Wedgetail

Australia's pocket AWACS

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With the first flight of Australia's first Wedgetail AEW&C prototype recently, and the aircraft now entering flight test in the United States, the issues surrounding this critical program deserve scrutiny. Despite the Wedgetail's pivotal long-term importance to the Australian Defence Force this program has received, until recently, neither the level of funding nor the public attention it truly deserves. Key questions surrounding the RAAF's AIR 5077 Wedgetail program remain, even though the number of airframes has now been increased from four to six.

Why is Wedgetail critically important?

Perhaps the single most important strategic change Australia has observed in this region since the end of the Cold War is the ascendancy of India and China as regional superpowers. Both nations are aggressively industrialising, and no less aggressively investing in what will become the two largest modern air forces in Asia over the coming two decades. The unrestricted availability of post Cold War Russian technology has provided the materiel base for Asia's arms race - much of this technology being of the same generation as contemporary Western systems. Smaller regional nations are following the two large players, often with 'copycat' buys of identical equipment.

This investment is being focused into achieving, where possible, technological parity or force structuring parity with Western nations. To that effect, hundreds of advanced Sukhoi Su-27/30 fighters are now in service with or ordered by India, China, Indonesia, Malaysia and Vietnam. The Sukhois are Russian analogues to the Boeing F-15 series, but larger and more agile. China is also well on the way to full production of its J-10 Lavi-analogue, and is evidently investing heavily in developing a significant indigenous cruise missile capability.

Across the region we have seen buys of Russian subsonic and supersonic cruise missiles, including the 3M-80/82 Sunburn/Moskit, Kh-61/PJ-10 Yakhont/Brahmos, Kh-35U Uran/Kharpunski, 3M54 Alfa/Club/Kalibr, Kh-59M Ovod and others. Of particular concern is evidence of China's effort to deploy strategic land attack cruise missiles suitable for aerial, submarine and ship deployment. Many sources claim that the PLA now operates the indigenous HN-1 (320 NMI/600 km), HN-2 (800+ NMI/1,500+ km) and the HN-3 (1,350 NMI/2,500 km) cruise missiles.

Reports have emerged claiming China has actively shopped in South Asia for debris from expended or failed Tomahawk rounds. Available imagery of a Chinese cruise missile suggests it is indeed a clone of the BGM-109 Tomahawk - a 1999 report in Hong Kong's 'Sing Tao Jih Pao' claimed a Tomahawk-like cruise missile with 1,080 NMI (2,000 km) range, a CEP of 5 m/16.4 feet using high-technology "map matching" + topography matching + inertial guidance + GPS auxiliary correction + other auxiliary guidance, the missile was claimed to cruise at 15-20m/49-65ft AGL.

More recently reports have emerged claiming China has purchased tooling for the Raduga Kh-65SE, the reduced range export variant of the Kh-55 (AS-15 Kent), which is Russia's answer to the Boeing AGM-86B ALCM. Reverse engineering the Kh-65 to make an Kh-55 clone involves mostly fuselage plugs for more fuel. The recently unveiled H-6H variant with four wing pylons carrying what appear to be four Kh-55/65 ALCMs is clearly intended to provide a long range cruise missile strike capability.

Cruise missile technology acquisitions have been paralleled by an effort to field aerial refuelling. India recently took delivery of its first Il-78MKI tankers while China continues its program of converting H-6 Badgers into V-bomber analogue tankers. With over 120 Badgers built since 1970, there is no shortage of raw airframes.

There can be no doubt that over this coming decade India and China will acquire a significant capability to project air and missile power into South East Asia.

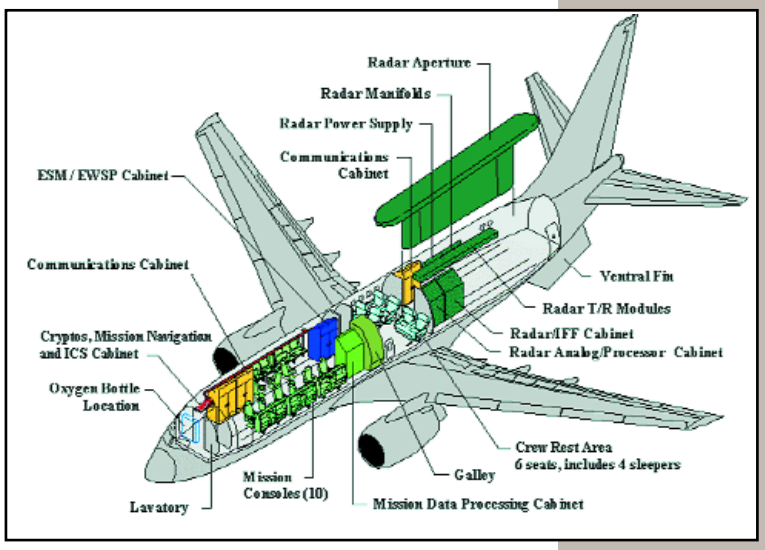
The drive to equip Asian force structures with modern fighter, tanker and precision weapons capabilities is paralleled by an ongoing focus on fielding AEW&C capabilities within the region. AEW&C aircraft are seen as much as military capabilities as they are seen as a status symbol: if you have them you are a serious regional player, if not you are a pretender. The pivotal role of AEW&C aircraft in the Desert Storm, Desert Fox, Allied Force, Enduring Freedom and Iraqi Freedom campaigns has been well understood across Asia and this is reflected in purchases since then.

China's PLA-AF entered a multi-billion dollar deal with Israel to integrate a variant of the Elta Phalcon phased array radar on the Russian Beriev A-50/ Ilyushin Il-78M airframe, and at that time also bid for Australia's Wedgetail on the A310 airframe. The Russian A-50 AWACS system was to be removed and replaced with the three sided L-band AESA (active phased array) radar and supporting systems, providing the PLA-AF with one of the most advanced systems worldwide.

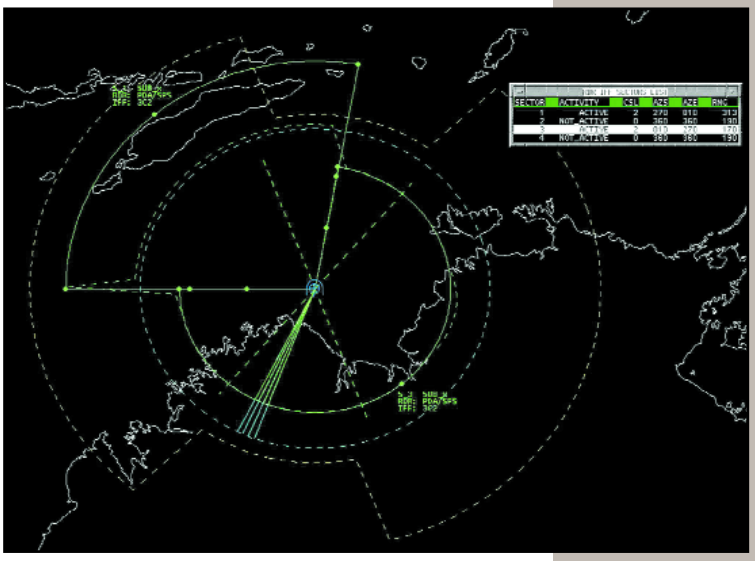
This ambitious plan collapsed in July 2000 when the US objected. This effectively killed the deal at the Israeli Cabinet level. Amid much face saving rhetoric about 'humiliation', the Chinese declared that the Russian A-50U/E would be acquired instead. The radome equipped A-50I prototype has been since observed flying over Nanjing, presumably without the Phalcon installation. While the issue has been quiet in the press, there is no doubt that China will field an AWACS over the coming decade - the only uncertainties being in timing, numbers and type.

India reciprocated, with quiet US approval, and earlier this year signed with Israel for several Phalcon equipped A-50I AWACS to be delivered later in the decade. The exact configuration has not been disclosed but we can expect these aircraft will carry a comprehensive package of Israeli ESM and communications hardware.

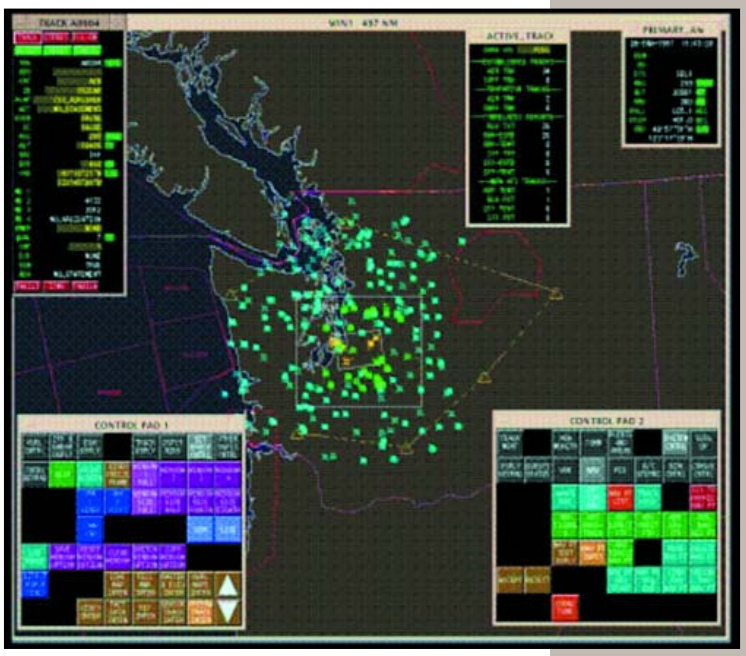
PLA-AF propaganda photo of a pair of Sukhoi Su-30MKK long range strike fighters. This aircraft provides similar strike capabilities to the F-111, but has only about 2/3 of the combat radius. India, Vietnam, Malaysia and Indonesia are acquiring similar Su-30 variants (PLA).



The Wedgetail system has grown since the 1999 proposals were published, with ten multi-function consoles for operators, a similar number to the E-3 AWACS. This provides significant growth potential for the system's roles and missions. A rest area is included to permit operator rotations on extended duration sorties (Boeing).



The Wedgetail's software intensive system will permit the use of a wide range of flexible, graphics intensive synthetic display formats, which can fuse radar, ESM, datalink and digital mapping outputs. These demonstrator displays illustrate the style of presentation to be used. This technology permits rapid growth to incorporate offboard data sources such as UAVs, satellites and ground-based databases (Boeing).



In the nearer region, Malaysia declared its aim in June last year to acquire four AEW&C aircraft, with reports indicating that the Embraer EMB-145/Erieye, Northrop-Grumman E-2C Hawkeye 2000 and the Boeing 737 Wedgetail were under consideration. Malaysian reports claimed the requirement to be urgent enough to delay the buy of additional Sukhois to cover this need.

The pattern of Asia's Sukhoi buys was that small initial batches were ordered, followed by much larger follow-on buys. This can also be expected for both China's and India's AEW&C fleets, as both try to match or exceed each other's capabilities. There can be little doubt that by 2020 almost every regional nation of strategic interest to Australia will have AEW&C fleets, some of which might be numerically quite significant.

In summary, if the RAAF is to have any hope of being competitive in this region, it must have a highly capable and numerically adequate fleet of AEW&C aircraft.

What is Australia buying?

The Wedgetail AEW&C aircraft configuration ordered for the RAAF is the most advanced design worldwide and more than a match for its regional competitors. Based on the Boeing 737-700 IGW, essentially a -700 fuselage mated with stronger -800 wings and undercarriage, this airframe is also the basis of Boeing's MMMA proposals for the AP-3C replacement. The aircraft has a cited dash speed of 460 KTAS, range of 3,000 NMI, time on station without refuelling in excess of eight hours, and an aerial refuelling receptacle to extend time on station.

With turbofan propulsion the Wedgetail has a station altitude between 30,000 and 40,000 ft, providing an important advantage in low-level radar horizon distance against turboprop competitors. Low-level footprint is a critical parameter in both maritime air defence and cruise missile defence roles.

The configuration of the mission system has evolved since the time of the tender. While the basic layout is retained (a forward fuselage mission deck with six operator consoles and cabinets with racked crypto, communications, ESM and data processing equipment, a centre fuselage crew rest area, and an aft fuselage radar/IFF equipment area), current diagrams indicate that 10 operator consoles will be used. The original E-3A AWACS configuration had 9 to 11 consoles while smaller AEW&C platforms like the E-2C have 3 to 4 consoles. Additional consoles provide for additional growth in roles. The console design is a new COTS based 'soft' design where all display formats are produced in software, permitting instant reconfiguration to whatever mode is desired.

In the future a Wedgetail could absorb the battle management roles now planned in the US for the MC-2A series of AWACS / JSTARS / Rivet Joint replacements. The networked and racked open systems based COTS computing package will permit much evolution over the service life of the system.

The core of the mission avionic suite is the Northrop Grumman MESA L-band (1.215-1.4 GHz) surveillance radar with an integrated IFF capability, feasible due to the overlapping radio frequency band coverage of the radar function. The MESA is an active array (AESA) - an integrated Transmit-Receive (TR) module with internal phase shift and RF gain controls drives each antenna element. This provides the type of time-sharing and sector scan capabilities most widely

seen today in the Aegis destroyers' SPY-1 series phased array, but the MESA does so with significantly lower sidelobe performance of an active array and the inherent reliability which comes with over a thousand independent solid state TR modules.

The MESA is an important innovation in the airborne AESA game as it provides 360-degree coverage in a compact and low drag lightweight package. Beam aspect coverage is provided by left and right looking 'slab' array apertures, while fore and aft aspect coverage is provided by endfire mode 'top hat' aperture, in the surfboard shaped upper structure. Best radar performance is in the beam sectors, used most frequently in AWACS style orbit orientation. The TR modules are racked in the upper fuselage for ease of maintenance, with feeds running into the external antenna structure. With no moving parts the MESA will be exceptionally reliable in service - unlike troublesome mechanically steered AEW&C radar antennas with rotational couplers.

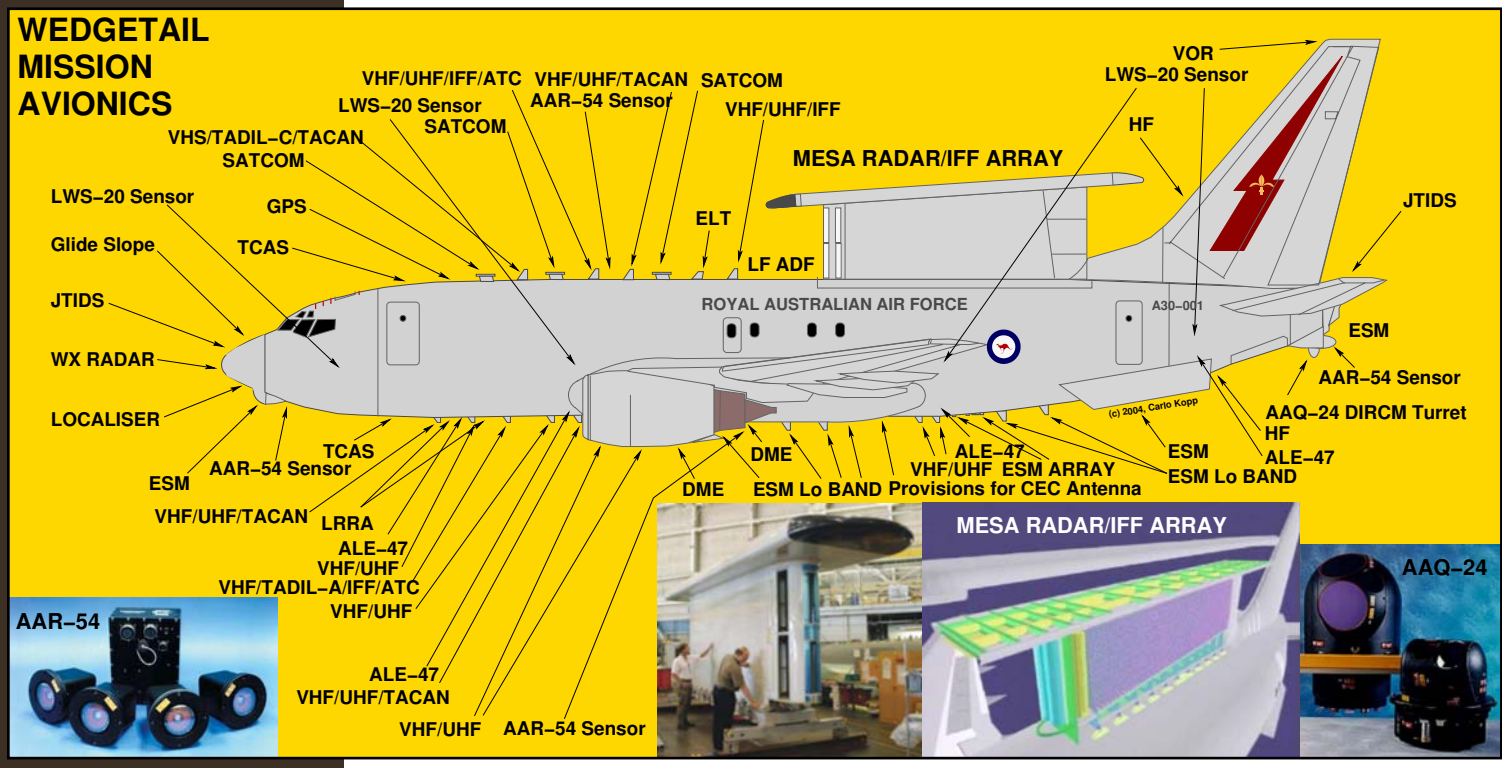
The MESA is well suited to the developing regional environment. The use of the L-band wavelength provides excellent penetration of heavy (cyclonic) weather, an issue for shorter wavelength radars. This radar band also defeats many 'add-on' stealth coatings and shaping measures that are optimised for the centimetric bands. L-band wavelengths resonate nicely with many feature sizes on combat aircraft, as distinct from centimetric band JSTARS like radars optimised for ground vehicles. In cruise missile defence, L-band is not always considered optimal, but the phased array and good station altitude can offset to some extent radar physics - a much increased number of radars pulses over time can still effect good detection performance against such small targets.

The phased array configuration permits highly flexible allocation of radar dwell time in space - basically permitting more energy to be put into specific areas of interest. While the radar can be used to sweep 360 degrees like a mechanically steered design, it can also focus all of its energy into a narrow threat sector to increase effective range performance, or it can timeshare between these two regimes to maintain 360 degree background coverage while increasing detection and tracking performance in a narrow sector of interest. The latter regime has proven very useful in naval Aegis radar operations in complex littoral environments.

The ability to focus energy into sectors permits higher update rates on target tracks, and higher track confidence levels against distant or faint targets. In an environment where larger supersonic combat aircraft and supersonic cruise missiles are common, this is a valuable capability.

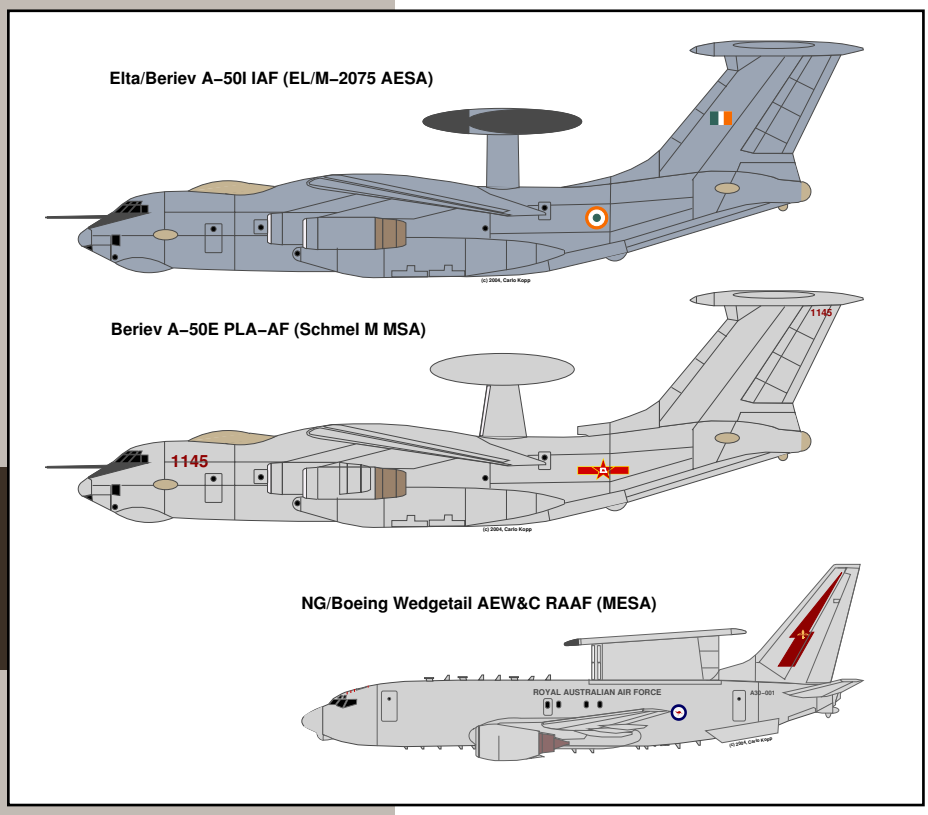
The MESA is supported by a communications/datalink suite and the ALR-2001 Electronic Support Measures (ESM) used to passively detect hostile emitters. Three HF voice/data channels, ten VHF/UHF (Have Quick II) frequency-hopping radio channels, four UHF voice/data channels, UHF MILSATCOM voice/data, Link-11, OTCIXS and JTIDS/Link-16 provide a comprehensive package permitting connectivity with air, land and maritime surface assets. Space is provided for a UN Navy-style CEC antenna for maritime operations. The system best compares to the late model E-3 AWACS suite.

The defensive package is also comprehensive by established standards, including an ultraviolet band Northrop-Grumman AAR-54 Missile Warning Receiver coupled to an AAQ-24 Directed



The Wedgetail will be equipped with a comprehensive mission avionic suite, rivalling that of the late model E-3 AWACS, but more compact and cheaper. The L-band MESA radar/IFF array is likely to be the basis of the US Air Force's AWACS replacement early in the next decade. The extensive defensive suite is the first on an AEW&C/AWACS platform (Author, Northrop-Grumman).

IR Counter Measures turret in the tail, an Elisra LWS-20 Laser Warning Receiver, and multiple ALE-47 countermeasures dispensers, capable of carrying flares, chaff or expendable radar seduction jammers such as the AM 6988 POET or RT-1489/ALE Gen-X. It has not been disclosed whether the AAR-24 is a lamp or laser equipped variant. Absent in the defensive suite is an internal microwave band track-breaking jammer, which might become a necessity in the future as long range counter-ISR missiles such as the Kh-31 and KS-172 series proliferate.



The region is seeing ongoing orders for AEW&C capabilities. Japan, Singapore and Taiwan operate E-2C Hawkeye variants, Japan the E-767 with an E-3 AWACS mission package, and India this year ordered the A-50I with a variant of the Phalcon phased array radar originally bid for the Wedgetail program. The PRC is expected to buy the Russian A-50U/E, and are now flying the recovered A-50I prototype depicted at a flight test centre (Author, PLA).

China's emerging program to deploy cruise missiles competitive against the US Navy Tomahawk and US Air Force CALCM will transform the regional strategic landscape. Available evidence indicates that these weapons are likely to be based on a cloned Tomahawk, and a licenced Russian Raduga Kh-55/65, the carried by the new H-6H Badger variant. The only viable defence against such weapons requires high performance AEW&C aircraft in adequate numbers (China Defence Forum, Russian MoD).

How many Wedgetails suit Australia's needs?

In a recent editorial, Australian Strategic Policy Institute Director Hugh White pointed out the unfortunate reality that Defence remains on track to purchase only four Wedgetail AEW&C aircraft and two additional mission packages for $3.6B, not taking up the option to add two airframes at an additional seven per cent increase to get six complete systems. As he observed, a 50 per cent increase in capability for a seven per cent increase in buy price is hard to argue against.

What the Wedgetail provides is a system which combines: 250 NMI class 360 degree all altitude radar and ESM surveillance coverage, comprehensive digital and voice connectivity, and battle or mission management functions – all in a single rapidly deployable and persistent package. Within the footprint of the Wedgetail all airborne traffic, maritime surface traffic and most emitters and cruise missiles can be detected and tracked. While JORN provides long range wide area coverage, it cannot provide the accurate height finding and position tracking, passive detection, communications and rapidly updated tracking functions of the Wedgetail - the two systems are complementary, not mutually exclusive.

In modern military terms the Wedgetail provides a comprehensive situational picture within its footprint, and the voice/data communications required to manage any ADF assets within reach.

In classic land and maritime air defence operations the Wedgetail, in concert with fighters and tankers, would be used to support intercepts by RAAF fighters against hostile aircraft and where applicable, cruise missiles. Moreover, its situational picture can be relayed to RAN surface assets, Army missile batteries and distant ADF headquarters. In the air defence game, early warning is one of the most precious commodities as it permits assets to be marshalled and readied for engagements. Every conflict since the Battle of Britain proves this beyond a shadow of a doubt.

In strike warfare the Wedgetail is no less valuable. Other than fulfilling the air control functions seen in air defence, it can be used for air traffic control management of strike aircraft but also to relay a situational picture of hostile surface air defence (via ESM) and fighter (via radar and ESM) dispositions to penetrating strike aircraft. Bypassing defences always beats shooting your way through them.

In purely surface-bound maritime warfare, the Wedgetail provides the RAN with a complete picture of opposing assets, vital in littoral combat, blue water surface operations and convoy escort. Consider a Timor-like or Falklands-like contingency with anti-ship cruise missile firing warships, patrol boats and helicopters targeting troop transports. Analogous gains arise in land warfare, as enemy heliborne and seaborne forces can be tracked in real time.

To these wartime uses we can add a range of peacetime roles that are no less vital. Wide area surveillance of air and sea traffic permits interdiction of people/contraband smugglers, movements of insurgents and terrorists, 'factory ship' poaching of fisheries and search and rescue operations. The large footprint of a Wedgetail compared to the lower power radar on a UAV or maritime patrol / coastwatch platform permits a single Wedgetail to surveil several times the area in much more detail, much faster.

The Noble Eagle operation post-911, when the USAF bolstered its E-3 AWACS fleet with NATO E-3s to ensure interception of hijacked airliners, is another contingency where Wedgetails would prove invaluable - be it for surveilling Australian airspace or on loan to allies such as the US.

In coalition warfare campaigns the US Air Force has repeatedly run short of E-3 AWACS and trained crews, frequently borrowing from the UK E-3D fleet to augment its own. With the US facing 'global overstretch' in coming decades, every Wedgetail we have is a politically and strategically valuable ADF campaign contribution without the political encumbrances which come with dropping live munitions. It takes no genius to observe that Prime Ministers of either political persuasion will be attracted to the high payoff, high visibility, low risk Wedgetail as a coalition campaign contribution.

The reality is that once the ADF has operational Wedgetails, the aircraft will be in high demand for peacetime surveillance and coalition warfare operations, aside from their important deterrent effect across the wider region. Were they operational in 2001, odds are much of the fleet would have been deployed to the US or Afghanistan.

This brings us to the key question of how many Wedgetails should the RAAF be operating: six, seven or more.

Conclusions

With four aircraft the RAAF could not have provided continuous 24/7 air defence coverage between the North West Shelf and Darwin areas. At least seven aircraft would be required to be effective against an air or submarine launched cruise missile armed opponent. With four aircraft the RAAF could not have provided AEW&C support for strike operations if on demand air defence coverage is required between the North West Shelf and Darwin areas. At least six aircraft are required, assuming threat strike aircraft with shorter ranging weapons. Should Australia need to provide short notice on demand air defence cover to protect all capitals against the threat of hijacked airliners, as has occurred in the US, then four aircraft would have permitted coverage for only three capitals.

It is clear that if the Defence of Australia is the priority, then a fleet of seven or more Wedgetails is the appropriate number. If coalition warfare is the priority, while retaining contingency coverage for the eastern seaboard capitals, or on demand coverage for the north, then more than four aircraft are required - assuming a coalition deployment of three to four Wedgetails, the total comes in at seven to eight. The `critical mass' number for a well sized Wedgetail fleet is above six aircraft, with eight being more flexible than seven. Six aircraft provides enough for 24/7 coverage of three orbits, without the essential one or two spares to robustly guarantee that coverage.

There is clearly an overwhelming case to get the six or more Wedgetails, regardless of the ideological and military/strategic doctrines used to define the ADF's long term force structure.

The decision to field six Wedgetails is clearly a good one but it brings the fleet size to just over the critical mass number. Wedgetails 7 and 8 remain an unfilled need.

Observations:

- A single Wedgetail aircraft can continuously surveil a circle of about 450 nautical miles diameter for low altitude airborne and maritime surface targets.
- To provide 24/7 coverage of single immediate area of operations requires a pair of AEW\&C aircraft, plus an additional spare should one of these aircraft experience technical difficulties. Full 24/7 coverage would be essential if an opponent used sub-launch cruise missiles, as these may be launched with no warning, or longer ranging air launched cruise missiles. Both categories are proliferating across the region at present.
- To provide on-demand coverage of single immediate area of operations, launching on a JORN track, requires one AEW\&C aircraft, plus an additional spare should this aircraft experience technical difficulties. This is required for a fighter or bomber threat, without longer ranging cruise missiles.
- The air defence of the North West Shelf area, the Darwin area and the Timor Sea would each require a pair of aircraft for 24/7 coverage, with one spare aircraft shared between the three areas. This requires a total of seven aircraft.
- The air defence of the North West Shelf area, the Darwin area and the Timor Sea would each require one aircraft for on-demand coverage, with one spare aircraft shared between the three areas. This requires a total of four aircraft.
- Any major strike operation performed in the region would require at least one aircraft, plus an available spare. Conditions may require that the spare is airborne for the mission. It is unlikely that such a contingency would arise without the risk of opposing air strikes against the continent.
- In practice, one aircraft might be in the depot for airframe maintenance, hardware and software upgrades and testing. Therefore, full fleet availability could not be guaranteed at very short notice, but is feasible with several months of warning time.