EVOLVING FORCE:
Enhancing the Defence Capability Plan

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Rationale

Executive Summary

The ADF faces some genuine challenges over the coming two decades, as a result of ageing inventories, rapid technological evolution and a complex and rapidly changing strategic environment. Under such circumstances the traditional strategy of large block replacements of equipment is non-viable within a limited budget.

This document proposes an alternative force structure than that currently under review within the Department of Defence, one that is operationally more flexible and significantly more cost effective.

Rather than performing large block replacements of existing equipment, a more flexible strategy is proposed which combines smaller block replacements with ongoing life extension upgrades of strategically viable platforms currently in service. A key element of this strategy is the exploitation, where appropriate, of mothballed hardware which is available at very much lower cost. Only platforms which have become non-viable in capability and difficult to upgrade would be replaced with new.

This approach offers important dividends. The first is that the large budgetary 'spikes' and negative effects on Australia's balance of payments associated with new equipment buys are avoided. The second is that upgraded surplus hardware which is customised to Australian needs can deliver much better 'bang for buck' than overseas new build products designed for unique overseas customers. The third is that Australian Industry can play a greater role in the delivery of such capabilities, thus contributing to the Australian economy and meeting the strategic Industry imperative identified in the Defence Australia 2000 White Paper. Key alternatives proposed are:

F-111: acquire low cost mothballed surplus F-111s, and upgrade these to extend the F-111 fleet until 2030 or later, to replace some portion of the F/A-18 fleet to extend the Air Combat Capability fleet life without the need for costly structural upgrades (that is, the F/A-18 Centre Barrel Replacement). Limit new fighter buys to remaining F/A-18 replacement only.

Aerial Refuelling/Airlift: acquire at least 16 low cost mothballed 767-200ER and 747-400 airliners for modification into tanker/transports. Perform conversions over an 8 year period to spread expenditures. Re-engine and upgrade the Caribou to avoid replacement expenditures.

Armoured Vehicles: acquire low cost mothballed late build surplus tanks and M113 personnel carriers as replacements for life expired Leopards and M113s, upgrade the latter as required to M113AS4.

Littoral Warships: trial a wave piercing catamaran hull as a multirole platform for littoral warfare, capable of performing both maritime surface action and fast sealift roles.

Air Defence Missiles: split capabilities currently planned for the Air Warfare Destroyer between the Army and Navy to minimise the acquisition cost of the Air Warfare Destroyer project and improve the capability provided for deployed ground forces.

These and other alternatives provide a force structure model which is better adapted to future needs than the model proposed in the Defence Capability Plan, and is significantly easier to fund than large block replacements of existing assets.

1 Australia's Strategic Environment

Since the Defence 2000 White Paper was released the world has seen a number of profound strategic changes, all of which have become superimposed over the strategic realities identified in that document. The basic reasoning espoused in the Defence 2000 White Paper, centred in the 'Defence of Australia' model, remains sound and relevant, but incremental adjustments to force structure and fundamental thinking on the use of many assets are justified [1].

The great challenge Australia faces over the coming two decades is in developing a modern force structure capable of flexibly adapting to a wide range of regional and global contingencies, exploiting existing ADF strengths, and doing so in a constrained fiscal environment with an ageing population demographic.

Australia today faces a number of less than palatable strategic realities, which must be addressed if the strategic risks to Australia's interests are to be minimised or managed.

The first strategic risk is that of growing nation state military capabilities, resulting from economic growth, across the nearer and broader region. This growth has seen the acquisition of modern long range fighter and strike aircraft, submarines, long range guided missiles, advanced air defence missiles and supporting systems such as Airborne Early Warning & Control aircraft, across the region. This growing weapons market has yet to saturate. Key long term issues will be the roles of China and India in the broader region as both continue to develop their respective capabilities to project air and missile forces into South East Asia.

The second strategic risk is that arising from the 'arc of instability' which spans an extent from the Middle East to the Pacific. This instability is a direct result of rapid social and economic changes across developing nations, and is manifested in ethnic, social and religious conflicts, often in nations which are struggling to cope with a competitive globalised economy, and a shift from rural to urban development. The ongoing conflicts in Aceh, Borneo, Ambon and other parts of the region present the possibility of future operations following the pattern of Australia's involvement in East Timor, Bouganville and the Solomons.

The third strategic risk arises from the ongoing War on Terror, which represents a large scale globalised insurgency. While the campaigns in Afghanistan and Iraq have been strategically successful to date, there is an ongoing risk of terrorist attacks conducted within developed nations, and developing nations. With terrorist networks of global and regional extent exploiting the chaotic security situation in many nations throughout the 'arc of instability' Australia is presented with the likelihood of ongoing coalition campaigns globally, and unilateral or bilateral campaigns or operations regionally. Moreover there are ongoing risks of direct attacks on Australians domestically and abroad - the WTC attacks of 911 present a good example of assymetric projection of terrorist power against population centres.

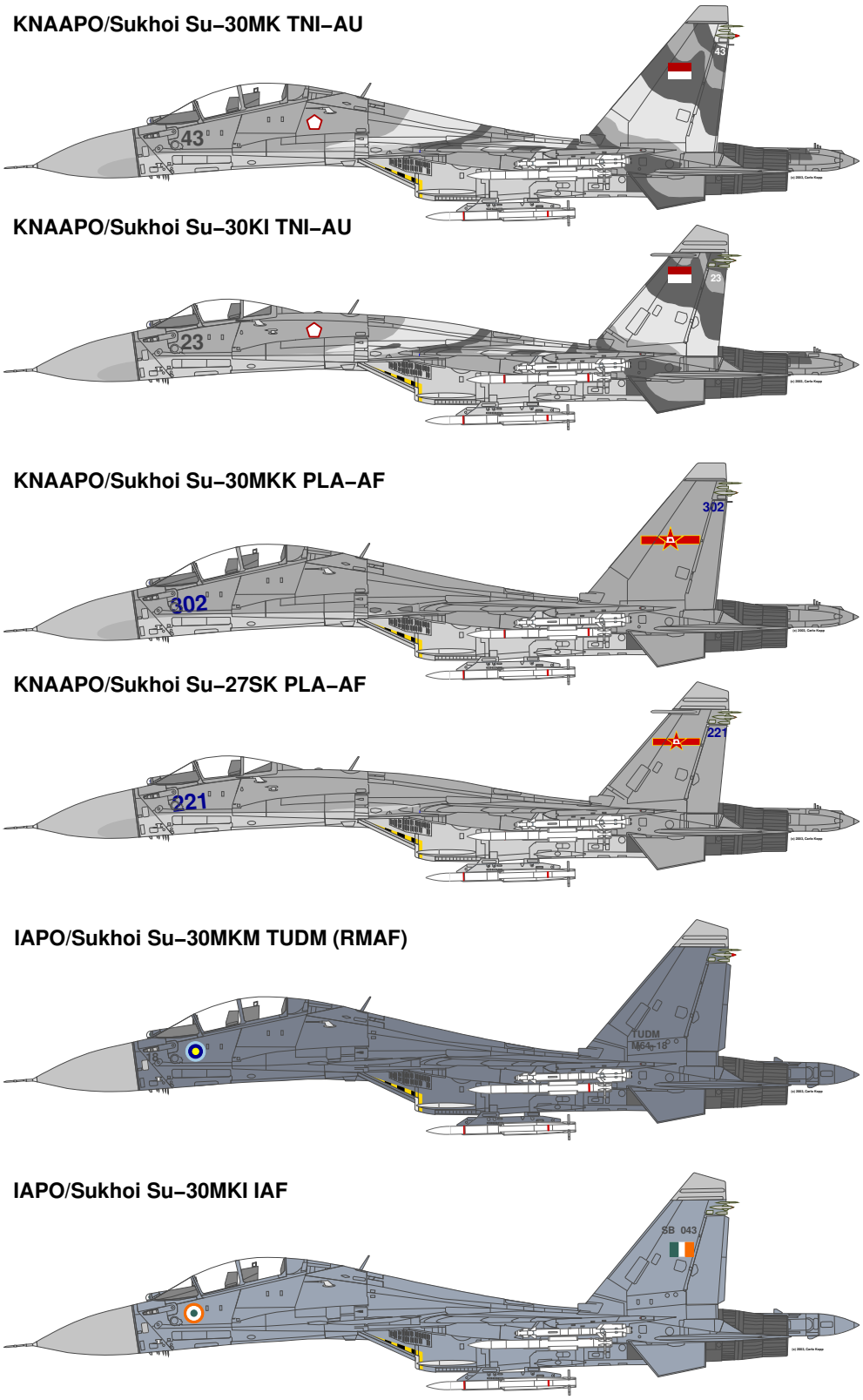


Figure 1: *Regional Sukhoi Su-30MK Variants.*

The fourth strategic risk is that of Weapons of Mass Destruction (WMD) and suitable delivery systems proliferating as rogue states market these to generate revenue. While the Baathist regime in Iraq is no longer a player in this game, the ongoing dispute with North Korea presents a vivid example of the global impact even a small nation in possession of WMD can produce. North Korea has supplied Intermediate Range Ballistic Missiles and production technology to Pakistan and Iran. Coalition operations against rogue states are a likely prospect over the coming two decades.

The fifth strategic risk is the proliferation of advanced Russian conventional weapons across the nearer and wider region, including long range strike fighters, long range guided missiles, smart bombs, long range surface to air missiles, surveillance radars, warships, submarines and associated tube launched standoff weapons, supporting assets and production infrastructure. Foremost amongst Russian weapon exports is the Sukhoi Su-30 series of long range strike fighters, highly capable in their own right and used both as a marketing vehicle and delivery system for a wide range of smart guided weapons. Without the political strings attached to US and EU weapons sales, and available in barter rather than hard cash deals, advanced Russian weapons can rapidly provide a nation with the basis for military capabilities historically unprecedented in this region. Refer Figure 1, 2 and 4.

The sixth strategic risk arises from the growing energy industry in Australia's North West and Timor Sea. Over time this industry will supply an increasing fraction of domestic energy needs, and an increasing fraction of export revenue via LNG production. Difficult to defend againt aerial, missile or terrorist attack due to its geographical location and its highly combustible facilities, a nation state or terrorist group could inflict significant economic damage, political embarrasment and loss of life by striking at this industry. Refer Figure 5.

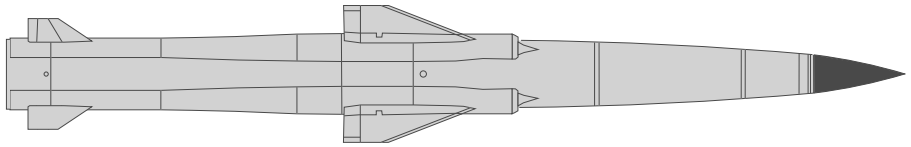
The seventh strategic risk is that the underperformance of the Department of Defence in acquisition, financial management and capability development, detailed in the FDATS DMO Inquiry, Kinnaird Report and ASPI Sinews report will persist over coming decades. This would degrade the ADF's ability to deliver military capabilities by inappropriate choices of weapons systems, very late deliveries to service and poor return on taxpayer's funding in capability terms. During a period of rapid technological evolution in systems and networks, block obsolescence of many key ADF assets, and rapid regional military capability evolution, underperformance in these key areas could see the ADF mired with obsoleted technologies or ill-suited weapons for a future regional and global environment.

These seven strategic risks are not an exhaustive representation of the risks Australia may face, but do cover the most critical items. Some of these risks are intrinsically difficult to quantify, but this does not mean that they cannot be or should not be addressed.

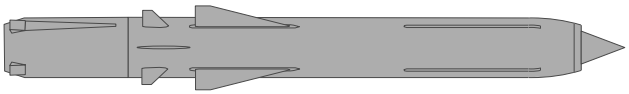
In addition, a future force structure must reflect these five fundamental principles to be relevant:

Flexibility in Roles: Capabilities should be developed first and foremost for the Defence of Australia, and then adapted for use in counter-terrorism, coalition warfare and regional intervention operations. Capabilities which are optimised for unique roles other than the Defence of Australia should receive lower funding priority.

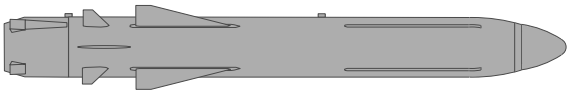
Technological Evolvability: Capabilities should be developed from the outset to be suitable for rapid technological evolution through upgrades over their operational life. Historical experience



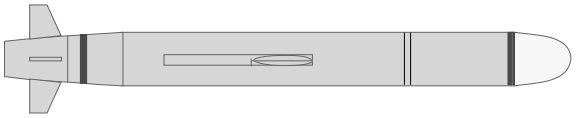
Kh–41 Moskit (SS–N–22 Sunburn) Mach 2.2 Anti–Ship Cruise Missile (Range ~ 135 NMI)



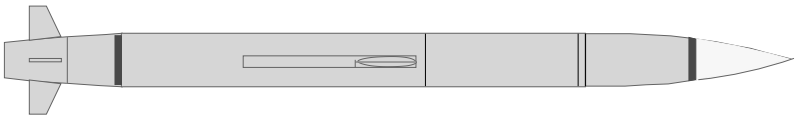
3M–55 Yakhont/PJ–10 Brahmos S (SS–N–26) Mach 2.5 Anti–Shipping Cruise Missile (Range ~160 NMI)



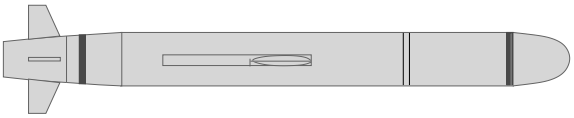
Kh–61 Yakhont/PJ–10 Brahmos A (SS–N–26) Mach 2.5 Anti–Shipping Cruise Missile (Range ~160 NMI)



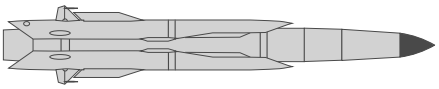
3M–54E1 Alfa (SS–N–27) Anti–Ship Cruise Missile (Range ~160 NMI)



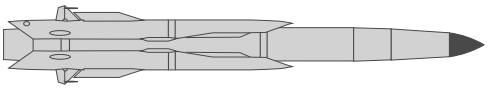
3M–54E Alfa (SS–N–27) Mach 2.9 Anti–Ship Cruise Missile (Range ~120 NMI)



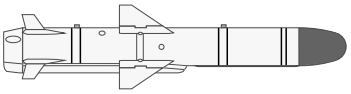
3M–14E Alfa (SS–N–27) Land Attack Cruise Missile (Range ~160 NMI)



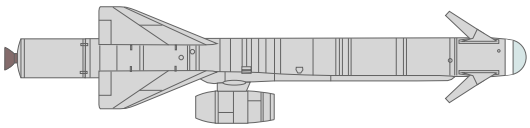
Kh–31A/R Mod.1 (AS–17 Krypton) Anti–Radiation / Anti–Shipping Missile (Range ~60 NMI)



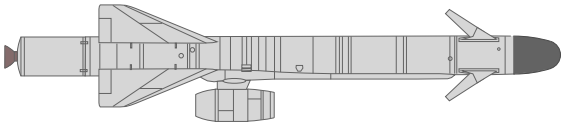
Kh–31MA/MR Mod.2 (AS–17 Krypton) Anti–Radiation / Anti–Shipping Missile (Range ~110 NMI)



Kh–35U Uran/Kharpunski (AS–20 Kayak) Anti–Shipping Missile (Range ~70 NMI)



Kh–59M/D (AS–18 Kazoo) EO/DL Stand Off Missile (Range ~54 NMI)



Kh–59MK (AS–18 Kazoo) Anti–Shipping Missile (Range ~54 NMI)

Figure 2: *Regional proliferation of advanced Russian guided missiles (C. Kopp).*

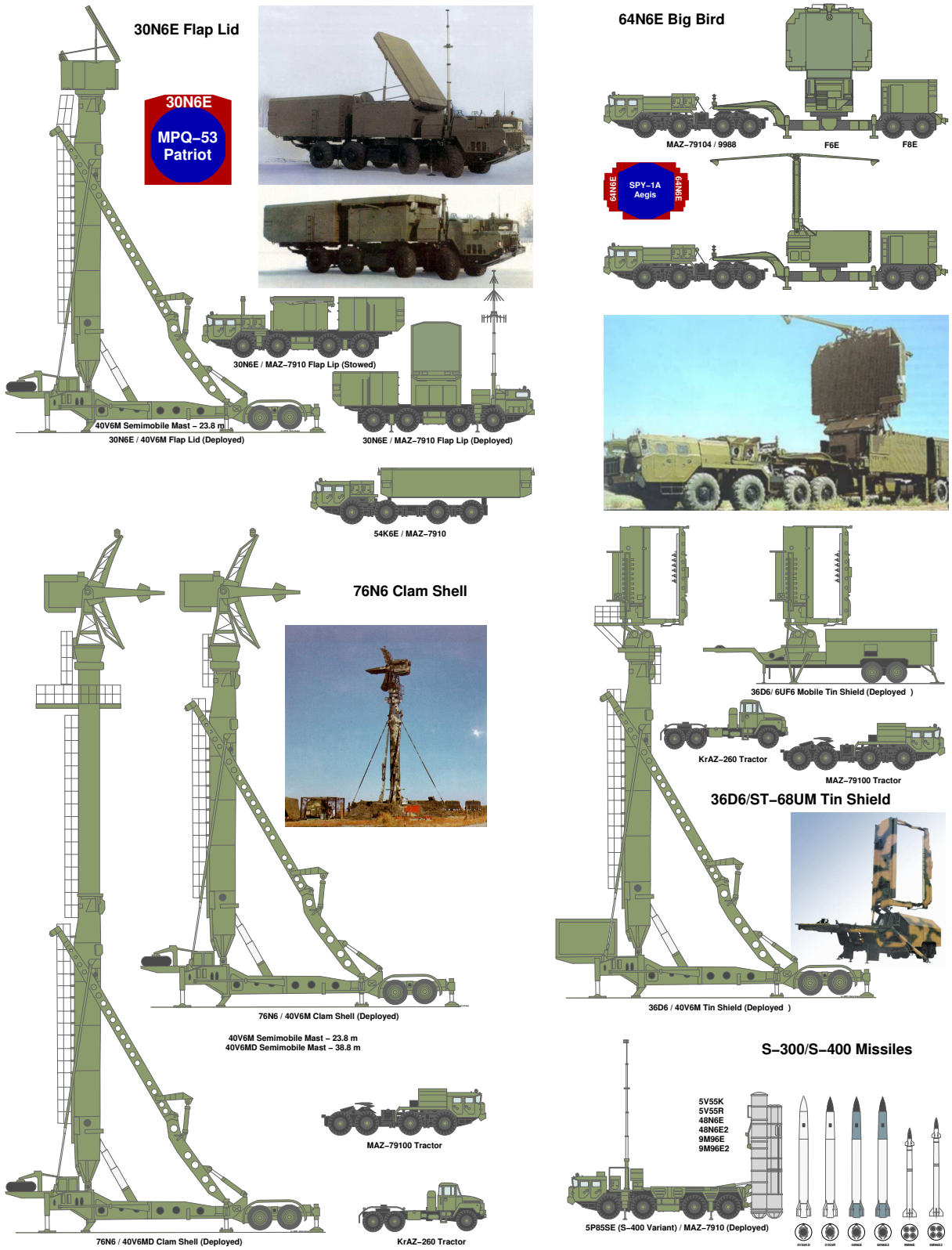


Figure 3: *Advanced Russian long range air defence missiles such as the Almaz S-300PMU series have been acquired by China and Vietnam, and Russian reports claim Indonesia is also interested (C. Kopp/Rosvooruzheniye).*

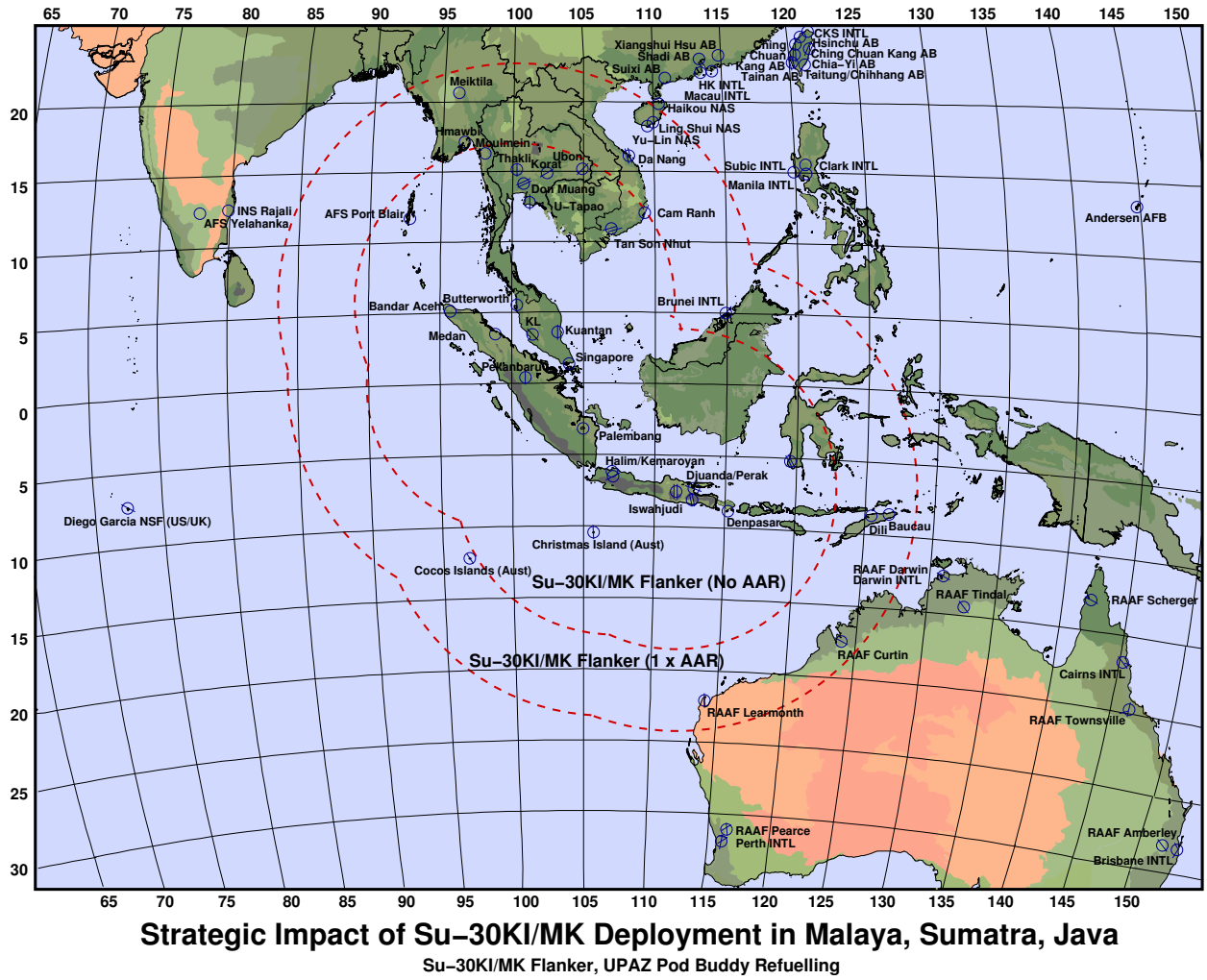


Figure 4: *Strategic Impact of Sukhoi Su-30 Fighter Proliferation in Near Region.*

shows that 'lightweight' or 'second tier' platforms are generally less able to evolve rapidly, and should therefore not be favoured.

Information Centric: Capabilities with a greater ability to gather information in the battlespace should be favoured over capabilities with lesser abilities. This places a premium on 'smart' systems and sensors, over dumb systems and sensors.

Combat Persistence: Capabilities with greater persistence in combat should be favoured over those with lesser persistence, but not at the expense of survivability, reach and firepower.

Sustainability: Capabilities which permit sustained delivery of firepower should be favoured over capabilities less able to do so. Sustainability reflects platform capabilities, supporting infrastructure and required warstocks of munitions.

The proposed adjustments to the ADF force structure are intended to address the seven strategic risks, within the contraints of the five fundamental principles outlined, and within reasonable

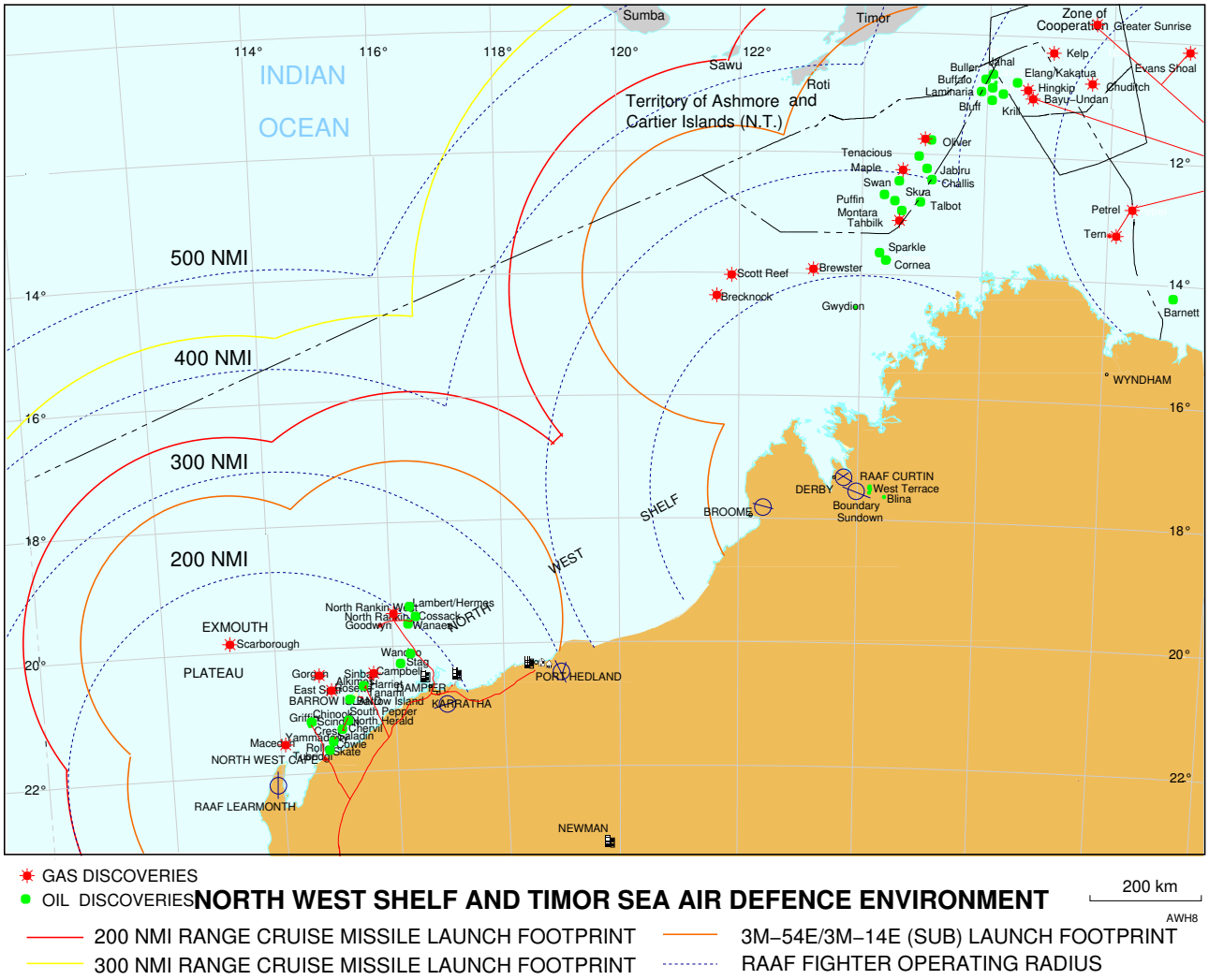


Figure 5: *Strategic Vulnerability of Australia's Energy Industry.*

budgetary constraints.

2 ADF Force Structure Adjustments

The existing ADF force structure is a legacy of the Cold War and earlier Second World War eras during which the idea of 'equal balance' in investment between the three services was popular, with capabilities built up to defeat regional force structures. Since then much has changed, in terms of the technology used to deliver military power, and in the way wars are fought. Precision weapons and the power of the information revolution have seen air power assume an ever greater prominence in recent conflicts. Precision weapons delivered by aircraft, and targeted by a combination of crewed aircraft, robot aircraft, troops on the ground and satellites, inflicted the decisive blows in the recent wars in Afghanistan and Iraq. The historical experience of air power supporting ground and naval forces has been superceded if not reversed - today firepower is mostly delivered by aircraft, with naval and land forces performing mostly a supporting role, or securing an area once the enemy's key assets have been overwhelmed by air delivered smart bombs.

It is often said that making larger investments in air power over land and naval power is a unique feature of the well funded US military, and is a much too expensive model for smaller nations to follow. Recent investments across Asia prove otherwise. China has ordered around 350 long range Sukhoi Su-30 strike fighters, and Russian sources claim that up to 500 may be purchased. India has ordered around 180 similar Su-30s, Indonesia intends to buy around 50, Malaysia bought 18 and more are likely, Vietnam has fielded the same aircraft, while South Korea has ordered 40 Boeing F-15K fighters which are the nearest US built equivalent. Like US strategic planners, nations across Asia are convinced that long range air power should be prioritised over land and maritime power. For Australia to pursue a different path would be foolish [3], [4], [5], [6], [7], [8].

In strategic terms Australia can survive with modest army and navy capabilities, but it cannot maintain its position without having an exceptionally powerful air force. The idea of 'equal balance' in investments across the three ADF services is obsolete and strategically risky in the developing global and regional environment.

The second key long term issue for the ADF force structure is its capacity for rapid evolution in an ever more rapidly evolving technological and strategic landscape. Technological evolution is now driven by Moore's Law, which sees computing performance double every 18 months, in turn driving capabilities in sensors like radar, and guided weapons, along a growth path without historical precedent. The reality of the near future is that all military systems will end up in continuous back-to-back upgrade cycles simply to maintain effectiveness, with operators able to most rapidly evolve through upgrades ultimately prevailing in combat. The idea of buying a military system or weapon, using it for 10-20 years without change, then replacing it, is no longer valid. This evolution is not limited to US and EU products - Russian radar and weapons technology has evolved faster over the last five years than during any period in the 45 year Cold War - facilitated by an open world market in IT and other technologies.

How can rapid evolution be best facilitated? Historical experience shows that platforms with higher performance and larger physical size can remain viable longer and have the internal volume and capacity to absorb more upgrades over time. The best contemporary example in Australia is the F-111, which evolved from a specialised nuclear bomber into a multirole land, maritime and battlefield

strike system, with a precision weapons capability. The F-111 followed a similar path to the older US B-52 which is programmed to fly until 2040 with dozens of upgrades planned in coming years.

Unless good choices are made regarding what ADF platforms to acquire, retain and upgrade, Australia could end up with significantly larger long term defence capital expenditures. Platforms which need to be wholly replaced rather than evolved through upgrades will cost much more in the short, medium and long term. Complete replacement of platforms is only justified when the platform becomes non-viable even with capability and maintainability upgrades applied - typically where its raw performance and/or physical measures are no longer adequate for the job.

A related issue is the national industry base and its capacity to provide upgrades over the life of ADF platforms. Without an effort to foster and maintain the technological skills base to perform upgrades in-country, the work will go overseas as will the taxpayer's dollars. The benefits to both taxpayer and ADF favour an industry skills base centred in software and systems intensive upgrades, a strength of Australia's industry, rather than manufacturing components for a volatile world market. The Israeli experience makes an excellent case study, with Israel earning significant export revenue by using its skills base to upgrade other nations' military equipment - Israel Aircraft Industries employs 14,000 personnel, turning over US$2.1 billion in 2002, with US$4.5 billion in current orders [9].

It is imperative that Australia grapple with the issue of rapid technological evolution. The established Cold War era model of large block replacements, not unlike the popular Cold War era model of 'equal balance' in force structures, is an ever growing budgetary millstone around the neck of the taxpayer.

3 Force Structure Adjustments for the Air Force

The Air Force is at this time well positioned with its existing force structure, having unique capabilities provided by the high performance long range F-111, the JORN long range surveillance radar, and the promise of the new Wedgetail AEW&C aircraft.

However, the Air Force faces serious challenges in the future, as current planning for aerial refuelling tankers falls far short of demonstrable needs, and the small, second tier Joint Strike Fighter may not provide the margin in capabilities over regional nations enjoyed by the Air Force today. Another critical hole in current planning is a shortage of surveillance and reconnaissance systems capable of finding ground targets, such systems playing a decisive role in Afghanistan and Iraq.

F-111:

The F-111, which provides around 50 percent of the Air Force's combat punch at a mere 3 percent of the total annual defence budget, is a critical asset in terms of its uniquely flexible capabilities, but also in terms of its low dependency on aerial refuelling support. In terms of 'bang for buck' the F-111 performs much better than the F/A-18A fighter. As the F-111's large size is conducive to long term upgrading, and there are 200 mothballed US F-111s available for spare structural parts, there are no fundamental reasons why the F-111 cannot be extended in service well past 2020, in a

manner identical to the US B-52H and B-1B bombers [10], [11], [12], [13], [14].

Figure 6: *The F-111 accounts for around 50% of the RAAF's combat firepower at a mere 3% or so of the annual defence budget. The aircraft is 'Australia's B-52' filling the same strategic, maritime and Army support battlefield strike roles. The F-111 carries about 50% of the 250 kg bomb payload of a US B-52H bomber (RAAF).*

This presents two exploitable opportunities. The first is that deferring the retirement of the F-111 defers the large cost of a block replacement, by decades if necessary. The second is that cheap mothballed F-111s could be bought up and refurbished in Australia to backfill the Air Force fighter fleet. If a squadron now flying F/A-18s is converted to fly F-111s, the remaining fatigue life of the F/A-18 fleet can be stretched by 25 percent without expensive rebuilds [15], [16], [17].

The recent proposal for early F-111 retirement destroys these opportunities for large budgetary savings, and results in a critical capability gap in a period of much increased strategic risk. The existence of the early retirement proposal raises serious questions about how well the Department understands the developing strategic environment [5], [6], [7], [8].

Conversely, increasing the ratio of F-111s to F/A-18As in the ADF force structure provides a better capability for regional interventions, counter-terrorist strikes and global coalition operations, in a period where the risk of any or all is quite high. An Industry Proposal titled the 'Evolved F-111' which was provided to Defence in 2001 provides a full road map for the technological, financial and industrial implementation of F-111 fleet life extension and expansion.

F/A-18A:

The F/A-18A fleet presents a far greater problem for the Air Force. It is strategically outclassed across the board by the Sukhoi Su-30. Unlike the F-111 the aircraft's fatigue life will run out at some point after 2010, unless expensive structural rebuilds are performed. Unlike the F-111 on which a wing swap can be done in days, an F/A-18A must be dismantled and rebuilt to effect a fatigue life extension, including fuselage 'centre barrel' replacement, and this takes months for each aircraft. The F/A-18A is not aerodynamically competitive against the Russian Su-30, it is slower, it cannot

match the agility of the Russian fighter, and it carries only about one half of the internal fuel and missile payload of the Sukhoi. The F/A-18A carries a much smaller radar. In practical terms large investments in extending the structural life of the F/A-18A amount to a waste of taxpayer's dollars [2], [5], [6], [7], [8].

Joint Strike Fighter:

The F-35 Joint Strike Fighter (JSF), nominated by Defence as the single type replacement for the F-111 and F/A-18A, continues to present a range of challenging risks. The first of these is the risk of late deliveries, arising from development problems. The second is the risk of the aircraft falling well below its very modest performance specification, due to weight growth during and after development through this decade. The third risk is that the performance specifications which attracted the interest of Defence in the JSF 18 months ago will not be adequate or credible compared to the evolving capabilities of Russian weapons purchased in the region.

In concept, the JSF is most akin to the Vietnam era F-105 strike fighter, a single seat bomber designed to defend itself against opposing fighters. The F-105 proved vulnerable when confronted with high performance fighters and was replaced by the larger F-111 and more agile F-4E Phantom in US service. Performance limitations in the JSF may not impair its usefulness to the US, as the Americans will have the significantly more capable F/A-22A strike fighter which can defend the JSF if required.

As a single type replacement for Australia's F/A-18A and F-111 any shortfalls in JSF performance would be catastrophic. A very strong case can be made to defer any contractual commitment to buy the JSF until after 2012, by which time the aircraft may be established in US service and its limitations well understood. An equally strong case can be made for the parallel evaluation of the JSF's sibling, the F/A-22A strike fighter, as an alternative F/A-18A replacement, should the JSF prove non-viable [18].

Wedgetail AEW&C:

The Wedgetail Airborne Early Warning and Control (AEW&C) aircraft is planned to enter Air Force service later this decade, and will provide a strategically vital capability to control air combat and strike operations. At this time the ADF is committed to 4 aircraft, with an option for an additional 3 aircraft. Four aircraft present genuine difficulties if the Air Force is to provide proper coverage for more than a single area of interest. The post 911 Noble Eagle air patrol operations in the US required the temporary loan of the NATO AEW&C fleet since the US Air Force was unable to meet demand alone. Given the ongoing risk of terrorist suicide hijackings, and the rapid proliferation of Russian fighters and standoff missiles across Asia, a strong case can be made to exercise contract options and field a fleet of seven Wedgetail AEW&C aircraft rather than four aircraft.

Aerial Refuelling and Strategic Airlift:

Aerial refuelling presents a major budgetary challenge for the ADF, for a variety of reasons. When the DCP was released in late 2000 a buy of four to five tankers was included, providing a small increase in capacity over the current Boeing 707 fleet and thus continuing only with a training

and limited operational capability. Budgetary planning in the DCP was made around this number assuming conversions of second hand airliners. This number is unrealistic for an operational fleet, as in practice one Boeing 707 or 767 sized tanker can support only 4 to 5 fighters - an operational Air Force fighter fleet of around 100 aircraft thus needs between 20 and 25 tankers of this size. With a larger tanker such as a Boeing 747 the number of tankers required drops to around 10 to 13 aircraft, depending on aircraft fit [21].

Purchasing between 20 and 25 new production tankers would cost several billion, and is not a wise strategy since both tanker types currently planned for production, the Boeing 767-200ER and Airbus A330, are likely to be replaced in production by the 7E7 and its yet to be defined Airbus equivalent within the next decade. Therefore within a 40 to 50 year service life these aircraft would become orphaned. The same is not true for mothballed airline 747-400 and 767-200ER aircraft as their remaining 25 to 30 years of service life will fall well within a viable commercial life of type - the 747-400 is likely to remain in production for at least another decade [19], [20].

With hundreds of mothballed airliners now available as a result of post 911 airline bankrupties, many of these less than a decade old, and many airliners in service with owners seeking to sell them, an attractive alternative exists to purchasing new tankers. Australia could buy a batch of used late model airliners at a fraction of the cost of new aircraft, and progressively convert these into tankers over the next decade. With two to four conversions effected annually, this spreads the expense but also provides time to slowly build up aircrew numbers and organise a pool of ex-RAAF airline pilots as reservist aircrew. The two types which are most attractive are the late build Boeing 767-200ER and 747-400. These 767-200ER aircraft are identical to new build Boeing tankers, while the 747-400 can be converted at low risk and cost by resuscitating Boeing's 1977 tanker conversion design for the earlier 747-100. The cost of a refurbished used 747-400 including a full freight conversion is now US$54 to US$58 million, about the cost of a new build F/A-18E fighter [22], [21].

Both the 767-200ER and 747-400 provide very robust airlift capacity. The 767-200ER carries about twice the payload of the Air Force C-130H Hercules, the 747-400 around five times the payload, and is large enough to carry even the LAV-25 and M113 armoured vehicles on special palletes. With the prospect of ADF forces deployed globally on peacekeeping and coalition warfare duties, the 747-400 would be especially valuable as a dual role tanker/transport. A mixed fleet using the 767-200ER and 747-400 would prove most flexible, with either 12 x 767-200ER and 6 x 747-400, or 8 x 767-200ER and 8 x 747-400 being the more economical choices [21].

A very strong case can be made for buying suitable used airliners in the near term, while the market remains depressed. In practical terms this strategy is no different from that proposed for the F-111 fleet - exploit the very low buy price of mothballed hardware and upgrade the aircraft over time to spread expenditure as evenly a possible.

Maritime Patrol:

Australia's two squadrons of AP-3C Orion maritime patrol, reconnaissance and anti-submarine aircraft provide a vital and heavily exploited capability. Existing estimates are that the fatigue life will be used up at some time close to the middle of the next decade. This presents yet another large block replacement expense unless alternate strategies can be found [2].

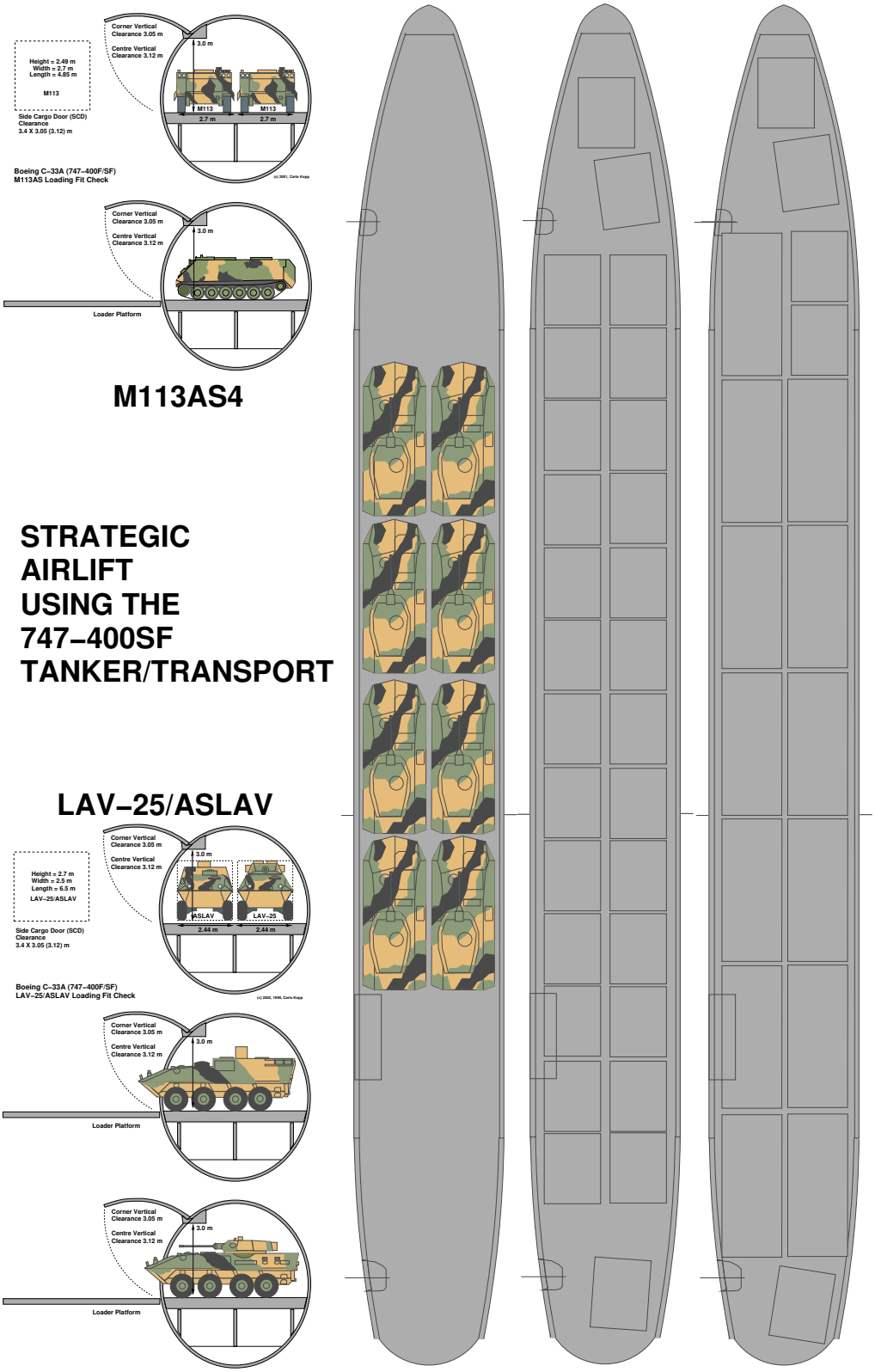


Figure 7: *Mothballed commercial 747-400 aircraft offer an attractive strategic airlift capability, while providing prodigious aerial refuelling performance. The supply of a used 747-400 airframe plus conversion to a freighter was recently advertised by IAI Bedek at around US$56 million apiece, about the cost of a new build fighter.*

Figure 8: *The Boeing 747-400 represents the best value for money aerial refuelling tanker available, moreso if mothballed late model 747-400 airframes are used. The 747-400 is a low risk option, since a number of 747 tanker conversions were performed during the late 1970s (US Air Force).*

The Global Hawk unmanned reconnaissance aircraft presents an attractive option. Not unlike the U-2 of Cold War fame in concept, the Global Hawk can fly 3,000 nautical miles and orbit on station for 24 hours before returning home to refuel. With the option of various reconnaissance and surveillance payloads, the unmanned Global Hawk can cover many of the patrol and reconnaissance tasks performed by the manned AP-3C Orion [23].

Acquiring some number of Global Hawks and attaching flights of these to each of the AP-3C Orion squadrons provides an opportunity to reduce fatigue life consumption of the AP-3C Orion fleet. Every hour flown by a Global Hawk is an hour not flown by an AP-3C Orion. Roles which are unique to the AP-3C Orion would not be flown by Global Hawks, and vice versa.

Intelligence Surveillance Reconnaissance Capabilities:

A key weakness of the ADF at this time is an inadequate capability to gather intelligence, surveillance and reconnaissance data. While high quality US and commercial satellite imagery is available and very useful, Australia does not control these assets and thus cannot manipulate satellite orbits to improve the timeliness of coverage in this region.

There is no single answer in addressing this capability gap. The Global Hawk would provide exceptionally good coverage and quality, and has the persistence to surveil an area for 24 hours or more. However, it is not survivable if confronted by the latest Russian long range missiles and Sukhoi fighters now being purchased across the region, and its slow cruise speed impairs its ability to respond quickly over large distances. It is thus only a partial solution.

A modern imaging radar and improved thermal imager fitted to the F-111 fleet would provide a survivable capability, and very rapid response times, but the F-111 does not have the range and persistence of a Global Hawk. It alone is also a partial solution [24], [25].

A reconnaissance package equipped F-111 combined with the Global Hawk addresses much of the ADF's capability gap in gathering imagery intelligence [26].

Imagery intelligence is however only part of the picture. Electronic intelligence to track mobile radars and eavesdrop communications is no less vital. While payloads carried by Global Hawks, AP-3C Orions and EC-130H cover part of this need, none of these aircraft are survivable where Russian long range missiles and Sukhoi fighters are deployed. The cheapest survivable electronic reconnaissance capability solution would be the refurbishment and upgrading of mothballed US EF-111A Raven aircraft which are similar to Australia's existing F-111s [27], [28].

The last critical gap is Australia's surveillance and reconnaissance capabilities is the absence of a radar system for tracking moving ground targets. The US E-8C JSTARS system, based on a Boeing 707 aircraft, was a decisive tool used to hunt down terrorists in Afghanistan and Baathist Republican Guard forces in Iraq. It will be replaced by the new MC2A system, carried on a Boeing 767. The UK is currently acquiring a smaller system, called ASTOR. None of these solutions are practical for Australia. The US solutions have excessive capacity at a large price, whereas the UK solution lacks the range and persistence needed [29], [30], [31].

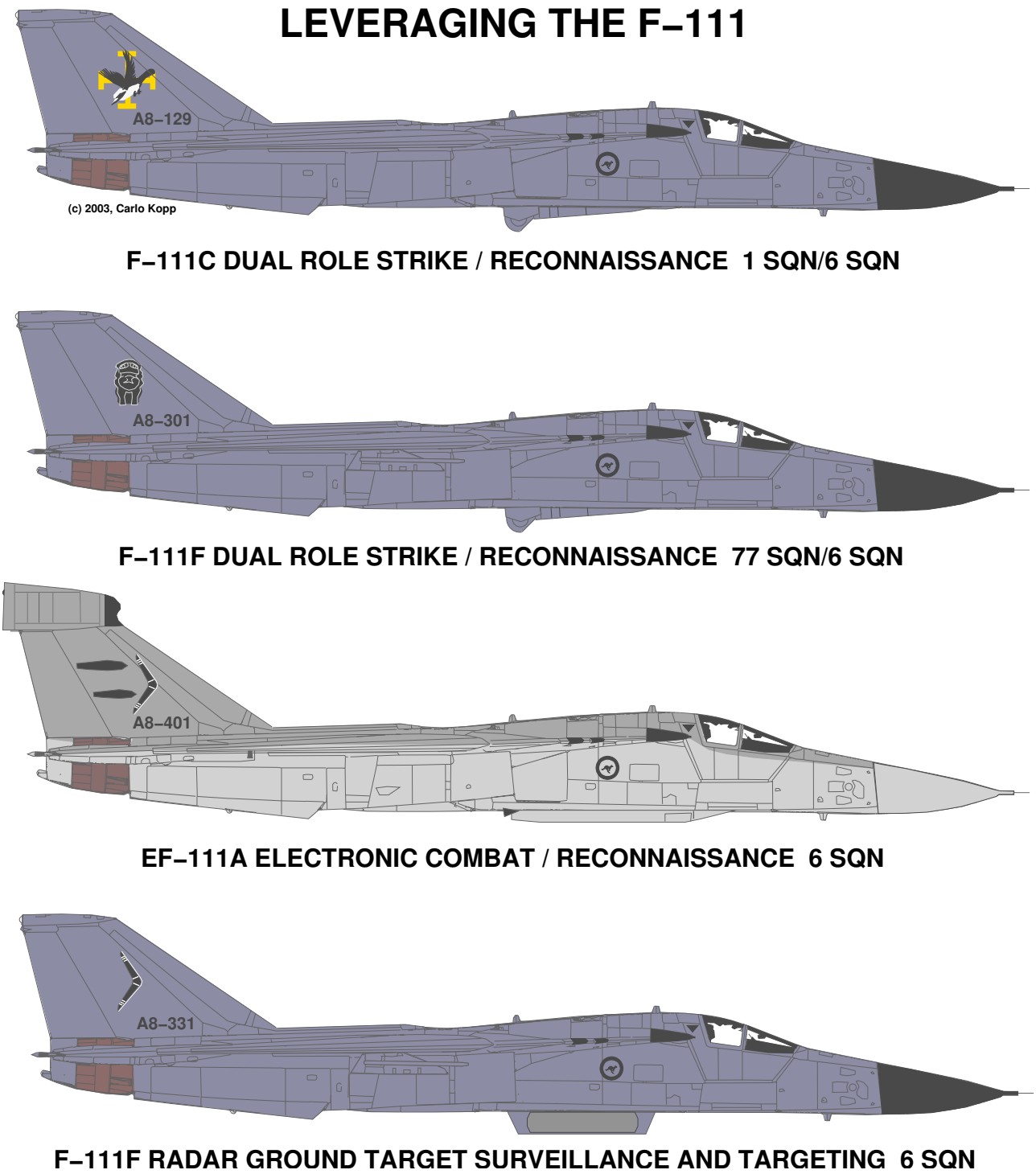


Figure 9: *The potential to extend the F-111's service life past 2030, emulating the US plan for the older B-52H, opens up a range of important options. F-111s could be then used to replace some number of F/A-18As reducing the numbers to be replaced with new fighters. Modified F-111s could also be used for specialist roles such as electronic combat and the carriage of ground target surveillance and targeting radars, both roles in which the US Air Force flew its F-111s (C. Kopp).*

However, a number of good alternatives exist, exploiting the US RTIP radar package intended for their JSTARS and MC2A fleets. Options include putting an RTIP derivative on a small number of 767-200ER tankers, 737-700 common to Wedgetail or AP-3C Orions. An Industry Proposal for this capability submitted to the Capability Technology Demonstrator Program in 2001 was based on the demountable High Capacity Cargo Pannier (HCCP) currently employed on the AP-3C [32], [33].

The most survivable option would be the carriage of such radars in the bomb bay of a number of F-111s. These would relay the radar data either to a modified Wedgetail or AP-3C Orion - the Pave Mover prototypes of the US JSTARS radars were carried in F-111 bomb bays using this technique [34].

Airlift Capabilities:

The Air Force has robust albeit technologically constrained tactical airlift capabilities in its fleet of C-130H, C-130J Hercules and DHC-4 Caribou transports. The C-130 is used for strategic and tactical airlift, the Caribou for light tactical airlift into very short fields.

The principal weakness of the Air Force airlift fleet is inadequate capacity to support global deployments. This weakness would be largely remedied should significant numbers of tanker transports such as the 747-400 be acquired, as these aircraft carry large payloads efficiently and quickly. The result of an expansion of the jet tanker transport fleet would be a major reduction in the demand for C-130H and C-130J flying hours to support remote coalition warfare and peacekeeping deployments. As a result the fatigue life of the C-130 fleet would be extended, since these aircraft would be only used for tactical airlift tasks, the intended design role of these aircraft.

Large specialised airlifters like the US C-17A and A-400M are expensive, and their short field capabilities frequently unusable in this region due to the fragility of poor quality runways. Exposing such expensive assets by flying them into combat zones is very risky. Neither aircraft can compete with the range and payload performance of a 747-400 tanker transport.

The Air Force's Caribou is impossible to replace properly as no production aircraft today matches its short and rough field performance. The life of the Air Force's Caribous could be extended to 2025 or beyond by retrofitting them with PT6 turboprop engines and suitable systems upgrades, also improving safety, reliability and much reducing operating costs. An Industry Proposal titled Project Tango Charlie which was provided to Defence in 2000 provides a full road map for the technological, financial and industrial implementation of such upgrades [35].

Airfield Infrastructure:

The two Air Force airfields which are strategically most important are RAAF Tindal and RAAF Learmonth. Neither has a fuel replenishment infrastructure suitable for sustained high intensity operations, using tanker aircraft. A strong case can be made for providing a fuel pipeline from Tindal to the Katherine railway junction to permit fuel replenishment using railway cisterns, and a loading jetty at Learmonth to permit direct transfer of fuel from an anchored tanker vessel to base storage tanks. Such an upgrade would include underground concrete storage tanks with an additional capacity of 10,000 to 20,000 tonnes of aviation kerosene, over existing storage.

The development of Gas To Liquid (GTL) feedstock industries in the Pilbara and the Northern Territory presents an opportunity for Australia to develop self sufficiency in synthetic aviation kerosene, covering national demand and providing a direct fuel supply in the north.

The recent aviation fuel shortages seen in NSW, which forced traffic diversions, present a good case study of how vital fuel resupply is to aviation operations.

4 Force Structure Adjustments for the Navy/Army Forces

The surface bound forces operated by the Navy and Army provide important capabilities which supplement the firepower and surveillance/reconnaissance capabilities delivered by the Air Force.

From a long term investment perspective, the focus in adapting both Navy and Army capabilities must lie in strengthening those capabilities which cannot be delivered by the Air Force. Large investments in heavy or long range firepower and surveillance/reconnaissance capabilities for the Navy and Army represent redundancies in the force structure and dilution of available taxpayer's resources - these are capabilities better provided by the Air Force.

The Army and Navy share many important problems, distinct from those faced by the Air Force. One is the historical dependency on a large pool of personnel, which drives up recurrent costs of all capabilities. Another is the dependency on long and exposed logistical trains, a result of the slow deployment and operating speeds of their surface bound forces. A key issue is the vulnerability of surface bound forces to attack, their persistence in an area of operations is paid for in persistent exposure to attack.

There is potential for important savings through commonality between key Navy and Army systems. Two areas which are clearly evident are helicopter fleets and air defence weapons - sharing equipment types across the two services removes large redundancies in the logistical infrastructure, support base, training and weapons stocks where applicable.

Air Warfare Destroyers and Frigates:

The most expensive Navy program for the coming decade will be the SEA 4000 Air Warfare Destroyer intended for 'sea control' operations. The case for this project is being argued on the basis of providing defence against aircraft, air and ship launched cruise missiles, and ballistic missiles should these proliferate in the region. The intent is to provide capabilities for the defence of naval task forces and Army forces [36].

This is a very expensive way of providing this capability for Army forces landing at a beachhead or port area. A highly mobile Army system on land vehicles would be much cheaper and provides the ability to move with a ground force inland, providing superior capability against the class of supersonic and subsonic Russian land attack missiles proliferating across the region. The same is also true for anti-ballistic missile batteries.

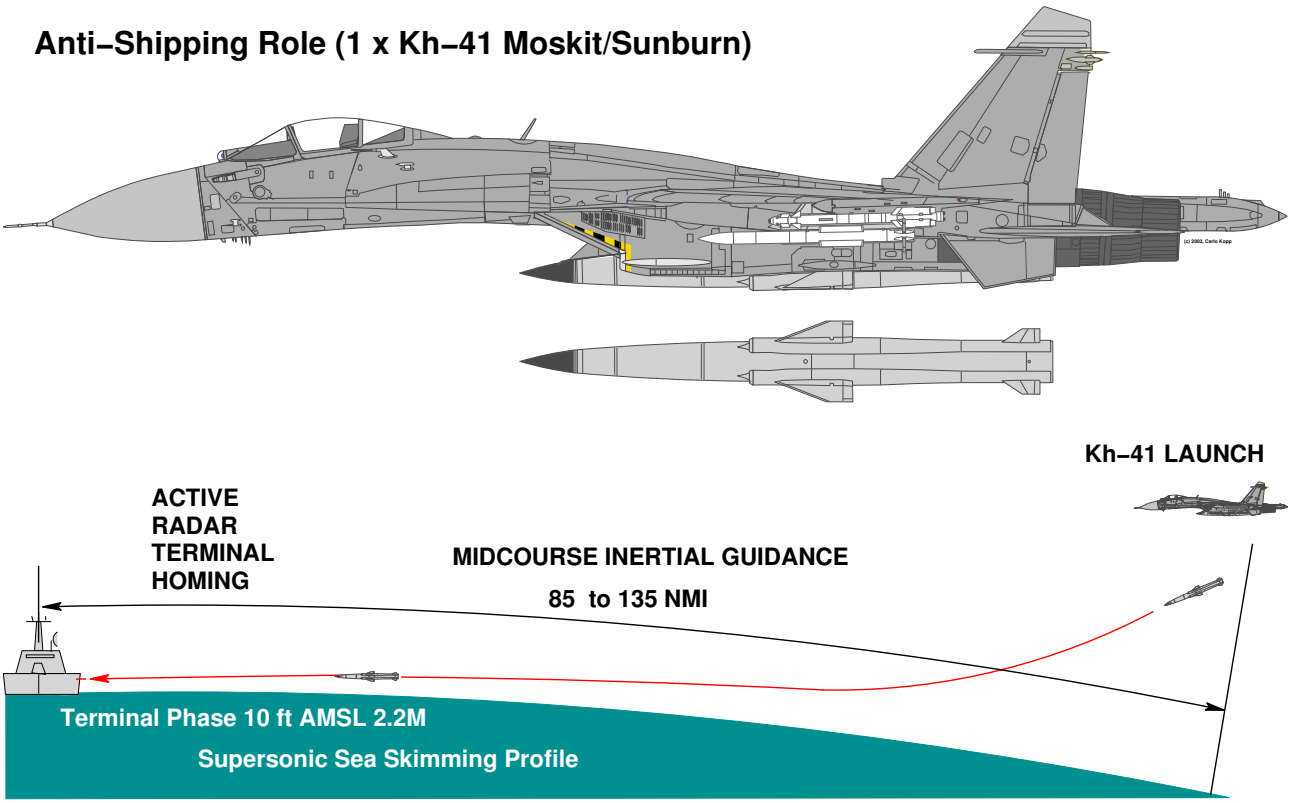


Figure 10: *The regional proliferation of advanced Russian supersonic sea-skimming cruise missiles presents genuine challenges for surface warships. Such missiles cannot be detected by the warship until they pop up over the radar horizon which might be as little as 20 nautical miles away. The launching aircraft can be more than 100 nautical miles distant under the horizon and also not detectable by shipboard radar. The high speed of such missiles makes them extremely difficult to intercept, especially if several have been launched concurrently to saturate the warship's defences. In practical terms such missile technology defeats long range shipboard radars (C. Kopp).*

The essential issue in defending against low flying cruise missiles and ballistic missiles is the geographical coverage footprint of the defending missile system. The reality is that defensive missiles have small coverage footprints against such weapons - low flying cruise missiles due to the 15 to 20 mile radar horizon, ballistic missiles due to the extremely high re-entry speeds. Therefore a warship is by physics alone very limited in its ability to defend a ground force against such weapons, or other naval vessels in a task force [8], [39], [40].

In terms of where to best put the investment in air defence missiles, given that low flying cruise missiles are a much more likely risk over coming decades, a larger number of shorter ranging defensive missile systems used both by the Army and Navy yields a better return than a smaller number of long range defensive missile systems as proposed for Air Warfare Destroyer. A weapon system capable of launching and guiding a dozen Evolved Sea Sparrow Missiles concurrently will prove more useful than a system which can launch and guide a much smaller number of long range missiles. In turn this permits the choice of a less costly warship for SEA 4000 to provide such a capability.

A key question for the Navy is that of how many surface warships should be operated in the longer

term. The eight ANZACs are new and will last beyond 2025. The six FFGs were delivered between 1980 and 1993, indicating likely replacement dates from 2015. The choice of a less costly warship for the Air Warfare Destroyer requirement would permit this type to replace some of the FFGs from 2015 onward.

Littoral Warfare and Sealift:

Perhaps the biggest single challenge the Navy must confront over coming decades is that of how to provide the ability to deploy and sustain Army ground forces engaged in regional combat, peace enforcement and peacekeeping operations. As there are few airfields across the less developed parts of the region with the ability to cope with repeated runway pounding by heavy airlifters, heavy ground force equipment and logistical resupply will have to be delivered by sea. A related issue is the ability to patrol littorals in the archipelago to the North, and other regional areas, to interdict an opponent's resupply chains and perform combat search and rescue operations.

Recent experience with people smugglers, illegal fishing and other violations of national sovereignty indicate that a capability for fast intercepts, delivery of special forces, and transport of apprehended personnel or refugees would be very useful.

These combat and non-combat roles all overlap in terms of the capabilities needed to perform them. A vessel which is fast, capable of embarking personnel, helicopters and vehicles, and with a relatively shallow draft is more useful than a 'conventional' heavy sealift vessel or surface warship.

The high speed/capacity, long range/endurance, low crew/cost, wave piercing catarmarans produced in Australia for the US Military, are the future of seapower in the 21st Century. Few experts realise that these ships can be used in more than logistical roles for which they are currently designed.

Catamarans are in fact capable of becoming highly advanced surface combatants, equipped with Aegis radars and vertical launch missile silos (VLS). In fact, compared to a late flight Arleigh Burke destroyer, a catamaran combatant could carry the same Aegis radar and helicopter fitout, with more than double the missile load and operated by less than half the crew of an Arleigh Burke destroyer[37].

Arguments against these ships include claims that they cannot operate in high sea states, that aluminium designs are prone to fire, and that they require armour that will degrade the speed and manoeuvrability advantages of these vessels.

These claims are utterly incorrect[38].

1. These ships currently operate at high speed in sea state 3 and are just as capable as any other ship in higher sea states.
2. Aluminium is in fact a fire-retardant material and the ships sunk in the Falklands War did not catch fire due to aluminium as was reported by the media at the time - this has been conclusively proven by Royal Navy and independent investigations.

3. In modern naval warfare, no armour will protect a ship from a missile, only sensors connected to effective self defence missiles and weapons systems will achieve a suitable level of protection. In naval warfare attack is the best form of defence.
4. Damage tolerance to smaller weapons can be enhanced by recently developed applique and laminate armour technologies developed for aluminium hulled armoured vehicles. These should be explored very carefully for this purpose.
5. It is noteworthy here that a high speed catamaran is more likely to out-run a torpedo than any other kind of ship.
6. Other criticisms have also been disproved in a series of combat operations where these vessels have been used.

We propose that a 'Multirole Littoral Operations Ship' be explored and trialled as a follow on replacement for the FFG7 class in the force structure. This ship would be based on a larger wave piercing catamaran design, and capable of embarking troops, armoured vehicles, and multiple Army trooplift and reconnaissance/attack helicopters in the sealift role. It would be equipped for a containerised defensive and offensive missile system and 4.5 inch gun, based on the ANZAC weapon system, and thus configurable for specialised maritime roles. When so tasked it would embark Navy helicopters, such as the Seahawk, Sea King and the latter's replacement.

A superstructure and hull shaped for stealth would be essential, designed in Australia to develop and retain the technological skills required.

Submarines:

Submarines provide important niche capabilities especially in naval blockades and the covert insertion and extraction of special forces. However they are much less flexible than surface warships in the number of roles they can perform, and much less flexible and capable than air power in the delivery of firepower.

Some serious thought should be invested in how to expand the utility of submarines as maritime reconnaissance assets, and how to closely integrate them as targeting and damage assessment tools to support other Navy and Air Force assets in sea control operations.

How many submarines should be available for combat operations at short notice is an open question.

Tanks:

A strong case can be made to provide the Army with an appropriate number of modern tanks which have better resistance to anti-tank infantry weapons than the existing inventory of Leopard 1 tanks. The greater capability of recent tank designs would permit replacement of the Leopard 1 with a smaller number of newer tanks.

While a wide range of new tanks are available on the market, priority should be given to refurbished or mothballed tanks as the acquisition cost will be significantly lower. Good candidates are the US

M1 Abrams series and the German Leopard 2A5, the latter widely used by EU nations. The lower fuel burn and slightly lower weight of the diesel Leopard 2A5 must be balanced against coalition force compatibility of the gas turbine powered M1 Abrams series. Both types require sealift to deploy overseas.

Self Propelled Artillery:

The Army's existing 105 mm and 155 mm artillery pieces are towed, which significantly impairs their mobility on a modern battlefield. Experience from Iraq indicates that artillery mobility is vital to maintain pace with advancing tanks and motorised infantry. A good case can be made for 18 to 24 self-propelled 155 mm artillery pieces to replace an equivalent number of towed systems. A wheeled design which is transportable by C-130 would be essential for strategic mobility. Good examples are the South African Denel G6 series, the Israeli Soltam SPWH 2052 and French Giat Caesar, on a Unimog chassis. Consideration should be given to transplanting an existing system on to a Unimog chassis operated by the Army.

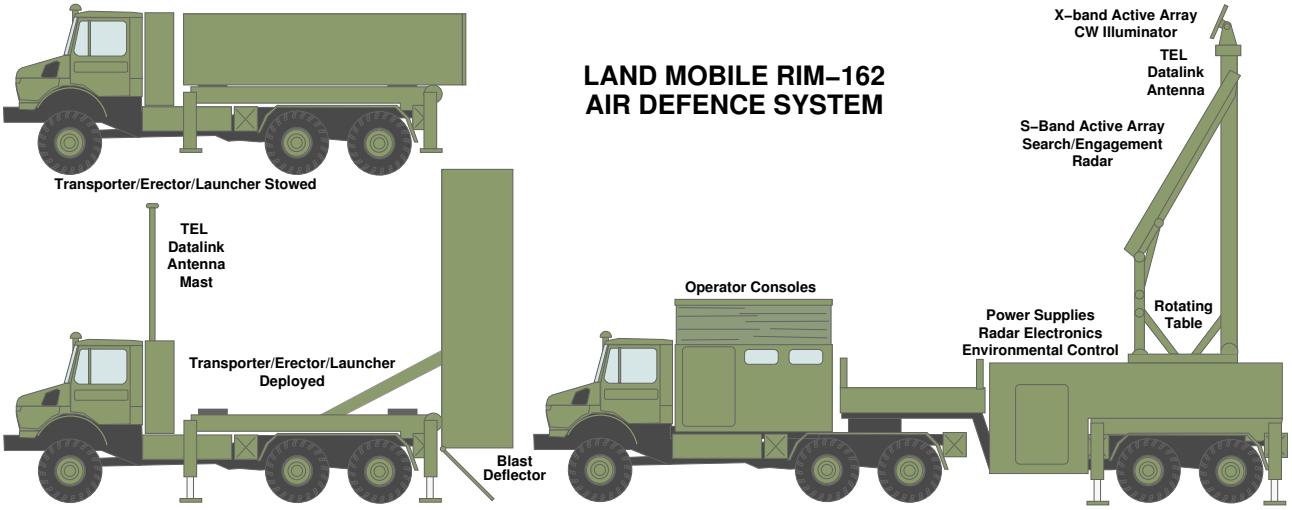


Figure 11: *An example of a C-130 transportable land mobile ESSM air defence system (C. Kopp).*

Air Defence Systems:

The towed Rapier systems currently operated by the Army are designed to engage low flying aircraft and helicopters. The proliferation of Russian standoff missiles in the region, and indigenous Chinese and Indian derivatives of Russian missiles, present the prospect of supersonic low flying cruise missiles which are much more difficult to engage. The towed Rapier is unsuited for an environment where a rapidly advancing ground force must be protected against supersonic missiles, making a good case for 12 to 16 mobile air defence missile systems. Strategic mobility dictates a wheeled system which is transportable by C-130. Good examples are the Euromissile Roland 3/VT1 series and the Thales Crotale NG, both of which are fully mobile systems with self-contained search and engagement radars.

An alternative is a 6x6 or 8x8 truck mounted derivative of the Navy's Evolved Sea Sparrow Missile, using variants of the Australian developed CEA FAR and CWI radars. Such a system would offer

important economies through commonality and balance of payments advantages if largely developed and assembled in Australia.

The case for long range area defence missile systems such as the PAC-3 Patriot is much weaker at this time, although the regional proliferation of ballistic missiles would strengthen the case.

Armoured Vehicles:

The Army operates several hundred M113 tracked armoured vehicles, and over a hundred LAV-25/ASLAV wheeled armoured vehicles. Experience since the 1940s proves the value of providing ground troops with mobility and protection from small arms fire - demonstrated again in Iraq earlier this year.

The M113A1 fleet is now quite old, and even with the major M113AS upgrade being performed by Tenix on 350 vehicles, the issue of providing this capability longer term will arise over the next decade. The M113 family of vehicles remains in production and the type is strongly favoured in the US Army operational community, since the vehicle is more survivable than wheeled equivalents and has better cross country performance, vital in undeveloped areas of operation. As with the Air Force Caribou, the M113 is impossible to economically replace with a different type [42], [41].

A good case can be made to explore the availability of surplus late model M113A2 and M113A3 vehicles as replacements for the older units in the Army fleet - these could be upgraded before service entry to a configuration similar to the M113AS4 rebuilds currently being performed in Australia. As 80,000 or so M113s have been built since the 1960s, availability of surplus used vehicles should not be an issue as an alternative to new production M113s. The Delco 25 mm gun turret for the LAV-25 is available as an upgrade for the M113 series [42], [43].

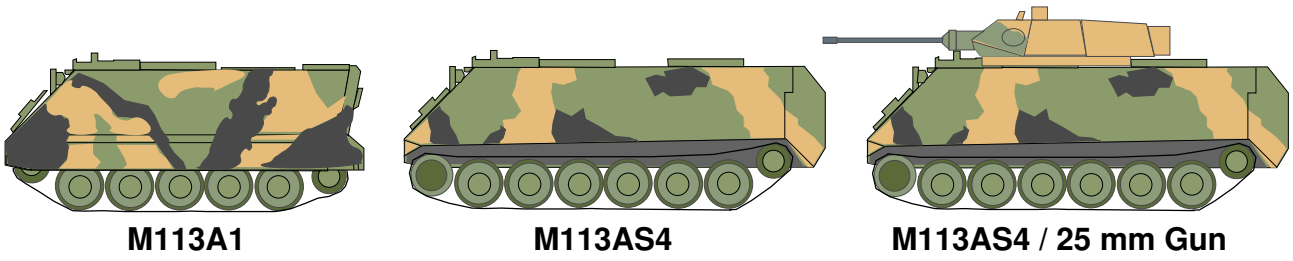


Figure 12: *The best available replacement for the ubiquitous M113A1 personnel carrier is a later generation M113. Mothballed surplus late build M113A2 or M113A3 vehicles could be refurbished and upgraded in Australia to the M113AS4 configuration currently being introduced by the Army. A range of stabilised gun turrets are available, including the 25 mm Delco gun turret used on the LAV-25 (C. Kopp).*

Helicopters:

The disparate fleet of helicopters flown by the Army and Navy represents a large overhead for the ADF in providing both engineering support and advanced training across both fleets. The very high operational tempo seen since 1999 has shortened the fleet fatigue life of a number of ADF helicopters, especially the Army's Blackhawks.

The Army operates the S-70A Blackhawk, UH-1H Iroquois, CH-47D Chinook, OH-58 Kiowa helicopters. The Navy operates the S-70B Seahawk, Sea King Mk.50A and SH-2 Seasprite. Both services operate the AS350 Squirrel. The Kiowa and Iroquois are to be replaced by the new Tiger helicopter.

The AIR 9000 program aims to rationalise the ADF helicopter fleet which is highly desirable.

An important capability which should be included in the AIR 9000 program is an aerial refuelling capability for trooplift helicopters. This would involve the addition of telescoping refuelling probes on some portion of the new helicopters to be acquired, and a palletised hose-drum refuelling system for the Air Force C-130J and possibly also the Caribou. Provision of aerial refuelling for helicopters expands capabilities for ground force insertion, extraction, resupply and combat search and rescue. Where naval vessels deploying such helcopters operate in contested air space, aerial refuelling permits much greater stand off range thus reducing risks to these warships.

5 Network Centric Warfare

Network Centric Warfighting capabilities were a key factor in the swift victories observed in Afghanistan and Iraq. At the most basic level Network Centric Warfighting is about the provision of digital wireless communications and supporting software, permitting the nearly instantanous exchange of intelligence, reconnaissance, surveillance and commands between military formations and platforms [16], [44].

Experience in the US indicates that the historically popular approach of splitting up Network Centric Warfighting programs into upgrades managed by operators of specific platforms is not effective. Individual services, and program managers in these services, have a propensity to prioritise other upgrades above those required for Network Centric Warfighting capability. The result is not only late delivery of the capability, but often capabilities with poor compatibility to other platforms or services.

Australia must develop strong Network Centric Warfighting capabilities to offset the small size of the ADF, and to exploit Australia's relative technological strength in this region. Such capabilities should be interoperable with the US to facilitate coalition operations regionally and globally, and should permit any ADF platform to communicate with any other.

We propose that a specific Joint Project be raised to implement Network Centric Warfighting capabilities across key ADF platforms. These capabilities should include but not be limited to the Link-16/JTIDS/MIDS and the Improved Data Modem systems [16].

All Air Force fighters, bombers, aerial refuelling tankers, UAVs and maritime patrol aircraft, Navy surface warships, helicopters and Army tanks, self propelled artillery, air defence missile batteries and helicopters should be equipped with Link-16/JTIDS/MIDS and the Improved Data Modem. Where possible, common hardware and software should be exploited. New technologies such as 'software

radios' could permit strong Australian industry contributions.

A specific capability which would yield a high payback is equipping all new aerial refuelling tankers as 'smart tankers' - airborne digital communications relays linking air, sea and land platforms. Such a capability emulates UK and US developments in this area.

6 Conclusions

The ADF faces some genuine challenges over the coming two decades, as a result of ageing inventories, rapid technological evolution and a complex and rapidly changing strategic environment. Under such circumstances the traditional strategy of large block replacements of equipment is non-viable within a limited budget.

This document proposes an alternative force structure than that currently under review within the Department of Defence, one that is operationally more flexible and significantly more cost effective.

Rather than performing large block replacements of existing equipment, a more flexible strategy is proposed which combines smaller block replacements with ongoing life extension upgrades of strategically viable platforms currently in service. A key element of this strategy is the exploitation, where appropriate, of mothballed hardware which is available at very much lower cost. Only platforms which have become non-viable in capability and uneconomical to upgrade would be replaced with new.

This approach offers important dividends. The first is that the large budgetary 'spikes' and negative effects on Australia's balance of payments associated with new equipment buys are avoided. The second is that upgraded surplus hardware which is customised to Australian needs can deliver much better 'bang for buck' than overseas new build products designed for unique overseas customers. The third is that Australian Industry can play a greater role in the delivery of such capabilities, thus contributing to the Australian economy and meeting the strategic Industry imperative identified in the Defence Australia 2000 White Paper. Key alternatives proposed are:

F-111: acquire low cost mothballed surplus F-111s, and upgrade these to extend the F-111 fleet until 2030 or later, to replace some portion of the F/A-18 fleet to extend the Air Combat Capability fleet life without the need for costly structural upgrades (that is, the F/A-18 Centre Barrel Replacement). Limit new fighter buys to remaining F/A-18 replacement only.

Aerial Refuelling/Airlift: acquire at least 16 low cost mothballed 767-200ER and 747-400 airliners for modification into tanker/transports. Perform conversions over an 8 year period to spread expenditures. Re-engine and upgrade the Caribou to avoid replacement expenditures.

Armoured Vehicles: acquire low cost mothballed late build surplus tanks and M113 personnel carriers as replacements for life expired Leopards and M113s, upgrade the latter as required to M113AS4.

Littoral Warships: trial a wave piercing catamaran hull as a multirole platform for littoral warfare, capable of performing both maritime surface action and fast sealift roles.

Air Defence Missiles: split capabilities currently planned for the Air Warfare Destroyer between the Army and Navy to minimise the acquisition cost of the Air Warfare Destroyer project and improve the capability provided for deployed ground forces.

These and other alternatives provide a force structure model which is better adapted to future needs than the model proposed in the Defence Capability Plan, and is significantly easier to fund than large block replacements of existing assets.

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