

May the force be with you:

Maximising the ADF's strategic air mobility

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'For the want of a nail a shoe was lost; for the want of a shoe the horse was lost; and for the want of a horse the rider was lost, being overtaken and slain by the enemy, all for the want of care about a horseshoe nail'.

—Benjamin Franklin

Defence White Paper 2000 states that the primary role of the ADF is the defence of Australia. However, while Defence of Australia (DA), Contributing to the Security of our Immediate Neighbourhood (CSIN), Supporting Wider Interests (SWI) and Contributing to Coalition Operations World Wide (CCOW) are the principal tasks of the ADF, the Government has stated in *Defence Update 2003* that there will be an increased requirement to deploy expeditionary forces under the CCOW task. Whichever task the ADF is called upon to perform it will require the deployment of forces to achieve the required effect where it is needed and when it is needed. So assuming you have the required capabilities, deployability of the force is vital to success.

Being an island nation Australia needs to be able to deploy her forces by air or by sea. The Government has stated that there is a need 'to enhance the lift requirement for deployment'. Deployment by sea is not always the best solution. The 1999 operation in East Timor was extensively supported by sealift because it was so close to Darwin. Operations elsewhere in the region would mostly not share this good fortune. The simple rule is the longer the distance involved the more time it takes to deploy or resupply matériel by sealift. The delays observed even in the East Timor case multiply with distance from Australian ports and in a broader conflict many Sea Lanes of Communication (SLOC) may be closed or contested, further adding distance and time. Some heavy equipment by weight alone, such as Main Battle Tanks (MBT) at 50–70 tonnes must travel by sealift. Also ammunition and fuel due to their bulk are also better transported by ship. However, personnel and material including M113AS3/4, ASLAV light-armoured vehicles, towed artillery, and general vehicles and palletised stores

can be delivered by air. The further afield these deployments are, the greater the requirement for high range, or high payload, strategic air transport aircraft.

However, Australia's existing airlift force structure is optimised for intra-theatre airlift rather than strategic airlift. The C-130H, C-130J and Caribou are tactical transports optimised for intra-theatre work. The prospect of ongoing global and regional operations over coming decades presents an ongoing demand for a strategic airlift capability.

Project AIR 5402 program objectives are to provide the RAAF with 4–5 medium-sized, twin-engine tanker aircraft 'to replace and enhance the air-to-air refuelling capabilities of the ADF'. The new tanker aircraft are to provide both boom and dual-redundant hose drogue capabilities to provide refuelling for F/A-18A, F-111 and the new AEW&C aircraft, and coalition aircraft types. 'Additionally, the aircraft will be required to enhance strategic airlift in support of ADF forces deployed in-country or overseas'. AIR 5402 presents a valuable opportunity to address both aerial tanker and strategic airlift needs with a single low-cost solution.

The AIR 5402 contenders are the Boeing KC-767-200ER and the Airbus/EADS A330 Multi-Role Tanker Transport (MRTT) aircraft. The best option, however, the Boeing 747-400SF (KC-33A) aircraft is not being considered.

Ostensibly this is due to a formal requirement that the tankers will operate to and from the remote 'bare bases' at Curtin and Scherger, and be capable of delivering fuel to either. Curtin and Scherger are not suited to the operation of tanker aircraft as neither have the runway strength or length to permit such heavy aircraft to operate with useful fuel payloads. Their remoteness also presents difficulties in sustaining fuel supplies for high intensity operations using sea and ground transport. Resupply by



The Nose Cargo Door (NCD) has been an option on new-build 747 freighters since the 1970s. The NCD permits the loading of long payload items, either on pallets or in containers, and is especially useful for palletised vehicles and artillery pieces. Depicted is an Iraqi Airlines example equipped with an internal pallet loader (Boeing On-Board Loader), several of which were built two decades ago (Photo courtesy Boeing).

air is not feasible because, even if heavy aircraft could land at these bases, the tankers used would probably consume as much fuel as they could deliver. More importantly, in both strategic and tactical terms, most tanker-supported missions are likely to be flown from Darwin, Tindal and Learmonth because of the geographic spread of these three bases. All three are accessible for high-volume fuel resupply using land transport. All three have the runway quality to support a 747-400SF-based tanker without any limitations in basic fuel payload. A common criticism of the 747 as a tanker is that it requires more ramp space for parking compared to the KC-135 and twin-engine 767/A330 options. This might be an issue for the USAF and RAF who use their tankers mostly during coalition warfare in areas with often underdeveloped infrastructure. It is largely irrelevant for Australia. Even in coalition warfare Australia would be unlikely to deploy dozens of tankers (let alone own them). Used as an airlifter, the 747 would be interchangeable with the C-5 Galaxy in terms of ramp space needs overseas.

The 747 is unique among commercial transports as it is the only one in the 100-tonne payload class. The 767, A310, A330, DC-10 and MD-11 are all in the 40–60 tonne class. In the strategic airlift world size itself matters as it sets bounds on the dimensions of the items that can be carried as payload. It is no accident that the C-5 Galaxy and the An-124 strategic airlifters are 100-tonne payload aircraft. Another key consideration is cost and availability. Since 11 September 2001 we have seen the largest accumulated glut of used commercial transport aircraft in history. Dozens of 747-400s are available at bargain basement prices and present a unique opportunity.

The existing contenders for Project AIR 5402 are both excellent aircraft. Neither of them, however, can compete in key performance measures against the much larger 747-400.

We can distil the key issues in the debate between 747, 767 and A330 down to the following points, accepting that many are ‘100-tonne payload aircraft’ versus ‘50-tonne payload aircraft’ comparisons rather than type-specific issues.

- The cost of new build 767/A330 conversions is \$US100m plus, compared with \$US58m for a used 747-400SF without the air-to-air-refueller conversion.
- Airlift capacity for the 767/A330 is limited compared with the 747-400 series—with the design payloads being at best 50 per cent of the 747-400SF.
- The fuel offload capacity of the 767/A330 is 40–50 per cent of the 747-400SF series. This doubles crew demands per available fuel offload in aerial refuelling work.
- Service life—both the 767 and A330 will be superseded in production between 2010 and 2020 by newer types and the industry support base will contract post 2030.
- Both the 767 and A330 are ‘slow’ Mach 0.78–0.8 class cruise speed aircraft compared with the 747-400SF with a fast Mach 0.855 cruise speed.
- Both the 767 and A330 are limited in the size of the main deck payload items they can carry compared with the 747-400SF.

The primary role of an ADF strategic transport aircraft would be to deploy and support forces overseas, principally land forces. Army states ‘As part of the ADF, the (Army) Objective Force will be optimised to conduct Manoeuvre Operations in the Littoral Environment (MOLE) in either a DA or CSIN context but will retain the flexibility to be employed in SWI missions and CCOW’. Australia has too few C-130H/J aircraft to use them for strategic transport, particularly as each can carry only one M113 armoured personnel carrier, unless the requirement is operationally urgent, hazardous, or the airfield cannot be used by a larger transport aircraft. A strategic transport aircraft is required that can deliver large

quantities of personnel, weapons, stores and equipment to the in-theatre Main Operating Base (MOB).

Onward delivery to a Forward Operating Base (FOB) would then be by C-130H/J or Caribou fixed-wing aircraft or by Army Chinook helicopter depending on the type and weight of the load and the distance involved. The ADF would not risk high-value aircraft such as C-17 or KC-33A into a hazardous FOB—assuming the FOB runway can survive repeated landings by heavily laden airlifters. Large airlifters are highly vulnerable to fire from large-calibre sniper rifles, shoulder-launched surface-to-air missiles, mortars, long-range artillery, rockets or tactical ballistic missiles. There is a high risk of the destruction of such a large aircraft closing the FOB down for many hours and stopping or impeding the vital flow of matériel and reinforcements.

The 747 as a Strategic Airlifter is the backbone of the US Civil Reserve Air Fleet which supplements, as required, the US Air Force fleet of C-5B, C-17A, C-141 airlifters during operations. The 747-100 is designated the C-19A, the 747-200 the C-25A and the 747-400 the C-33A. The E-4B airborne command post and VC-25A presidential transports are based on the 747-200. The YAL-1A Air-Borne Laser is based on the 747-400F. The 747-400 strongly outperforms the C-17A in payload or range capability. It provides C-5B Galaxy class payload lift, yet is faster and has a longer range than the C-5B and C-17A. It does, however, lack their intra-theatre short-field, outsize payload and Roll-On Roll-Off (RORO) capabilities.

Political access considerations aside, and excluding US and Japanese military airfields, there are no less than 55 runways rated as suitable for the 747 within the arc from India through China to South Korea. Thailand has three such runways, Malaysia six, Brunei one, Singapore two and Indonesia no less than nine. Within the nearer region this is a total of 21 runways rated for 747 operations (excluding military installations).

With the KC-33A the ADF does not need to rely on USAF Air Mobility Command or commercially leased Antonov or Ilyushin aircraft for most of their strategic air transport requirements. We would have discretion in deciding where and how we lift which assets. With the KC-33A performing personnel and palletised matériel lift, RORO airlifters are needed only for the remaining fraction of outsized or oversized payloads, and short field operations if or when required.

Example deployment scenarios

- 1 Brigade—half a mechanised infantry battalion with 348 troops in six sorties, including personal weapons, 30 x M113 APC and up to 40 tonnes of stores on 463L pallets.
- 1 Brigade—one 6-gun 155mm M198 Battery in three sorties with 92-202 tonnes of stores on 463L pallets.

- 3 Brigade—half a light-infantry battalion with 348 troops in three sorties, including personal weapons, 10 x Unimog, 10 x Land Rovers and up to 50 tonnes of stores on 463L pallets.

- 3 Brigade—one 6-gun 105mm L119 Hamel Battery in two sorties with 42–82 tonnes of stores on 463L pallets.

Example deployment ranges

Achievable deployment range varies with runway parameters, aircraft configuration and engine fit, elevation, temperature, payload and fuel load. The cited examples are best estimates based on published performance figures for the 747-400F series. Townsville is limited to payloads of around 70 tonnes to achieve useful unrefuelled ranges. Darwin permits full payloads of around 110 tonnes for unrefuelled operations in the nearer region.

- 1 Brigade (Darwin) to approximately 4500nm with 70-tonne payload, approximately 2300nm with 110-tonne payload, subject to aircraft configuration and unlimited with aerial refuelling.

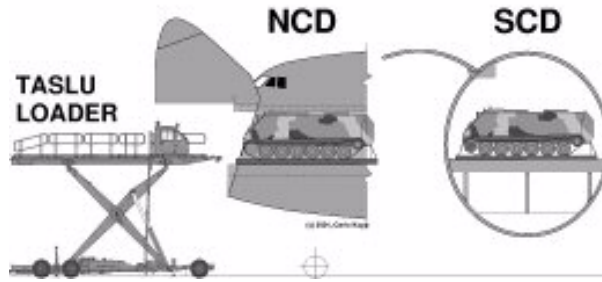
- 3 Brigade (Townsville) to approximately 2500nm with 70-tonne payload, subject to aircraft configuration and unlimited with aerial refuelling.

Some payloads will remain incompatible with the KC-33A for reasons of size, weight or both. These items must be moved by sealift or by RORO airlifters such as the C-5B, C-17, An-124 or C-130. The height of S-70 or UH-60 Blackhawk helicopters in stowed configuration is too large for Nose Cargo Door (NCD) access to the KC-33A. Without significant upper fuselage disassembly these cannot be carried. The Leopard and M1 series tanks are too large and heavy. In practice, tanks are not generally carried by airlift anyway, even if the C-5B, C-17

The Side Cargo Door (SCD) is available as a retrofit on 'Special Freighter' 747 conversions, or a new-build option on Freighters and Combis. The SCD is larger than the main cargo door in the tail of a C-130 Hercules, but fuselage width limits payloads to a length of about 6 metres. Concurrent unloading of a 747-400 via both the SCD and NCD permits the aircraft to be emptied in half the time of a single-door aircraft of such size (Photo courtesy of Boeing).



LOADING PALLETISED VEHICLES INTO 747-400F



The wide availability of high performance air transportable mobile loaders, such as the Australian TASLU, US Air Force Halvorsen (licenced TASLU) and Tunner, permits the use of the 747-400SF for strategic lift in and out of locations without an existing pallet and container handling system. The flexibility of these loaders permits palletised vehicle loading and unloading as an alternative to RORO techniques (Diagram C. Kopp).

and An-124 are able to carry one tank each. Cabin height is the principal limitation on loading trucks via the NCD. The retrofit of soft top cabin roofs and folding windshields to most truck types would permit access via the NCD.

M113 variants, including the M113AS3 and stretched M113AS4 are suitable for palletised carriage. NCD access is limited to subtypes without turrets. Land Rover *Perentie* variants are suitable, but with height restricting NCD access for some models. Palletised L119 and M198 artillery pieces are suitable for NCD access, the L119 also for Side Cargo Door (SCD) access. ASLAVs may prove suitable for SCD loading, but a clearance check is required to prove this. The Unimog 1700L/38 4x4, 2450L 6x6, Mack MC3 and *Bushmaster* Infantry Mobility Vehicles are too large for either door, although minor modifications to the Unimogs would permit NCD access.

Use of the 747 in the tanking role is not new. In the late 1970s there was a US Air Force program to provide a tanker transport aircraft to support fighter wing deployments from the US to Europe and Pacific rim bases. Although the 747 lost the competition to the McDonnell Douglas DC-10-30, Boeing produced complete production documentation packages for the 747 tanker design in anticipation of further orders. The Shah of Iran purchased the prototypes and additional aircraft conversions to support Iran's fleet of F-4Es. Boeing abandoned marketing of 747 tanker conversions in 2000 to avoid competition against its new build medium-size 767 tanker.

There are good operational reasons for favouring the KC-33A over smaller twin-engine tankers:

- Strike operations at 1000nm or greater favour heavy tankers over medium-sized ones.
- Persistent strike operations against highly mobile targets favour heavy tankers over medium-sized ones.
- Only defensive fighter patrol support at 500nm or less favours medium-sized tankers over heavy versions.
- Fast 747 Mach 0.855 cruise speed does not impose speed restrictions on fighters refuelled by the KC-33A unlike twin-engine tankers.
- Four engines on the aircraft provide mission-critical

reliability for long-range or long-endurance refuelling missions unlike twin-engine tankers.

- An additional satellite antenna for communications relay will not incur a significant performance penalty unlike with twin-engine tankers.

The operational effectiveness of the KC-33A used as an aerial refueller can be summarised thus:

- The large fuel offload and freight capacity permits its use in the same global deployment support role performed by the USAF KC-10A Extender fleet.
- The main deck freight payload of the 747-400SF is equivalent to five C-130H aircraft. This permits a small number of KC-33A aircraft to support global deployments of ADF F/A-18A and F-111 aircraft with a low number of sorties.
- Its large offload capacity makes the KC-33A a very attractive contribution to coalition air campaigns, especially to support carrier-based US Navy and US Marine Corps assets. The KC-33A is also well suited to supporting extended-range coalition operations in the Pacific rim from secure Australian basing—supplementing limited US Air Force KC-10A Extender numbers.

As a Project AIR 5042 alternative, the KC-33A (an aerial refuelling conversion of the 747-400SF) represents a lower acquisition cost and higher performance alternative to the twin-engine tankers currently being sought under AIR 5402. Most of these advantages accrue from the unique size of the 747 design, permitting it to perform many tasks that are beyond the reach of the smaller alternatives. The glut of used 747-400s has driven prices down to unprecedented low figures, presenting an opportunity never observed before. There is a compelling case to be made for adopting a used 747-400 aircraft solution over the existing AIR 5402 plan. ♦

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