensive systems this means the F/A-22A will not be detected at all during the attack.

- * In May, Northrop-Grumman delivered the first APG-77(V)1 multimode radar to the US Air Force for integration testing. The APG-77(V)1, described as a "fourth generation radar", is a lower cost, increased capability derivative of the baseline APG-77 radar. It incorporates low cost transmit/receive module technology developed for the JSF, an improved dedicated digital processor, and high-resolution air to ground imaging and moving target modes in addition to established air-to-air modes. US sources claim the radar also provides an embedded electronic attack (X-band jamming) capability. One US source claims the radar generates enough power in the X-band to be used as an electromagnetic weapon against cruise missiles and other targets dependent upon internal avionics.

- * Northrop Grumman announced that work has commenced on the second generation Communications, Navigation and Identification (CNI) system. This integrated system includes networking capability enhancements over the baseline JTDIS terminals in current production aircraft. The new CNI will include JTRS compliance, JTIDS transmit capability, and software radio technology, resulting in more capable design at lower cost.

- * Lockheed-Martin publicly stated that the flyaway cost in each subsequent production block of the aircraft had declined by 15 per cent, reflecting improvements in manufacturing processes and technology insertion. This rate of cost reduction has

been greater than anticipated, suggesting that a build of 300 or more would see a flyaway unit cost well below US\$85M.

The principal issue confronting the F/A-22A at present is that of long-term build numbers. Until December last year, budgetary allocations allowed for the manufacture of 271 or more aircraft, subject to achieved flyaway production costs. The US Air Force publicly stated intent to acquire at least 381 aircraft to cover full replacement of the F-15C fleet. In December 2004, a team of civilian bureaucrats proposed an aggressive package of budgetary cuts across the US Services to 'balance the books', given higher than expected outlays in the War on Terror. Numerous programs were targeted, including the F/A-22A, with a plan to cancel the last 99 aircraft of the then budgeted production run. The proposed cut would see only 172 aircraft built, and effectively deny the most economic latter phase of production as the aircraft matures.

The Selected Acquisition Report to Congress for December 2004, including 99 aircraft reduction, indicates that at the end of Lot 7 and 8 of F/A-22A production, the unit flyaway cost per aircraft would be around US\$87 million each.

The US Air Force, industry and many legislators have fought aggressively against the proposal to cut numbers. In the US, Congress must approve defence budgets and without Congressional support large cuts to any program are difficult to implement. Congress recently overturned plans to cancel the C-130J program.

The final number of F/A-22As to be built remains undecided but many key US observers say that a combination of the QDR, risks arising from Chinese military growth along with US industrial interests will see the proposed cuts reversed in the next six months. A key factor in favour of the F/A-22 is that it is in full rate production and thus largely free of further technological risks - a key problem for many other advanced technology US programs.

Lockheed-Martin Joint Strike Fighter

Australia's anointed replacement for the F/A-18A and F-111C, the F-35 JSF, remains in development but many uncertainties remain at this time. Like the F/A-22A, the JSF is in the midst of heated budgetary and strategic planning debates arising from the defence budget crunch and the QDR effort.

While the F/A-22A is in a robust position, assessed against potential upper tier threat scenarios long term, the position of the JSF is much weaker. This is because future nation state conflicts are less likely to involve large land armies pitted against modern air power, as anticipated during the definition of the JSF. More likely is the involvement of upper tier Russian capabilities such as A-50 AWACS, Sukhoi fighters and Patriot-like S-300/SA-10/20 series SAM systems (see www.ausairpower.net/APA-2005-04.html). As a result, the JSF program is exposed at the fundamental level of its utility in future combat.

Numerous reports surfacing recently in the US and UK press claim that major cuts are likely in the JSF program as a result of the QDR. Many of these reports could be the result of intentional leaks – to gauge the reaction of JSF partner nations and US interests. Concurrently, the US Marine Corps has been publicly lobbying for the JSF, and this is usually a good indicator that the internal DoD debate is not favouring the Marine Corps program. At least three specific outcomes have been reported. One is that the Navy CV variant of the F-35 may be chopped in favour of more F/A-18E/Fs. Another is that the Navy CV and Air Force CTOL variants may merge into one variant. The third and most aggressive is that the US Air Force CTOL variant may vanish, with the US Air Force acquiring only a smaller number of STOVL variants with boom refuelling capability.

The key issue for the JSF will be numbers, as any significant reduction in numbers will drive up early unit flyaway costs into the bracket of late build F/A-22A flyaway costs. In the US, a JSF at a similar buy price to an F/A-22A would see the F/A-22A bought every time.

Another risk that may emerge, if significant cuts

are made to the US Air Force CTOL program, is that it will fall below critical mass and not survive at all. Usually the cut-off point for viability of a mass production combat aircraft is around 700 to 1,000 aircraft. If the JSF were to be reduced to only the STOVL variant - the only subtype that cannot be replaced by evolved legacy aircraft or F/A-22As - then its survival would hinge on whether aggregate buys by the US Marine Corps, US Air Force and UK would be enough to keep the program alive.

In perspective, there are a wide range of possible outcomes from the current situation, of which three are most prominent. The first is that the program sails through the QDR with incremental reductions in numbers, and incremental increases in flyaway costs. For this to be achieved, given the US\$250+ billion aggregate costs of the program, it would require an immensely successful lobbying effort by JSF proponents.

The second outcome, if significant cuts are made in numbers, could mean the merging or loss of either the Navy CV or the Air Force CTOL variants. If cuts don't jeopardise program survival, then the result could be a common big-wing CV/CTOL variant at much higher unit cost than the current CTOL variant, and total build numbers closer to 1,000 units.

The third outcome could be that the program falls, or is reduced in numbers to the point where a collapse occurs at some stage over the next several years when the unit costs and development costs cross some pain threshold.

Defining exact probabilities for these outcomes is problematic since the large number of players and complex mix of agendas makes the problem difficult to analyse. What is clear is that the future of the JSF will remain uncertain until the current force structure replanning cycle is completed.

In terms of the development program, there have been few reports of substance in recent months, and the weight issue remains on the agenda. Lockheed-Martin has made numerous statements that progress was being made but little detail has been forthcoming on the specific implications in terms of capability and performance.

The proposed use of the larger 2,000 lb class bomb capable weapon bays for the CTOL and STOVL variants has been dropped in favour of the original plan for the smaller 1,000 lb class bomb capable bays. If these reports are correct then this amounts to a halving of disposable internal payload for the 'small wing' variants.

The Selected Acquisition Report to Congress for December 2004 covering the JSF program indicates that the average unit flyaway cost across all JSF variants for a total build of 2458 aircraft is US\$87.11 million each. This cost would be achieved some time after aircraft number 1,200 rolls off the production line.

Should major changes occur in program numbers and unit costs, this will have a significant impact on current RAAF planning which is centred largely on the assumption that the aircraft will follow the current roadmap in capabilities and numbers.

Boeing F/A-18A/B Hornet

Current plans to go ahead with all near and medium term upgrades into the F/A-18A/B fleet remain unchanged since public announcements 18 months ago. Preceding phases of AIR 5376 will see Link-16, colour cockpit displays and digital moving maps installed. Upgrades in progress and pending include new defensive jamming equipment, the new Follow On Stand Off Weapon (FOSOW), new GPS aided inertially guided bombs, new thermal imaging and laser targeting pods, along with centre barrel replacements for a large fraction of the fleet, intended to extend airframe fatigue life.

At present uncertainties remain in terms of several of these upgrades.

The replacement thermal imaging / laser targeting pod appears to be a defacto fly-off between the Lockheed Martin AAQ-33 Sniper XR / PANTERA Advanced Targeting Pod (ATP), the designated replacement for the legacy AAQ-13/14 LANTIRN pod set, and the Raytheon ASQ-228 ATFLIR (Advanced Targeting Forward Looking Infrared), which is the designated replacement for the legacy AN/AAR-55 and AN/AAS-46 pod set.

Both pods are dual band systems providing visual TV and mid-wave infrared imaging using focal plane array technology. Both have eye-safe laser modes and both are designed to permit precision bombing from medium altitudes – rather than from lower altitudes for which their predecessors were designed. Due to improved image quality both provide some bomb damage assessment capability, although not as good as dedicated legacy strike cameras.

Both pods are designed to support both legacy laser guided munitions and the newer GPS-aided JDAM and EGBU-10/12 series. Compared to the legacy targeting pods they replace on the F/A-18A/B, either would provide for a more compact and higher performance capability.

The successful FOSOW contender remains to be decided, although reports indicate the EU KEPD-350 has dropped out of the bidding. This relatively heavy design could be carried by the F/A-18A, but it would impose a range penalty. The remaining contenders are the Boeing AGM-84 SLAM-ER and the Lockheed Martin AGM-158 JASSM.



The Quadrennial Defence Review is expected to bring changes in the numbers of the three Joint Strike Fighter variants. While speculation continues in the US over the future of the program, this will not be known until the end of the QDR process.



A large package of upgrades remains to be implemented on the F/A-18 fleet, including new targeting pods, new EW equipment, GPS aided bombs, the FOSOW and structural life extension.

Of these two contenders the newer JASSM, and its extended range JASSM-ER, are regarded as the more capable design, compared to the Harpoon-derived SLAM-ER. JASSMs are stealthier and longer ranging, and will acquire a JTIDS derivative datalink for retargeting and bomb damage assessment in the near future. However, repeated test failures have encouraged recent threats of program cancellation from the Legislature, and the budgetary squeeze could impact the JASSM along with other high profile US programs. US sources claim the US Navy has opted to withdraw from JASSM and retain the production SLAM-ER instead for its existing Harpoon-capable platforms. As a result, the JASSM would need to be integrated on the F/A-18A and AP-3C, which may be a factor if Defence is reluctant to accept even modest risk. To date the SLAM-ER has only been exported to the RoKAF for the F-15K.

In terms of GPS-aided bombs, the principal contenders are the GBU-31/32/35 JDAM family of weapons and the enhanced EGBU-10/12/16 Paveway series, which retain laser guidance capabilities. The enhanced Paveways will be more expensive than the JDAMs because of complexity and smaller volumes but cheaper to integrate as they are virtually identical to the baseline weapon aerodynamically. While the JDAM, like the JASSM, represents a better long-term choice, concerns about integration risks and costs could see the older weapon adopted.

There have been no public disclosures on the defensive jamming system upgrade, other than a stated intent to decide this year. Defence budget papers indicate the BAeA ALR-2002B has been selected for the F/A-18A/B, pending contract negotiations. It is unclear whether an internal or podded jammer, such as the Elta 8222 fitted to the F-111, would be acquired.

Were a podded jammer selected, issues could arise with weapon load-outs when external fuel tanks are to be carried. Unlike the F/A-18E/F, with an additional pair of external stations, the F/A-18A/B is limited to two outboard stations once the inboards and centreline carry fuel tanks. As a result, carriage of a defensive jamming pod would be at the expense of half the stores-lifting capability, with major implications to force structure capability.

All indications are that the plan to rebarrel up to sixty per cent of the F/A-18 fleet is likely to proceed. US sources claim that the US Navy rebarrelling plan may be abandoned because of the budgetary crunch, and if this happens Australia could be the sole operator performing substantial fleet rebarrelling.

Analysis of Defence Department public documents on program costs puts the total project cost of ownership for the F/A-18A/B fleet at AU\$8,032.40 million (or AU\$113.1 million per aircraft) for a planned withdrawal in 2015.



The most important recent development in the F-111 world was the successful test firing of the AGM-142E Stand Off Weapon, using the new Block C-4 Mil-Std-1760 based digital weapon system, designed to support the latest digital weapons.

RAAF/GD F-111C and F-111G

The plan to retire Australia's fleet of F-111s by 2010 remains. While public statements by Defence allude to a possible 2012 retirement date, the very recent issuing of an ITR to privatise the Amberley Engine Business unit includes a statement that the intended retirement date remains set at 2010.

There has been considerable press coverage exploring the future of the F-111G fleet. Numerous sources indicate that deep maintenance on the F-111Gs would be suspended in 2006 as a prelude to the aircraft being mothballed. More recently, RAAF sources have disputed this position and claim that the F-111Gs will remain in operation until the F-111Cs are retired.

The most important recent development has been the successful test firing of the AGM-142E 'Popeye' Stand Off Weapon (SOW) from a Block C-4 configuration F-111C. The Block C-4 is now entering installation phase on the F-111C and provides an additional VME format computer to support smart weapons capability and, importantly, the Mil-Std-1760 weapons bus to the pivot pylon weapon stations. This provides the F-111C with the capability for rapid integration of all 'J-series' smart weapons, such as the JDAM, JASSM, ASRAAM and Small Diameter Bomb. None of these options have been funded, as the budget was redirected into the F/A-18 fleet.

Other previously planned upgrades that have been cancelled include the retrofit of the ALR-2002A, a new internal jammer to replace the interim Elta 8222, and an intended series of upgrades in targeting capability.

Analysis of Defence Department public documents on program costs puts the total project cost of ownership for the F-111 fleet at AU\$2,023.00 million (or AU\$72.25 million per aircraft), assuming a planned withdrawal in 2015, and all planned system upgrades.

As a final word, fighter force planners in the US and Australia will have to confront genuine uncertainties in the near future.