by Dr Carlo Kopp, PEng

Taking the 'Force' out of Air Force?

On November 7, Defence Minister Senator Robert Hill announced that Cabinet had accepted a case put by the Department of Defence to retire the F-111 fleet from 2010 onwards, essentially without replacement. A gap filler capability comprising a standoff missile on the F/A-18A and AP-3C Orions was presented as the alternative until Joint Strike Fighters are acquired.

This is the most radical downsizing in RAAF firepower seen since the post WW2 demobilisation and raises a series of very important questions about where Australia is heading longer term in firepower and strategic posture, and where it is putting its priorities in force structure development. This month's analysis will focus on the arguments supporting this decision and identify key incongruities.

THE DECISION

The public announcement capped off a three year long debate within the Department of Defence on when to retire the F-111. The specifics of the announcement, presented as part of the briefing on the Defence Capability Review conducted last year (2003), are best presented verbatim:

"The Air Force also has plans for the acquisition of Global Hawk unmanned aerial vehicles and a replacement for the AP-3C under the further maritime patrol and response capability. In such circumstances, the Air Force has advised that by 2010 – with full introduction of the AEW&C aircraft, the new air-to-air refuellers, completion of the F/A-18 Hornet upgrade programs including the bombs improvement program and the successful integration of a standoff strike weapon on the F/A-18s and AP-3C – the F-111 could be withdrawn from service. In other words, by that time the Air Force will have a strong and effective land and maritime strike capability. This will enable withdrawing the F-111 a few years earlier than envisaged in the White Paper."

Senator Robert Hill: "in light of the increasing strike capability that's going to be attached to principally the F/A-18s, but also the Orions as I've detailed in this paper, it's believed that the retirement date of the F-111s can be brought forward a few years. That's a decision, that's guidance that's been given to government by Air Force and guidance that government has accepted. ... Can I just say that the existing projects such as the AGM-142 will continue."

Chief of Air Force AM Angus Houston: "There will be no gap and I think that's the important message to get across. Essentially the F-111 will not be withdrawn until such time as we've fully upgraded the F/A-18. We have the much more capable tankers. We have the AEW&C. We've upgraded our weapons. The F/A-18 will be capable of dropping not only laser guided precision munitions but also satellite guided precision munitions and will also be capable of delivering a follow-on standoff weapon, which will also be fitted to the AP-3C. ... Well what will dictate the retirement of the F-111 will be the achievement of a suitable capability to replace the F-111. Now we think that will be somewhere from 2010 onwards. And we're very

If the Federal Government follows through on the Defence Department plan to kill off the F-111 after 2006, Australia will mostly likely achieve parity in strike capabilities against regional nations like Indonesia, who are acquiring Su-30MK variants. The Defence proposal to put a standoff missile like the JASSM on the AP-3C Orion and use it for strike is not unlike flying B-29s into MiG Alley in a Sukhoi rich neighbourhood – great recruiting poster material for prospective RAAF aircrew. (Paul Merritt)

much focussed on the capability that the Joint Strike Fighter will provide. And of course what you've seen in recent times is the increasing fragility of our F-111 capability. By 2010 it will be almost 40 years old. And our studies suggest that beyond 2010 it will be a very high cost platform to maintain and there's also a risk of losing the capability altogether through ageing aircraft factors ... No I don't think you will and frankly I, as the Chief of Air Force, would not want to see it flying beyond 2015. Because I think we've got a very old platform there and the risks of capability failure will increase with age. By 2020, if we were to go that far, the F-111 would be 50 years of age. That's a pretty old platform. ..."

The central thesis of the argument presented is that the F-111 is perceived to be old, with the risk of an unspecified catastrophic structural fatigue problem which would ground the fleet permanently, and will become significantly more expensive to maintain over time.

The new strike strategy will instead be to substitute for the F-111 until the Joint Strike Fighter is delivered by putting a shorter ranging cruise missile such as the AGM-158 JASSM on the F/A-18A and AP-3C, and by supporting the former with the four or five new tankers. So the trigger point at which the F-111 would be withdrawn from service is likely to be attainment of the second generation standoff weapon's Initial Operational Capability, and the new tankers (either KC-767s or A330-200MRTTs) replacing the current Boeing 707s.

The plan presented would most likely see the completion of the F-111's Block C-3A upgrade with the Elta 8222 self protection jammer, and the Block C-4 upgrade which entails the addition of a Mil-Std-1760 weapons interface and integration of the AGM-142 Stand Off Weapon. Whether the GBU-31/38 JDAM is cleared as part of the Block C-4 upgrade package remains unstated. Block C-4 is in the prototyping phase and likely to enter production post 2004.

Follow-on Block C-5 and later upgrades, which were intended to integrate a new Radar Warning Receiver, a new internal self protection jammer, the AGM-158 JASSM, possibly ASRAAM, JTIDS datalink and other capabilities would be dropped. As a result F-111 software development and integration work would begin to wind down after the completion of Block C-4. Longer term airframe maintenance such as fuel tank deseal-reseal will also begin to wind down around the middle of the decade.

The 2010-2015 timeline discussed in the briefing does not fit the stated model for the phase out criterion. Weapons like the JASSM are very easy to integrate – they are not unlike a large Harpoon in delivery method and supporting software in the aircraft is relatively simple. Therefore an IOC for a weapon like the AGM-158 JASSM in RAAF service could be as early as 2006 to 2008. The IOC for the replacement tanker was originally intended to be 2006, with slippages perhaps to 2008.

Therefore the likely outcome would be that the F-111 would be withdrawn earlier than 2010, perhaps starting as early as 2006. The initial leaks to the press over this matter proposed 2006 as a withdrawal date, and it is not unreasonable to conclude that this is the actual target withdrawal date. With allowances for slippage in the gap fillers, any date post 2006 is possible.

THE STRIKE CAPABILITY GAP

The statement claiming there will be no gap in strike capability does not stand up even to basic analysis.

In terms of the capability to deliver raw firepower, the F-111 typically performs the work of two F/A-18A Hornets and about one half of a supporting medium sized tanker. This is regardless of the type of weapon carried – tonnage is tonnage. For most scenarios a pair of F-111s does the work of four F/A-18As and one tanker, making the F-111 operationally cheaper.

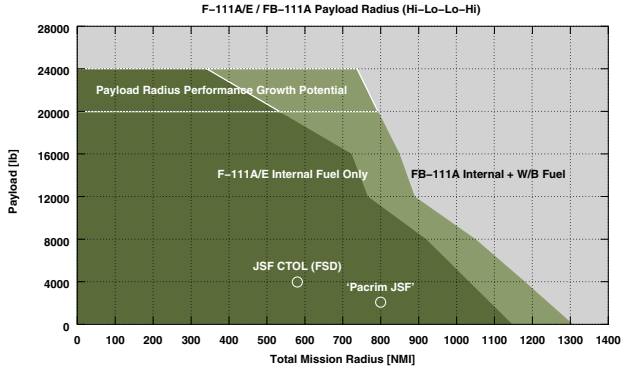
A range of starting assumptions can be applied, but all essentially lead to the same conclusion – the F-111 provides around 50 percent of the RAAF's total strike firepower. Therefore, for any gap filler capability to be credible strategically, it must double the firepower available once the F-111 fleet is removed from the force structure.

Assuming that Hornets are employed and there is no demand for any air combat activity which diverts Hornets away from strike work, this argument in effect asserts that the proposed gap filling measures will permit a doubling of the total firepower deliverable by the F/A-18A fleet. It takes very little to show that this argument is essentially wrong and not supportable by hard numbers.

The public statement claims that this aim can be achieved by integrating JDAMs on the F/A-18A, a weapon like the JASSM on the F/A-18A and AP-3C, and supporting the F/A-18As with the planned number of four to five tankers.

The notion that the AP-3C armed with a JASSM or similar weapon presents a credible strike capability is also unsupportable. The survivability of the AP-3C in a regional environment where many nations will be flying the Su-30 or Su-27 is minimal. Arming the AP-3C with a 200nm (370km) class range weapon doesn't change the basic reality that it is a slow moving turboprop with a

What sets the F-111 apart from contemporary fighters is its prodigious fuel capacity, combat payload radius and supersonic performance. This diagram based on a General Dynamics P-chart compares the payload radius of the F-111 against the baseline full scale development JSF and proposed 'Pacrim JSF' hybrid, which replaces one of its two GBU-31 bombs with a fuel tank. Both the JSF and F/A-18A require significant tanker support to compete with the F-111. (Author)



With enough tanking you could take JSFs or F/A-18As easily to 1500nm (2800km), perhaps further. Over Afghanistan the USN flew 3000nm+ (5560km+) round trips, but that required enormous USAF KC-135 tanker support. Current RAAF tanker fleet planning covers perhaps 30% of what numbers are needed to simply offset the loss of the F-111, without allowances for escort CAPs. Claiming the JASSM as a "range extender" ignores the need for tactical routing of the missile flightpath which might cut 50% off its range.

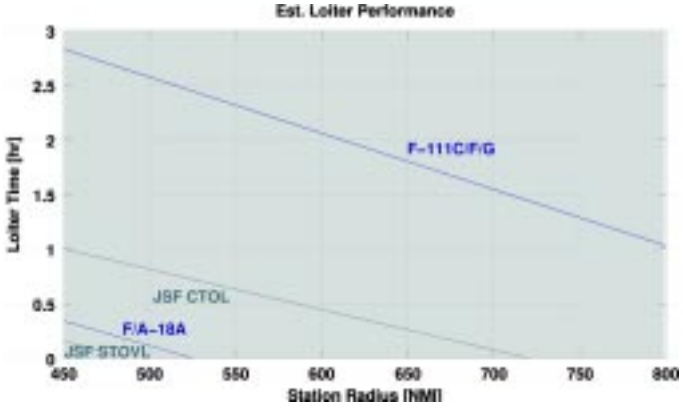
large radar cross section, which on a long range profile will have limited dash endurance at 400kt (740km/h) speed.

The Sukhoi fighters have an on station endurance of around 2.5 hours without refuelling at 200nm (370km) from base. Against a high radar signature target like a P-3C they have a radar detection range around 200nm (370km), and an effective weapons range of 50nm (95km) or more. A combat air patrol with two Sukhois flying a paired racetrack pattern using only their N011 radars can cover an effective footprint of around 300nm (555km) diameter. Even a dozen Sukhois could provide effective air defence coverage of a focal area against a missile armed AP-3C. In practical terms the AP-3C idea would result in a very high probability of AP-3C aircraft being destroyed in combat – it is akin to flying missile armed B-24s into harm's way.

If we assume 18 AP-3Cs available and wholly committed to strike operations, each carrying four JASSMs, the 200kt (370km/h) class cruise speed indicates that at best such a force can deliver firepower equivalent to only 4.5 F-111s. Each JASSM's J-1000 warhead is only 50% of a GBU-10/24/31, and the F-111 can sortie, launch, return and reload at twice the rate of the AP-3C, simply because it cruises twice as fast. Even without opposing interceptors and assuming the AP-3C fleet is needed for nothing else but strike sorties, in numbers alone the AP-3C is not a viable gap filler. Flying F/A-18A escorts to protect it would soak up the whole tanker fleet, actually reducing total strike capability.

Additionally, a single JASSM round, at $US400,00, would buy 20 2000lb JDAMs or Paveways.

Persistence over the battlefield is crucial to supporting ground forces in a rapdily moving network centric environment. A single F-111 can do the work of around nine F/A-18As in this regime at 450nm (835km) radius. Experience from Iraq indicates that frequently a ratio of two smaller fighters to one tanker was required for 'killbox interdiction', significantly driving up the cost of refuelled lightweight fighter operations. (Author)



Against the AP-3C, an F-111 delivering JASSMs has very good odds of survival against the Sukhois as it is harder to detect, is exposed for the fraction of the time an AP-3C is exposed, it can jam the N011 and can egress at supersonic speeds to evade engagement.

Given that the AP-3C provides little more than a paper capability for strike operations, the next question which arises is whether the strike capability of the F/A-18A fleet can be effectively doubled, and if so by what measures or means.

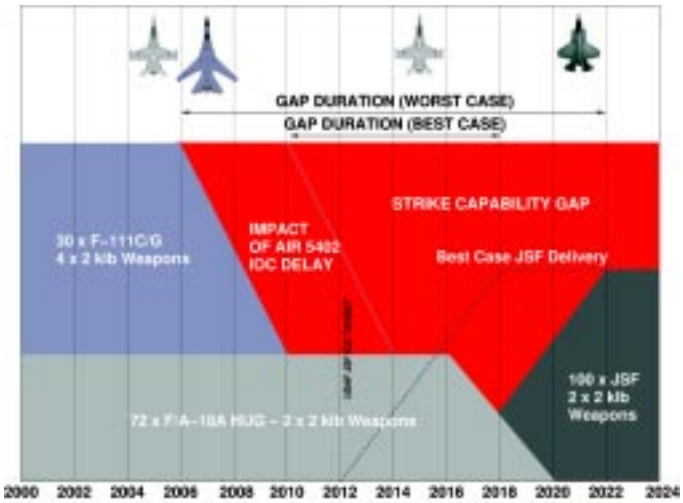
The basic restriction on the strike capability of the Hornet is its small size. Long range overwater operations supported by tankers will require that the aircraft carry two 1815 litre (480 US gal) drop tanks of fuel to provide a safe fuel margin for diversions if refuelling equipment fails. In practical terms this limits the aircraft to a pair of 2000lb class weapons, be they bombs or JASSM class standoff missiles. In such a configuration the aircraft will exhibit similar fuel burn to an F-111, or more if the weapons are draggier.

In terms of raw numbers of weapons deliverable the whole inventory of 71 Hornets equates in carriage capacity to 35 F-111s – F-111s have no difficulty in carrying four large weapons. Regardless of available tanker capacity to support the F/A-18A fleet, in raw numbers of aircraft the Hornet fleet simply cannot be made to double its strike capability. You can't beat the laws of physics.

What fraction of this fleet can deliver a long range strike capability? That number is bounded by the number of tankers and their size. If the preferred twin engine tankers are to be acquired, at the very best five aircraft will support between 20 and 30 Hornets. In terms of firepower, this is equivalent to between 10 and 15 F-111s. However, tactics will dictate that at least a third of the package is armed and loaded for escort. Therefore the reality is closer to 7 to 10 F-111s, yet again a fraction of the existing capability in the F-111 fleet, regardless of availability rates.

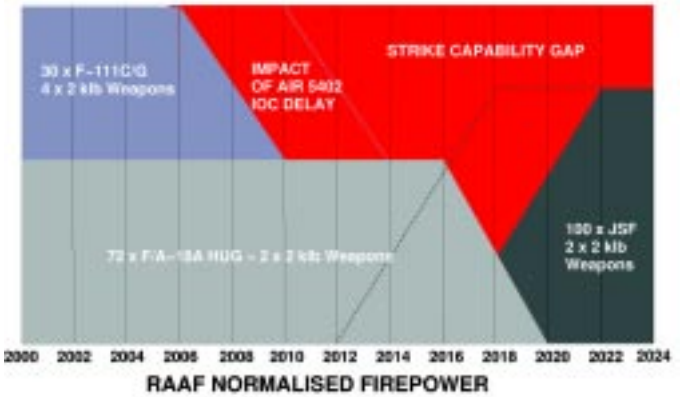
This argument will also apply to the Joint Strike Fighter, the ordained F/A-18 and F-111 successor. While it should achieve some range advantage over the F/A-18A as it carries its pair of 2000lb bombs and extra fuel internally, it will demand similar amounts of tanker support. The proposed extended range JSF using the navy carrier variant's bigger wing and a fuel tank filling one bomb bay essentially delivers 25% of the effective firepower of an F-111 to achieve an 800nm (1480km) plus unrefuelled radius – requiring four times as many sorties to achieve the effect of one F-111 sortie.

Another good measure for comparison is normalised 'throw weight', used extensively in arms control negotiations for sizing up strike forces. Throw weight is the product of striking range times weapon size – therefore it factors in aggregate firepower and combat radius effects. If



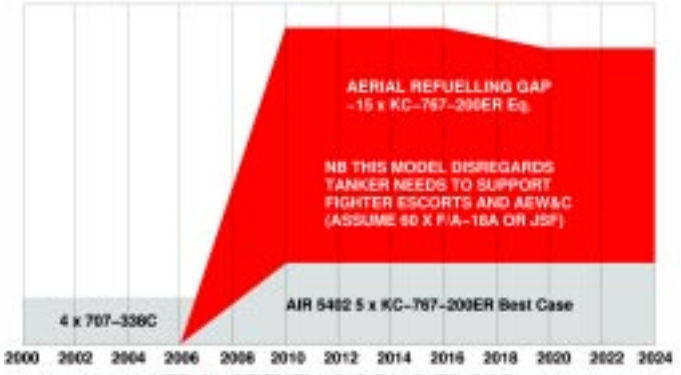
RAAF NORMALISED THROW WEIGHT

(Throw Weight = [Weapon Count] x [Combat Radius])



RAAF NORMALISED FIREPOWER

(Firepower = [Weapon Count per A/C] x [Number of A/C])



AERIAL REFUELLING TANKER GAP

(Number of tankers to offset F-111 loss disregarding DCA/OCA CAP needs)

we apply throw weight to compare future plans against current capability, excluding tankers, post F-111 we get a circa 62.5% reduction in throw weight, once 100 JSFs are online we get a circa 37.5% reduction.

Adding in the trivial number of five tankers lifts this to a 52% reduction post F-111 and post JSF around a 29% reduction. Factoring in a pessimistic assumption that the F-111 achieves at best 75% of the uptime of the F/A-18A alters the results very little. Yet again you can't beat the laws of physics.

It follows that the assertion of "no strike capability gap existing post F-111" is not supportable by fact. At best a fraction of the F-111's capability can be replaced, and doing so by diverting F/A-18As away from air defence tasks. The AP-3C armed with a standoff weapon is for all practical purposes unusuable in the regional environment – unless Australia intends to shoot stealthy JASSMs at Fiji or Vanuatu. The AP-3C is an excellent maritime patrol platform, but a strike platform it's not.

(left) The Department of Defence deserves the greatest of accolades for sheer salesmanship, given what has been successfully put to Federal Cabinet in the JSF and early F-111 retirement schemes. This set of three charts illustrates the enormity of what the Department is aiming to do with the RAAF over the coming two decades. The first is Throw Weight, a measure used in arms control negotation, for the existing, the gap period and the final RAAF strength, assuming 100 JSFs – if less are bought the chart must be adjusted proportionately. The second shows firepower measured by the aggregate number of weapons which can be lifted by the RAAF combat fleet. The final chart shows tanker needs to match the existing RAAF capability in the mixed F/A-18A and F-111 fleet. All charts assume that F/A-18A or JSF can be committed without fighter escort CAPs. It is clear that the JSF as planned for represents a significant capability reduction were the F-111 retained until 2020. Current plans for aerial refuelling sit at about 25% of the numbers needed just to cover existing capabilities. Charts based on LM, Boeing and GD data. (Author)

Removing around 50 percent of the RAAF's striking power cannot be explained away by any amount of well crafted language.

Given that Indonesia is likely to end up with something between 16 and 50 Su-27/30s by the end of the decade, the prospects are that the region will approach effective parity with Australia in strike capability once the F-111 is gone. The JSF will provide only an incremental improvement over an equivalent number of F/A-18As, and at least 130 JSFs would be required to match the raw firepower of the RAAF's current F-111/F/A-18 force mix.

With the prospect now of the US Air Force cutting JSF numbers to pay for more F/A-22s, the resulting cost impact is likely to drive down the number of JSFs the RAAF could acquire and thus the intended 100 JSFs are unlikely to fit into the currently planned budget. If the basic cost of the JSF creeps up this will be exacerbated. The use of smaller fighters supported by tankers typically costs 60 to 80% more in raw operational expenses, compared to the use of the F-111 for the same tasks, further driving up operational costs longer term.

An RAAF with a combat arm of 70 JSFs is in basic strategic effect marginally better than an RAAF with 72 F/A-18As.

THE AGE AND COST ARGUMENTS AGAINST THE F-111

CAF's statement referred to the "increasing fragility of our F-111 capability", the aircraft's age and "studies [which] suggest that beyond 2010 it will be a very high cost platform to maintain and there's also a risk of losing the capability altogether through ageing aircraft factors".

But these assertions are open to question as publicly available information on the F-111 and comparable overseas programs suggests.

The US Air Force fielded the B-52H in 1961 and intends to fly it until 2040, the planned withdrawal date for the last KC-135R/T tankers deployed during the mid 1960s. The B-1B was fielded in 1985 and is also expected to fly until 2040. The B-52H remains the cheapest to operate of the three US heavy bombers, and it is a much larger, more complex and older aircraft (by at least five years, or a decade in service years) than the F-111 is.

The argument that the operating costs of the F-111 will increase significantly over the coming decade runs contrary to what has been observed at Amberley since Boeing took over the F-111 depot, it runs contrary to US experience, and it runs contrary to the mathematics of basic reliability theory – every time an old component is replaced with new, reliability improves, running cost is reduced and service life is extended.

These incongruities run deeper as the Department of Defence has never kept the type of detailed component level failure rate statistics needed to develop a reliability model based projection of long term F-111 support costs – a mathematical model which tracks wearout 'bell curves' for each component or subsystem and which is used to produce a 'bathtub' curve for the aircraft. Therefore any

assertions that the aircraft is in terminal wearout is not based on hard engineering facts.

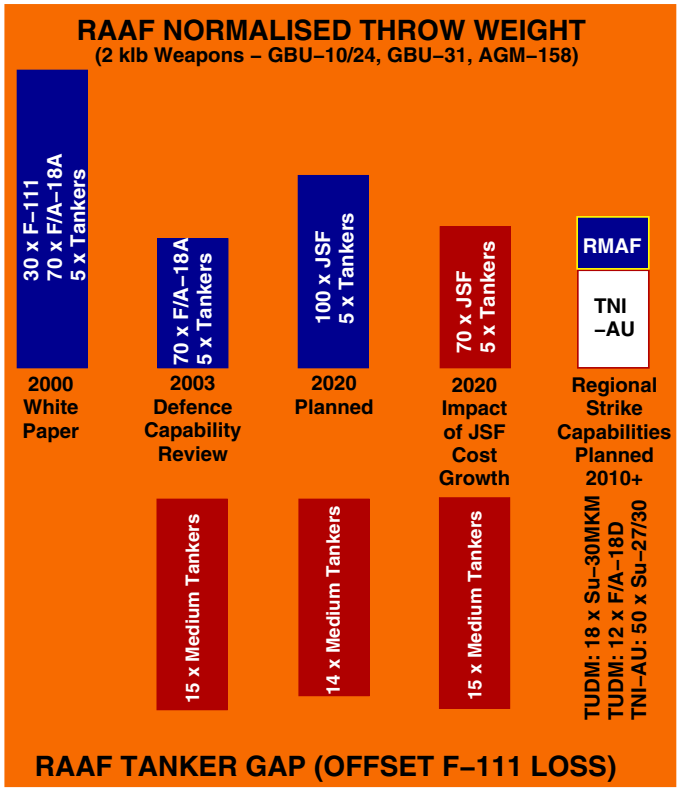
Last year's Hansard is most revealing – DSTO's preliminary F-111 Sole Operator Program findings cited by the former Vice Chief of the Defence Force are that the F-111 structure and TF30 engines can be managed to 2020 with no difficulties. With around 200 mothballed AMARC F-111s there is an ample supply of spare bits to work with – many of these mothballed aircraft have less than 3000 hours of airframe time. As a refurbished set of AMARC wings can be swapped in three days, the RAAF could swap wings to extend fatigue life for decades to come. During the 1980s the US Air Force even swapped the Wing Carry Through Box on damaged F-111s – it is regarded to be the single most critical structural part after the wings.

As structures are not the critical cost driving long term issue for the F-111, avionics, wiring and engines remain as the other key hotspots in older aircraft. Most of the wiring and core avionics in the F-111C and G were replaced in the AUP and AMP upgrades respectively, and later block upgrades. The idea that this quite new hardware will incur unusual cost growth over the next two decades doesn't stand up.

In terms of engines, the RAAF acquired all remaining P109 series engines from the retired USAF F-111D fleet, and could further acquire 77 shipsets of mothballed F-111F engines, and now also the TF30 engine stocks remaining from the US Navy F-14A fleet. The total pool of TF30 engines could last for decades. DSTO have stated that the existing pool of engines, with DSTO devised durability fixes, will last at least until 2020.

What is not well known in Australia is that General Electric initiated design work on adapting the F110 retrofit kit for the F-14B/D to the F-111 during the early 1990s. In principle, an F-111 retrofit with high thrust low maintenance F110 engines common to the massive F-16C/D fleet is a low risk low cost conversion. With an engine retrofit the F-111 can have a propulsion package supportable well past 2030 – using the F110, or later engine.

Recently published reliability analysis cost studies performed in the US indicate that the cost of engine maintenance dominates operating costs for all older aircraft. The F-111 cannot be any different, as it obeys the same laws of physics as its contemporary types in service.



This chart compares throw weight and tanker demand over time, and compares the former to current regional strike force plans. If the regional operators and Department of Defence both get what they have asked for, by the middle of the next decade the region will have defacto parity with the RAAF in strike capabilities. (Author)

The only potential issues longer term are the remaining original analog avionics – the steamgauge cockpit, analog radar and some boxes inside the Pave Tack. The overseas approach remains to replace such subsystems with new hardware and realise a net saving in total ownership costs usually within a decade – the plethora of recent glass cockpit, FLIR module, laser and radar retrofits seen in the US and Europe speaks for itself. Australian industry put forth unsolicited proposals for such cost saving F-111 maintainability upgrades two years ago – in compliance with former minister Reith's policy directives and the subsequent Defence Capability Systems Life Cycle Management Guide – but did not receive any responses from the Defence Department.

What must raise serious questions is the sudden turnaround in F-111 availability and reliability since Boeing took over the Amberley depot operation, and with Amberley F-111 SPO and DSTO Melbourne support launched an ageing aircraft engineering program. During last year's Red Flag exercise the F-111s were more reliable than all of the newer types at the exercise – a clear indication that significant effect was being achieved.

Historically such dramatic changes in aircraft availability are symptomatic of poor prior maintenance technique and planning being replaced with proper technique and planning. Events like the near loss of A8-112 due to the retention of 1960s cabling in a fuel tank, the tragic deseal/reseal saga, and the need for a fleetwide wing replacement program raise serious questions about the whole regime of F-111 support prior to the full commercialisation of the depot.

Of no less concern are assertions concerning the age of the F-111 and the risk of "loss of capability", essentially that some unsolvable structural fatigue problem will be found which cannot be easily fixed – engine and avionics problems by definition do not fall into this category. Given that the F-111 is one of the few aircraft which can be mostly

Prior to details of the new Defence Capability Plan was released, Defence originally plan was to put JASSMs (or similar) on the F-111 since it can truck four of them rather than the F/A-18A's two, without tanker support. JASSM provides survivability for any platform which shoots it, so the question should be, what platform makes for the most dollar efficient means of carrying X JASSMs to the launch point?

DSTO's preliminary F-111 Sole Operator Program findings cited by the former Vice Chief of the Defence Force are that the F-111 structure and TF30 engines can be managed to 2020 with no difficulties.

dismantled by hand tools, this is an extraordinary assertion by any measure.

The F-111 is arguably the structurally safest aircraft in ADF service and due to ongoing structural Cold Proof Load Testing the only ADF airframe where the primary structural integrity can be demonstrated to be safe. The F-111 fleet has considerably more remaining airframe structural fatigue life than the Hornet fleet does – if structural fatigue were the driving issue the Hornets would have to be retired first. While most contemporary fighters are built for a 6000 hour fatigue life, the F-111 was built for 10,000 hours, and that figure is driven by wing fatigue life.

The F-111 airframe was designed during the 1960s to be 85 percent common for both the land based air force variants and the catapult launched arrestor recovered naval F-111B variant. While the F-111B never made it to production, the land based F-111s inherited a heavily overbuilt, and slightly overweight, common structural design. So tough is this airframe that several aircraft seriously damaged in landing and takeoff accidents were rebuilt under the 'FrankenVark' program and continued in operational use. The RAAF's A8-112 flew home after a fuel tank explosion which would have torn a lesser aircraft to pieces – the explosion itself a consequence of another maintenance planning failure.

The principal fatigue issue in the F-111 has always been the wings, primarily the D6AC steel Wing Pivot Fitting (WPF) at the wing root. The often maligned Wing Centre Carry Through Box (WCTB) has had very few problems statistically, and a number of US Air Force F-111s had their WCTBs replaced. DSTO Melbourne regarded the WPF as a priority and during the SOP devised a modification which arguably 'fatigue-proofs' this critical component.

The RAAF's much publicised wing replacement program resulted from a confluence of historical gaps in the fatigue analysis of the FB-111A/F-111C 'long' wing and delays in analysing fatigue test articles in Australia – largely attributable to poor planning. With the wingtip extensions fitted – all F-111 wings are otherwise identical – the different stress distribution reduces the life of the 'long' wing against the 'short' wing.

With perhaps 90 percent or more of the key fatigue limited components in the F-111 airframe concentrated in the wings, the fatigue life of the current RAAF fleet can be extended by wing swaps for as long as surplus wings remain in AMARC mothballs – with 200 airframes many under 3000 hours of time this is a lot of fatigue life. Indeed, one F-111D went into the smelter with around 2500 hours of airframe time – a mere quarter of its design life. Additional hours can be added to F-111 wings by reskinning, fastener reworking and selective component replacement, as done with the B-52H, C-5B, KC-135, 707 and planned for the B-1B. Other key structural components such as undercarriage sets, wheels or WCTBs are available in abundance in AMARC.

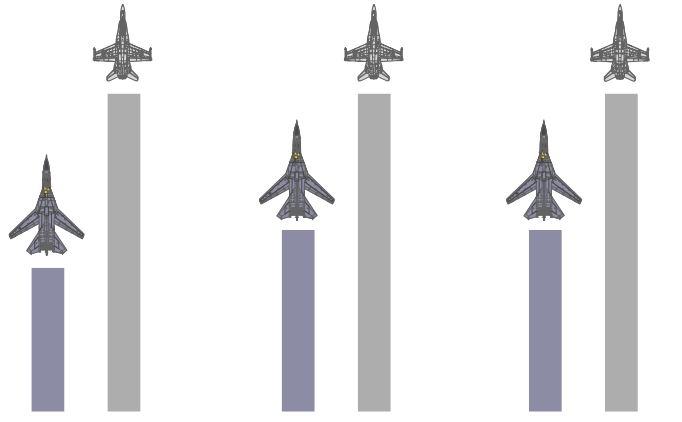
The F-111's aluminium honeycomb sandwich skins can be arbitrarily replaced with more durable and tougher carbonfibre composite replacements, using a DSTO devised reverse engineering technique.

There are no obvious engineering reasons why the F-111 cannot be life-extended into the 2030-2040 period, like the US Air Force B-52H and B-1Bs – both programmed for use until 2040, using small block retrofits during scheduled downtime.

The arguments put forth by Defence on both costs and risks of fatigue related catastrophic failure are paper thin at best, and essentially speculative. They are in engineering and strategic planning terms little more than guesswork, not supported by hard engineering analysis like we see in the US.

This analyst (and formerly reliability engineer) has previously challenged the Defence Department to provide a publicly available, comprehensive Mil-Std-756 compliant reliability and wearout analysis of the F-111, using hard statistical data at a component and subsystem level. An analysis without 'estimates' and 'projections'. The Defence Department did not respond to this challenge.

The argument that the F-111 is expensive is simply bunk. This diagram compares the operational cost of doing a task with a single F-111 against the use of F/A-18As, supported by tankers in the latter two scenarios. While each F/A-18A is about 30% cheaper, the need to use larger numbers and supporting tankers drives the costs of the Hornet up significantly over the F-111. The idea that 'small fighters with tankers are cheaper' is a deceptive fallacy. (Author)



Scenarios B, C require aerial refuelling for the F/A–18A
Scenario A assumes 3 x F/A–18A, Scenarios B, C assume 2 x F/A–18A

Cost of Bomb Delivery – F–111 vs F/A–18A

How Survivable is the F-111?

Claims that 'the F-111 is no longer survivable' are demonstrably nonsense.

Given the weapons and systems upgrades until recently planned for the F-111, and the proposed alternatives in the F/A-18A and AP-3C, a converted 1950s airliner airframe, the opposite holds true.

A good sanity check is comparing the until recently planned JASSM armed F-111 against the proposed alternatives, JASSM armed F/A-18As and AP-3Cs, for likely regional air defence capabilities.

With well over 150nm (280km) of standoff range the JASSM essentially defeats all existing SAM systems, as the missile can be fired from below the radar horizon of the SAM acquisition and engagement radars. Therefore the principal threat to any JASSM shooter in this region will be prowling patrols of Su-30s (AA Aug/Sept 03).

The Sukhoi will rely on its large N011/N011M radar to perform sweeps of the expected threat sector, the CAP station being positioned between the defended area and anticipated threat sector. If the JASSM is fired from inside the Sukhoi's detection footprint and the Sukhoi can acquire the JASSM shooter, the issue is then one of whether the Sukhoi can effectively prosecute an engagement and achieve a kill.

For an unescorted JASSM shooter the best strategy will be to turn tail once the JASSM is fired and gain as much separation from the Sukhoi as possible, as early as possible, and use a trackbreaking jammer to disrupt the N011M. At the limits of N011M detection range, adding a reasonable number of miles quickly enough could cause the radar to lose the track, if not increasing distance affords an increasing advantage in Jam/Signal ratio.

The AP-3C has little hope – its speed is inadequate, and its large radar signature makes effective jamming difficult. At long ranges the F/A-18A will not have the spare gas to engage the Sukhoi, and since it is slower the Sukhoi will close the gap fairly quickly. The game is then whether the F/A-18A's jammers are good enough or the Sukhoi runs out of gas soon enough.

In this engagement scenario the F-111 is more survivable since it can sustain a much higher egress speed much longer than the F/A-18A, and its new Elta 8222 jammer is regarded to be the most capable in the Pacrim region.

This scenario is academic insofar as in the real world JASSM shooting F-111s (or F/A-18As) would be escorted by a tanker supported F/A-18A CAP intended to keep the Sukhois away. The US will escort the B-52H, the B-1B and even the B-2A in environments where a fighter threat exists. Asserting that the F-111 is not survivable when escorted is a non-sequitur. The F-111's speed minimises its exposure time to the Sukhoi and thus minimises the odds of detection and engagement, and the odds of the Sukhoi closing in to effect a successful missile shot, escorted or unescorted, compared to the F/A-18A.

Where the threat is a double digit SAM system (AA Oct/Nov 03) and the target is to be engaged using guided bombs, such as the Paveway, JDAM or HdH winged JDAM-ER, the contest between the F/A-18A and F-111 also favours the F-111. Assuming equally good defensive jammers on both aircraft, the key factors are speed and how low the aircraft can fly to the bomb release point. The F-111's terrain following radar and much higher low level speed give it a decisive survivability advantage over the F/A-18A in this scenario. Once the winged JDAM-ER is deployed, this scenario also becomes academic, since the weapon can be tossed from low level from well below the radar horizon of the threat SAM systems. For many SAM types the range of the winged JDAM-ER will permit drops from cruise altitude. Yet again asserting that the F-111 is not survivable compared to an F/A-18A is a non-sequitur – the opposite applies.

If Defence is constructively concerned about F-111 survivability and not simply concocting lame justifications for an internal budgetary politics driven decision to downsize the RAAF, then many alternatives exist to further improve upon the F-111's existing strengths. Options include introducing the EF-111A Raven, fitting the F-111 with AGM-88 HARM missiles, an AESA radar with TFR modes and AMRAAM guidance capabilities, an advanced optical fibre fed internal active jamming system, and radar signature reduction of the engine inlets and radar bay – all the subject of unsolicited industry proposals submitted over the last two years. Many affordable low risk options exist to ensure that the F-111 remains the most survivable strike platform in this region.

CONCLUSIONS

The arguments put forth to justify the early retirement of the F-111, and the arguments asserting that no strike capability gap will exist, are difficult to support by hard facts. It is unfortunate that Cabinet agreed to the early retirement proposal, as a policy change now presents a public embarrassment to the Federal Government – even if the responsibility for this situation rests squarely with the Department of Defence bureaucracy.

Delayed F-111 retirement increases budgetary flexibility for a future government by spreading the replacement expense over a longer period. Evidently budgetary flexibility was not a factor. Given the evident weakness of the strategic, cost and airframe life arguments against the F-111, the root cause of the drive to early retirement clearly lies elsewhere.

The long history of public embarrassments resulting from F-111 management, maintenance and planning blunders in the bureaucracy is without doubt the key factor which led to this situation. The early retirement of a number of key senior Air Force officers post 2000, all advocates of the F-111, left the aircraft without any champions in the upper ranks of the ADF and highly vulnerable to bureaucratic attack.

The strategic consequences of this decision, if followed through with, will be profound as Australia's strike capability dips to parity with other regional nations. The Amberley WSBU (Weapons Systems Business Unit) with its unique systems integration capability will wither away, damaging the industrial base possibly irreparably. Australia's credibility with the US will take a serious hit, as the US Air Force will have to beef up PacRim assets to offset a 50 percent reduction in effective RAAF combat strength, likely to persist with the introduction of the second tier JSF.

The RAAF is now well on track to becoming a strategically irrelevant force suited primarily for second tier support roles and with a very limited capability for independent combat operations. In a period of increasing strategic risk across the region and globally, this is not a path Australia can afford to take.

What do you think of the F-111's retirement?

Australian Aviation invites your letters to the editor on this very important defence debate.