Three decades of the F-111


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When the Menzies Government ordered 24 General Dynamic F-111C aircraft in October, 1963, it could have hardly imagined the versatility or longevity of this exceptional aircraft. With current long term government planning envisaging the operation of the aircraft until 2020, no less than 57 years will have elapsed between the ordering and the currently planned retirement of the aircraft.

The F-111 remains the most potent strike aircraft in its class, worldwide, outperforming the Russian Su-24 Fencer and the European Panavia Tornado IDS, both largely inspired in concept by the F-111.

Australia is now the sole operator of the F-111, which remains as controversial today as in its youth. With three decades of RAAF operational service under its belt, the F-111 has had a colourful history in every respect.

An historical retrospective

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The F-111 is a product of the peak of the Cold War. During the late 1950s the prevailing philosophy in Western military doctrine was ‘massive retaliation’: an attack by the SovBloc would attract waves of nuclear-armed bombers that would obliterate the Warsaw Pact in a conflagration of nuclear hellfire.

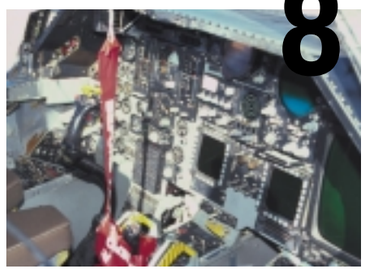
At that time large proportions of the US Air Force budget were being devoured by Strategic Air Command (SAC), with its massive fleet, which peaked in the early 1960s at 650 B-52 bombers, 86 B-58 Hustler bombers, and its ultimately 600-strong fleet of KC-135 tankers.

Tactical Air Command (TAC), which operated much of the US land based fighter fleet, was hard pressed to compete against SAC in the nuclear warfighting game. In the nuclear warfighting strategy TAC would engage SovBloc battlefield assets in theatre. Its best asset, the Republic F-105 single seat strike fighter - similar in size/weight/fuel, thrust and role to the contemporary F-35 Joint Strike Fighter - proved to be disappointing in range/payload and its low level penetration aids inadequate to the task. TAC wanted a better strike fighter, which was more survivable and could penetrate deeper, an aircraft with a primary nuclear strike role, and secondary conventional fighter/bomber role. This led to the WS 324A requirement, which evolved into the SOR-183 document. The new aircraft was to be a two seat all weather STOL capable Mach 2.5 fighter, with a payload in excess of 10,000 lb of conventional bombs, or 1,000 lb of internal nuclear bombs. In late 1960 this project became the Tactical Fighter Experimental (TFX).

In 1961, the recently appointed Secretary of Defence Robert McNamara decided to imprint his own ideas on how the TFX should evolve. At that time the US Navy were exploring the problem of how to defend carrier battle groups against Soviet long-range bombers armed with supersonic cruise missiles. The answer would clearly be a large supersonic interceptor with a large radar and long range radar guided missiles.

McNamara entered office from a previous industry position and was intent upon acquisition reform - at any cost. Minimising the number of aircraft types in service would provide mass production economies of scale, so the TFX shortly thereafter became a ‘joint’ Air Force/Navy program. The airframe would be essentially common for both services, with ‘missionised’ variants for each. The Air Force would get a supersonic theatre strike F-111A with some air-air capability, the Navy a heavy long-range supersonic interceptor labelled the F-111B. The basic airframe and propulsion design was to be identical for both services. General Dynamics and Boeing were shortlisted, with the former winning the contest by McNamara’s directive largely due to greater commonality in the paper design. The aircraft was to be an ambitious showcase of the latest (untried) technology, incorporating variable geometry wing design, leading and trailing edge high lift devices, afterburning turbofans, a crew ejection module, a highly automated inertial bomb/nav package and automatic terrain following radar in the F-111A, a long range pulse Doppler air intercept radar in the F-111B, and internal electronic warfare equipment in both. The ambitious use of untried technology went further, with major structural components to be made of D6AC steel and much of the aircraft clad with lightweight aluminium honeycomb panels. The aggressive schedule set for design, development and production matched the ambition in the use of advanced high risk basic technology - the F-111 was to employ a ‘concurrent’ production and development model, where the aircraft would be pushed into production while bugs were ironed out of the design.

History tells us this was a recipe for a disaster, and that the F-111 became in political and budgetary terms - a feast for a mass media unsatiated with the bloodlust of Vietnam.



The first F-111 rolled out in October 1964, almost a year after the Australian order. The aircraft ran into developmental difficulties early, as the inlet design was created around experience with turbojets, much less sensitive to airflow disruptions than the immature first generation Pratt & Whitney TF30 turbofan. The engine would stall as a result, and vortex generators were introduced into the inlets to correct this in the 'Triple Plow I' modification. Ultimately, the problem was fixed in the Triple Plow II inlet used in later models.

The aerodynamics of the aft fuselage and its interface to the engine nozzles produced drag well above predictions, especially due to flow disruption from the circumferential blow-in doors. The aircraft's weight shot up, as GD had little experience in designing for naval carrier operations, and over-designed a great many structural components - commonality saw the same structure used in both A and B models. The tailhook, later to save several operational F-111s, is a legacy of this.

Grumman, who became the lead contractor for the navalised F-111B, performed major design changes to reduce weight, which had exceeded recovery momentum limits for even the new Enterprise/Nimitz class supercarriers.

While the F-111 entered early pre-production, the US involvement in Vietnam escalated and both Navy and Air Force fighters were thrown against targets in North Vietnam. Both services quickly learned that their theoretical assumptions about future conflict in the nuclear age were off target - conventional conflict would be the dominant environment. The Navy soon found that its agile lightweight F-8U Crusader performed generally better than the heavyweight F-4B Phantom. The massive F-111B, built to kill long-range bombers and their supersonic cruise missiles, was not designed for knife fights with lightweight MiG-17s and MiG-19s. The shift in Navy priorities saw the F-111B axed in 1968 in favour of Grumman's VFX. The VFX became the F-14A which inherited the huge AWG-9 air intercept radar and AIM-54 Phoenix missile from the F-111B, which had by then lost much of its commonality with the F-111A.

The F-111A suffered from excessive drag and weight, incurred by structural design for carrier landings, and the TF30 did not develop enough thrust to offset the weight. The result was the F-111A not meeting its intended climb rate and range specifications. While it outperformed every fighter-bomber in existence in top speed and typically twofold or better in payload-range, it would not be the full spectrum multirole fighter TAC hoped for.

Other problems soon developed. The D6AC steel was exceptionally strong, but prone to cracking, especially if production quality control technique was lacking. An Air Force F-111A suffered a fatal accident when a Wing Pivot Fitting failed in flight. This led to a major and costly rework of the design and rebuilding of existing airframes, including the 24 F-111Cs for the RAAF. The Cold Proof Load Testing techniques used by the RAAF to this very day were developed at this time.

The first combat deployment of the F-111A was not entirely successful. In March 1968 the first six F-111As deployed to Thailand to bomb North Vietnam. In 55 sorties three were lost due to a combination of tailplane control rod failures, immature Terrain Following Radar problems and small arms fire - the glossy underside reflecting the afterburner plume - and hurriedly painted black. The aircraft was unstoppable in enemy airspace, the Soviet IADS being impotent against the high-speed low level penetration technique.

The F-111A returned to Vietnam in 1972, and played a key role in the Linebacker I and II campaigns. With more mature avionics the aircraft yet again defeated the by then expanded and refined Soviet IADS. The SA-2, SA-3 and ZSU-23-4P were no match for the F-111.

F-111 variants

The US Air Force deployed five F-111 variants. TAC operated the baseline analogue F-111A, the analogue F-111E with Triple Plow II inlets, the digital F-111D using the F-111E fuselage, higher thrust TF30-P-109 engines, and which introduced the first HUD and digital bomb/nav computer in a fighter. The final digital F-111F had higher thrust engines, and 'low cost' analogue cockpit. SAC replaced its B-58s with the FB-111A, which used a variant of the F-111D digital bomb/nav system, extended wingtips borrowed from the F-111B, revised exhaust nozzles, and heavy duty undercarriage for higher gross weights. This veritable 'zoo' of variants, with dissimilar engines, avionics, systems and combinations of wing configuration, inlets and exhausts, made the early F-111 fleet very expensive to maintain. The US Air Force took delivery of a total of 419 F-111 variants - a fraction of the intended 1,706 airframes.

The sixth variant, the RAF's F-111K, intended to replace the UK's stillborn TSR.2, also died at birth. The only export customer was the RAAF, with its F-111C variant.

The F-111C was yet another hybrid, using the baseline analogue F-111A fuselage and engines, with minor structural changes, and extended FB-111A wingtips and heavy duty undercarriage.

When Australia ordered the F-111C in 1963, the world was a very different place. Indonesia was not only belligerent but teetering on the edge of a Soviet and Chinese sponsored communist takeover. Supplied with Soviet Mig-21s and Tu-16 bombers there was a genuine fear it could become a Soviet proxy not unlike Cuba - full of Soviet advisors and potentially a forward base for Soviet nuclear weapons. Australia during the late 1960s came very close to developing its own nuclear weapons. The F-111C, with the range to hit Jakarta flying from RAAF Learmonth in Western Australia, would have been the unstoppable nuclear delivery platform.

While the TNI backed coup, which saw the demise of communism in Indonesia changed that aspect of the regional environment, the military junta running Indonesia inspired little confidence in Canberra. The F-111 order remained.

First F-111C (A8-126) was accepted by the RAAF on 5 Sep 68 and flown to Edwards AFB the following day by Ron Green and Harry Walton for some validation of predicted performance. A ground failure of a Wing Carry Through Box in the fatigue test resulted in non acceptance of further aircraft at that time and A8-126 was returned to the USAF following some RAAF performance test flights. The RAAF's F-111Cs were eventually delivered in 1973, remaining until then in US storage while structural modifications were performed. Prior to delivery, the RAAF operated loaned F-4E Phantoms. RAAF Amberley, previously the home base of the Canberra-equipped Nos 1, 2 and 6 Squadrons, became the home of the F-111C in Australia.

The introduction of the F-111C was a major leap for the RAAF. In terms of basic technology, the F-111C propelled the RAAF to the cutting edge. The aircraft was arguably the most complex of its generation, in terms of structures, systems and avionics. It is often argued that the F-111C did more to educate the RAAF in modern technologies than any other program.

The RAAF's fleet was not limited to bomber variants, as four aircraft were modified for strategic and tactical reconnaissance, with a total of six originally provisioned for this role. The four RF-111Cs acquired a bomb bay recce pallet with an AAD-5 infrared linescanner, KS-87C, KA56 and KA93 cameras. TAC's RF-111A and RF-111D never materialised.

The cold war era

What the RAAF acquired in the F-111C was the premier theatre strike aircraft of the Cold War era. With 2.5 times or better the payload radius of typical multirole tactical fighters, the F-111 remains today in a class of its own. With Mach 2.6 class high altitude supersonic dash performance, and Mach 1.2 dash capability at low level, the F-111 is arguably the fastest combat aircraft remaining in operation in any Western air force.

There is no 'tactical' aircraft that can match the F-111 in its key aerodynamic performance specifications - other than the large Russian MiG-31 Foxhound which curiously enough is nearly identical to the F-111 in most cardinal weight/performance parameters, lending truth to the idea that similar needs evolve similar specifications.

While the F-111C was acquired and politically justified as a 'strategic strike' aircraft, the aircraft was clearly much more flexible in its usage. TAC quickly expanded its conventional theatre strike role in Europe to cover all weather close air support in high threat environments. Soviet tanks in the Fulda Gap would have been carpeted with cluster bombs delivered by UK based F-111Es and F-111Fs. TAC maintained two wings, or virtually half of its F-111 fleet, at Upper Heyford and Lakenheath in the UK as a sledgehammer force to break any Soviet conventional thrust into Europe - apparently a bone of contention with the Soviets for the two decades these aircraft remained in the UK.

As a battlefield air interdiction and close air support aircraft the F-111 remains challenged only by the B-52. With twenty-four 500 lb Mk.82 bombs, a single F-111 carries roughly half the bombload of all B-52 variants other than the Vietnam era 'big belly' B-52D. In simple terms, a pair of F-111s can carpet bomb an enemy trenchline or fortification with about the same payload of dumb bombs as a US B-52H. While modern strike technique is focused on killing high value targets with guided weapons, battlefield bombardment remains a niche where sheer tonnage still remains decisive. Doubters might consider the demise of the Taliban in 2001, or the collapse of Serbian fortifications in Kosovo in 1999.

Were the balloon to have gone up in Europe during the Cold War, the F-111 force in the UK would have disrupted and destroyed Soviet forward echelon forces, and reinforced second echelon forces in East Germany, Poland and Czechoslovakia. With the option of carrying B43, B61 and B83 nuclear bombs, the 'Warpac Central Heating' Mission was a formidable deterrent during this period.

By the mid 1970s TAC began to retire its force of EB-66/RB-66 standoff jammers, and 40 F-111A aircraft were rebuilt into dedicated EF-111A support jammers. Using a heavily automated variant of the US Navy Prowler's ALQ-99 tactical jamming system, the EF-111A remains to this very day the epitome of the tactical support jamming aircraft.

With ten independently steered jammers in the bomb bay, the EF-111A delivered roughly twice the capability of its naval cousin, retaining the supersonic performance of the F-111A.

By the early 1980s TAC embarked on a major enhancement of their F-111F fleet, fitting the Ford Aerospace AVQ-26 Pave Tack thermal imager / laser targeting pod. Fitted to a bomb bay cradle, the Pave Tack enabled the autonomous delivery of laser-guided bombs. The 2,000 lb GBU-15 television-guided glide bomb was also integrated.

The RAAF soon after adopted Pave Tack and retrofitted it to the F-111C fleet concurrently with hardware to support the AGM-84 Harpoon anti-shipping missile. The weapon bay gun pack and optional tanks were removed.

Australia's F-111C remains the most potent land based anti-shipping strike aircraft in operational service, excepting the much larger Russian Tu-22M3 Backfire. Its large 1,000 nautical mile class combat radius and very high low-level penetration speed make it an exceptionally difficult target for a hostile warship. Once crippled by Harpoon missiles, a warship would be despatched with laser-guided bombs. It is worth noting that a GBU-24/BLU-109/B laser-guided bomb is competitive against the armour piercing ammunition fired by battleships of half a century ago.

The next big event in the F-111 world was the 1986 El Dorado Canyon punitive strike on Libya. A package of 48th TFW F-111Fs launched from the UK, supported by tankers, to strike at targets roughly 3,000 nautical miles from their home base, as France denied permission for overflight. One aircraft was lost with its crew. This TAC sortie included supporting EF-111A jammers and compared closely with the types of long range nuclear strike profiles SAC trained for in their FB-111As. It's worth noting the long-lasting deterrent effect this one strike had on Gaddafi to this day.

The US Air Force during this period initiated a mid-life upgrade under the Avionics Modernisation Program (AMP), involving replacement of the analogue flight control computer with a digital system, an AYK-18 digital mission computer, new RLG INS, incremental radar upgrades, and incremental defensive avionic changes. A number of F-111Es and FB-111As were upgraded. A second-generation digital system was also developed for the F-111D/F models under the Pacer Strike program, with close to half of the F-111F fleet retrofitted before its retirement.

The 1991 Desert Storm campaign was the high point in the operational career of the US F-111 fleet. The F-111F and F-111E were deployed to the Middle East, supplemented by much of the EF-111A fleet. The EF-111As played a key role in the opening hours of the campaign, blinding Iraqi radars across the country. The F-111F was the backbone of the coalition precision bombing fleet, outnumbering all other types equipped with laser designating equipment. In the earlier phase of the campaign, the F-111Fs pounded key strategic targets, and accounted for more than 300 hardened aircraft shelters and bunkers.

In the latter phase of the campaign, they hunted Iraqi armour in Kuwait and Southern Iraq. The high altitude 'tank plinking' tactics, where F-111s orbited at 15,000 ft and picked off individual tanks with GBU-12 500 lb laser guided bombs, accounted for roughly 1000 armoured vehicles.

Of interest is that this technique was developed by RAAF 82Wing at Amberley and propagated to the 48th TFW in the UK via a US Air Force exchange officer posted then at Amberley. The 'persistent bombardment' techniques flown by B-52s and B-1Bs over Afghanistan in 2001 were a repeat of this tactic, using GPS guided JDAMs.

Statistically the F-111 was the most successful strike aircraft used in the Desert Storm campaign, and no F-111E or F-111F aircraft were lost to enemy fire, in the highest density air defence environment seen outside of central Europe. The combination of range, payload, high speed and precision gave the F-111 more punch than the UK's Tornado or the stealthy F-117A, and its speed at low level made it extremely difficult to engage by older generation Soviet SAMs.

With the collapse of the Soviet Bloc in 1991, the US Air Force was subjected to the greatest contraction in force structure size since 1945. With the concurrent pressures of funding the new B-2A 'batwing' and the F/A-22A Raptor, the super-cruising stealth fighter, the US Air Force found itself in an invidious position. The force structure size which was funded could support little more than the late build F-16C and F-15E, and the need to keep McDonnell-Douglas (now Boeing) in St Louis and General Dynamics (now Lockheed Martin) in Fort Worth alive dictated a force structure centred on these two types.

The disbanding of SAC during this period saw the FB-111A fleet converted to conventional bombers, renamed the F-111G and transferred to TAC. TAC was then absorbed into the new Air Combat Command (ACC). Very soon the F-111G, together with the troublesome F-111D and oldest F-111A/E, were on their way to be mothballed at the vast AMARC storage facility. ACC retained its wing of F-111Fs, and EF-111As for as long as it could politically sustain them. The F-111F went to AMARC in 1996, ending the era of US F-111 bomber variants. It was followed by the EF-111A in 1999, after a bitter and protracted fight.

The US Air Force had planned to operate its fleet until 2015, when the projected 10,000 hour fatigue life of the wings would expire. With the fleet consolidation in the early 1990s, the pool of spare wings would have permitted the smaller fleet to operate at least a decade longer.

Australia benefited from the consolidation of the US fleet, acquiring 15 F-111Gs for a ridiculously cheap unit cost. Unfortunately this 40% expansion in F-111 fleet size was barely funded, and the F-111Gs remain to this day largely in the same avionic configuration as delivered, and used typically for type conversion and training in No 6 Squadron. The RAAF previously acquired four F-111As to replace aircraft lost in accidents, and rebuilt these into a defacto F-111C configuration.

The late 1980s also saw the launch of Australia's Avionics Update Program (AUP), which involved the replacement of the analogue core avionics with a new digital system, derived from the TAC Pacer Strike system, but with better computers. The aircraft retained the analogue radar, cockpit and original Pave Tack configuration. The AUP yielded a large improvement in avionics reliability and bombing accuracy.

As the US Air Force wound down its fleet, Australia had to assume sole responsibility for engineering support of the type. This meant replicating many of the key support facilities until then located in the US. Amberley acquired a Cold Proof Load Test facility, recently commissioned, and the depot facilities were expanded to provide a full support infrastructure, including facilities for maintenance of the weapon system / software in the Weapon System Support Facility (WSSF), and integration of new weapons. DSTO were commissioned to perform a detailed study of the aircraft's structural life, and devise techniques for reaching the intended target retirement date of 2020. The DSTO Sole Operator Program involved dismantling an early F-111A and analysing the fatigue life of every component, but also yielded techniques for reverse engineering the honeycomb panels and replacing them with carbonfibre, and numerous life extending modifications to key components such as the engines and D6AC Wing Pivot Fitting.

Current upgrades in progress under the Block Upgrade Program include a defacto Mil-Std-1760 capability, the AGM-142 missile, the Elta 8222 jammer and possibly the GBU-31/38 JDAM bomb.

Australia's fleet saw its first operational use during the 1999 East Timor crisis. Forward deployed to Darwin, the F-111 fleet presented Indonesia's military rulers with the prospect of seeing their forces in Timor annihilated from the air. Indonesia blinked, and the rest we observed on our television sets. The Timor crisis could have followed a very different path had the RAAF not possessed the striking power of the F-111.

The future

Current planning espoused in the Defence 2000 White Paper sees the F-111 ultimately retired in the 2020 timeframe, with the fleet most likely winding down from 2015 onward as a replacement aircraft is introduced. Should the government decide to proceed with the Joint Strike Fighter, as announced last year, the F-111 will be replaced with an aircraft more akin in size and concept to the aircraft the F-111 replaced, the Republic F-105 Thunderchief.

The JSF would represent the most fundamental force structure change in the RAAF since the end of the Second World War. Over the last 50 years, the RAAF has always maintained a force structure split between genuine bombers and multirole air combat fighters. The Mustang/Lincoln mix, the Sabre/Canberra mix, the Mirage/F-111 mix and the Hornet/F-111 mix always provided for a genuine bomber and genuine fighter capability, with the long range punch and flexibility inherent in the model. The JSF is not in the class of the F-111 and can never be such; it is a strike optimised replacement for F-16Cs, F/A-18A-Ds and AV-8B Harriers, with about half the fuel and two-thirds the combat radius of the F-111. To merely match what is lost with the F-111, a significant number of aerial refuelling tankers would be required.

Against a tanker supported F-111, the JSF remains uncompetitive for strategic strike in the region. Size does matter, and any support cost savings a smaller JSF delivers are likely to be quickly eaten up by the support costs of the additional tankers it needs.

Given that the JSF is apt to be in production for three decades, deferring the replacement of the F-111 for as long as possible allows the RAAF to buy a cheaper and more mature JSF, rather than a more expensive and 'buggier' early production aircraft, if indeed it finally opts for JSF. The proposed super-cruising FB-22 bomber might materialise by then – and it would be a genuine F-111 replacement.

How long can the F-111 be kept in service? DSTO advice cited in recent Hansard indicates that the structure and existing pool of ex-F-111D TF30-P-109/108 engines can easily reach 2020. With the current program to replace wings with mothballed AMARC hardware, the RAAF is in the position to make use of large fraction of around 200 AMARC resident shipsets, and around 70 engine shipsets from the F-111F fleet. The DSTO view is that remaining analogue avionics present the main challenge in the 2020 timescale. Replacing these avionics (refer Feb 2003 issue) is not a great challenge, and with the engineering infrastructure in place the RAAF is ultimately in the position to follow a similar path to the US Air Force with its B-52H and B-1B fleet, operating into the 2035-2040 timescale.

The incumbent RAAF leadership is confident that 2010 is achievable, but uncertain about the 2010-2020 period. The three groundings due to reseal-deseal problems, wing fatigue management problems and aged fuel tank wiring have created much anxiety in many senior officers. Given that Australia has been rebuilding from scratch lost capabilities in complete aircraft and systems support, the circumstances which produced the groundings reflect the realities of the learning curve and over a decade of 'bandaid maintenance'. These are hardly the 'trend indicators' many in Canberra seem to so fear. With nearly 200 mothballed F-111s in AMARC, the RAAF has a tremendous resource to draw upon in managing any known or unknown risks in the structure.

The F-111 is the ADF's most versatile strategic asset. It is 'Australia's B-52' and occupies on the regional stage the same force structure niche as the US B-52 does on the global stage. It provides a formidable platform for standoff weapons, such as the AGM-158 JASSM, and a devastating amount of punch in battlefield interdiction, close air support and strategic bombardment, once opposing air defences are broken. It is the backbone of the current force structure, allowing the RAAF to 'punch above its weight' in the broader region - providing a significant deterrent effect.

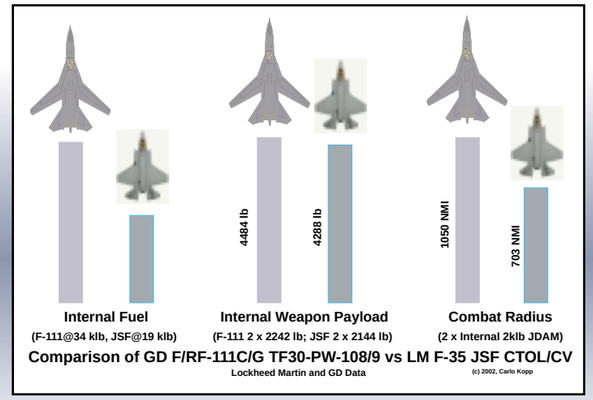
The silence of the Army community in this debate, the great beneficiaries of much of the F-111's diverse capabilities, is astounding.

With the evolving War on Terrorism, coalition deployments are a reality of life, and the F-111 is well matched to a coalition warfare environment where basing difficulties and tanker shortages are an unavoidable reality. In its current configuration the F-111 offers a valuable niche capability for battlefield interdiction, close air support, and strategic bombardment - in a US led coalition F-15C CAPs, F-16C HARM shooters and EA-6B Prowlers mostly nullify the gains of modern air defence systems against the F-111. Airfield footprint, tanker usage and time on station matter in expeditionary warfare, and with a dozen F-111s doing the work of three dozen US F-16Cs, the F-111 is unbeatable value for money in this game.

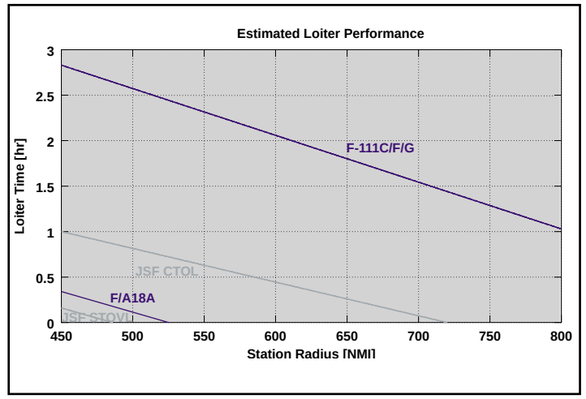
The F-111 offers opportunities in other areas. As fatigue life bites into the F/A-18A fleet around the end of the decade, refurbished F-111s from the AMARC could be used to backfill force structure numbers until the F/A-18A's replacement comes on line. At a buy price around 5 to 10% of a new fighter, this argument is difficult to contest. The ability to refurbish the aircraft in country puts much of the expense back into the domestic economy, unlike other alternatives. This and other proposals intended to manage risks in transitioning to a new fighter have been put to the DoD by Australian Industry in recent times - we have yet to see a response to Industry.

What future lies ahead of the F-111? Budgetary politics in Russell Offices have always been vicious: the operational pressures of the War on Terror, optimistic forward projections in the 2000 Defence Capability Plan and lobbying by desperate vendors of Gen 3 fighters threatened by JSF market dominance have created an unhealthy climate where short term funding priorities dominate over fundamental long term strategic force structure needs.

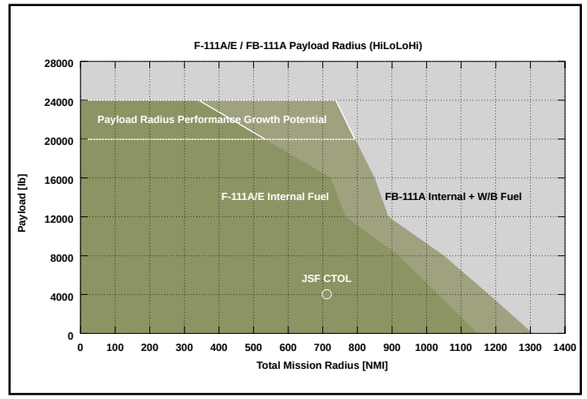
The Australian taxpayer has an enormous material and intellectual investment in the F-111, and given the aircraft's exceptional strategic value and remaining growth potential, the case for keeping it as long as possible is very strong. If the RAAF has to disband a squadron of P-3Cs or F/A-18As to balance the books, this could be strategically a better choice than losing the F-111 fleet.



The intended replacement of the F-111 fleet with JSFs in the 2015-2020 timescale would represent the most radical force structure change since 1945. Contrary to public assertions by some in the Canberra DoD, the JSF falls well short of the F-111 in cardinal performance parameters. Replacement of the F-111 using JSFs will require larger numbers of JSFs and additional aerial refuelling tankers, simply to match the existing capability in the F-111 fleet (LM/Author).



Modern battlefield air interdiction and close air support techniques are centred on the use of `persistent' or `loitering' bombardment techniques, which require not only a large fuel load, but also a large weapon payload. The bomber loiters at altitude in the vicinity of the target and is called in by a ground Forward Air Controller to strike within minutes of a target being detected. These techniques were put to good use by tank plinking F-111Fs over Southern Iraq in 1991, and were instrumental in the annihilation of the combined Taliban and Al Qaeda armies in Afghanistan, during late 2001. In the absence of B-52H or B-1B, the next best platform is the F-111 (Author).



This payload radius chart is based on a 1980s General Dynamics document. It illustrates graphically what sets the F-111 apart from 3rd and 4th generation multirole fighters - payload radius performance. With a tactical payload of 4,000 lb, the F-111 can reach targets beyond 1,000 nautical miles, while the typical large multirole fighter achieves less than 70% of that capability (GD/Author).

CAPTIONS:

Pic.1 USAF F-111A

The F-111A was the first analogue production variant, which deployed to Vietnam under Combat Lancer, and later returned for Linebacker I and Linebacker II, achieving an exceptional success rate in the latter bombing campaigns. Its then state of the art terrain following system made it unstoppable by the Soviet V-75/SA-2 SAMs.

Pic.2 USAF F-111E

The F-111E was based on the F-111A, but employed the revised stall proof Triple Plow II inlet configuration. Through the latter years of the Cold War the US Air Force maintained a wing of F-111Es at Uppe Heyford in the UK to provide conventional and nuclear theatre strike capabilities in the central European theatre.

Pic.3 USAF F-111D

The digital F-111D was the most sophisticated of the early F-111s, pioneering the first glass cockpit and HUD in a fighter. Due to its higher complexity and inadequate spares stocks, the F-111D developed a reputation for being a hangar queen, the result of which today is that mothballed F-111D wings often have less than 3,000 hours of time accrued.

Pic.4 USAF F-111F

The most powerful F-111 variant was the F-111F, equipped with the Pave Tack and digital avionics. This aircraft distinguished itself in the 1986 3,000 nautical mile strike against Libya, and later formed the backbone of the coalition precision bomber fleet in Desert Storm. During that campaign, F-111F accounted for around 1000 Iraqi tanks and AFVs, attacking from high altitude orbits using 500 lb GBU-12 bombs. At this time many RAAF F-111s are flying with wings recovered from mothballed F-111Fs.

Pic.5 USAF FB-111A SAC wraparound

The Strategic Air Command deployed one wing of FB-111As to replace its B-58 Hustlers. The FB-111A carried the supersonic AGM-69 SRAM missile in the bomb bay, or on wing stations, as well as free fall nuclear bombs. Limited to 3G for much of their lives, many FB-111As were converted to non-nuclear F-111Gs.

Pic.6 USAF EF-111A

The EF-111A Raven remains to this date the `heavy iron' in the support jamming game, never matched by its naval cousin the EA-6B Prowler. The Raven was retired in 1999, after a protracted and bitter fight in the US electronic combat community. It carried up to ten ALQ-99E jammer modules in the weapon bay.

Pic.7 RAAF F-111C

The RAAF's F-111C is a hybrid, using a modified F-111A fuselage, and FB-111A wingtips and heavy duty undercarriage. It was the most heavily armed F-111 variant ever used, capable of firing Harpoon anti-shipping missiles in addition to guided weapons.

Pic.8 RAAF F-111G

The Keating government bought 15 F-111Gs during the 1990s, to provide the RAAF with additional aircraft to cover attrition losses and extend fleet fatigue life. The F-111Gs are primarily used as trainers, and currently cannot designate or control guided weapons.

CAPTIONS ??

1. F-111C
2.First delivery
3. F-111C
4. F-111A
5. Delivery
6. F-111C
7. F-111F
8. F-111EF
9. F-111E in the Gulf
10. F-111F
11. Turkey
12. GBU-10
13. F-111C
14. F-111FB
15. F-111F
16. F-111D
17. F-111F
18. F-111EF
19. ???
20. F-111A - Vietnam
21. F-111C