

This article was published first in Australian Defence Magazine in June 2005. Although some of the details, especially in relation to the project schedule, have been overtaken by events, most of it remains valid and it provides a snapshot of the program as it stood in early-2005 and the roadmap that EADS and the RAAF had drawn for this all-new capability. GF

The RAAF's plane in Spain

The RAAF's tanker program is taking shape in Spain with first flight of EADS' new boom refuelling system expected later this year.

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Thanks to the RAAF's AUD\$1.8 billion order for five A330-200 multi-role tanker transports, signed late last year, European aerospace and defence giant EADS has a modern state of the art tanker design with which it can attack the massive US market.

But to a considerable degree its credibility will depend on its ability to satisfy its demanding launch customer. And the RAAF is staking a great deal on the outcome of the tanker program.

The RAAF's decision to retire its F-111 strike aircraft in or shortly after 2010 is partly justified, it says, by the capabilities of its new aerial refuelling tankers and the new Follow-On Stand-Off Missiles (FOSOW) which will extend the range and endurance of its Hornets.

After evaluating bids from Boeing and EADS, late last year Defence signed a AUD\$1.4 billion contract with the latter for five Airbus A330-200 Multi-Role Tanker Transport (MRTT) aircraft. Total project value is about AUD\$1.8 billion.

Due to be delivered from 2008, these multi-role aircraft will replace the RAAF's three ageing Boeing 707 tankers. They can carry up to 111 tonnes of fuel each in their existing wing tanks without requiring any additional tanks in the cargo bay and will endow the RAAF's F/A-18 Hornets, F-35 Joint Strike Fighters and Wedgetail airborne early warning aircraft with range and endurance equal or superior to the 1,000 nautical mile radius of action attributed to the F-111s.

The new tankers will also provide the RAAF with strategic flexibility it hasn't enjoyed before, thanks to their passenger and cargo capacity. A single A330 will be able to refuel six Hornets on a non-stop transit from Darwin to Butterworth in Malaysia, while carrying up to 300 ground crew and 43 tonnes of cargo, spares and equipment in its uncluttered cargo hold.

The first of the new tankers will be modified in Spain by EADS but the remaining four will be modified in Brisbane by Qantas Defence Services, starting in 2008. Qantas already operates the A330-200 so will also service and maintain the new tankers under a technology transfer agreement worth up to AUD\$500 million over their service lives.

Ironically, the new tankers will be able to refuel the F-111s as they will be fitted with a flying boom refuelling system. The F-111s can't be refuelled using the "probe and drogue" system employed by the RAAF's Boeing 707 tankers and by the tanker fleets of the US Navy and Britain's UK Royal Air Force.

Britain has also selected the A330-200 as its Future Strategic Tanker Aircraft (FSTA) and will acquire 16 to replace its current fleet of 28 TriStars and VC10s; but the RAF aircraft will continue to be equipped solely with probe and drogue equipment under the wings and on the centre line so refuelling aircraft of USAF origin such as the F-111, F-15 and F-16 – not to mention the RAAF's F-35s and Wedgetails - will be impossible.

The flying boom which will equip the A330-200 is 11.6m long and weighs 1.2 tonnes. Like its rival systems from Boeing and McDonnell Douglas it is attached to the lower rear fuselage of the tanker and when it is required it is lowered into the slipstream using a cable and winch. It employs small winglets so the operator aboard the tanker can steer it into a refuelling socket on the fuselage of the aircraft being topped up. A 3-D camera mounted under the rear fuselage, along with 3-D goggles at the operator's work station, provides depth perception to enable the operator to steer the probe accurately into the receptacle.

The flight control system for the boom is, in Airbus tradition, "fly by wire", though not integrated in any way with the A330's own fly by wire system. However, the aircraft's FBW system does automatically relieve some of the stress and strain imposed on the airframe by boom refuelling operations.

The total modification, including strengthening of the rear fuselage, the necessary fuel plumbing, the flight control system and the operator's console adjacent to the flight deck (hence the fly by wire system) adds about 5 tonnes to the empty weight of the aircraft.

Boom refuelling is in many ways more efficient than probe and drogue, though requires more intrusive modifications to the tanker. The boom can transfer fuel significantly faster than the probe and drogue system; furthermore, the probe and drogue system doesn't lend itself easily to realistic simulation – it's actually harder to use for the pilot of the receiver, especially in turbulence when the "basket" on the drogue can whip around at random.

With boom refuelling, the pilot of the receiver simply maintains close formation with the tanker while the boom operator steers the boom into position and extends the probe to engage the refuelling socket on the receiver. Especially in turbulence or at night, this is an easier manoeuvre to train for than probe and drogue refuelling.

However, given the RAAF's mixed legacy of US Navy, RAF and USAF aircraft its new tankers will be hybrids, equipped with the centreline boom system and Flight Refuelling Mk32 hose and drogue pods under each wing. This will enable the RAAF to refuel all of its current and future combat aircraft - the F-111, Hornet, F-35, Hawk LIF and Wedgetail AEW&C - and those of all its allies, making its tankers a versatile and much sought-after asset.

The test bed for EADS's boom refuelling system is an Airbus A310 airliner similar to the models the company has already converted to probe and drogue tankers for the German and Canadian air forces. More importantly, its rear fuselage is very similar to that of A330, both structurally and aerodynamically. The A310 was undergoing conversion at the time of ADM's visit to Getafe in late-April and is expected to make its maiden flight with the boom in August.

The flying boom flight test and qualification program will last 300-400 hours, with the first dry and then wet contacts starting towards the end of this year. The principal receiver for these trials will be the F-16, and possibly also larger types such as USAF, French and/or NATO E-3 AWACS aircraft. The boom is expected to be qualified by early-2006, in time for the first RAAF aircraft to arrive at Getafe in mid-2006. This will make its maiden flight in the tanker configuration during 2007 and is scheduled for delivery to the RAAF in late-2008. The first of the remaining four aircraft will be delivered to Qantas Defence's Brisbane facility for conversion in the third quarter of 2008.

As the lead aircraft in the A330 MRTT program, the RAAF's aircraft will undergo 16 months of flight testing and certification. This will be conducted by EADS CASA at Getafe under the auspices of the European Aviation Safety Agency (EASA) for issue of a Supplemental Type Certificate for the modified A330-200 and the Spanish Military Airworthiness Authority (INTA) for issue of a Technical Certificate for the operation of the military modifications. ADM was told this testing will form part of the Commonwealth Type Acceptance Test and Evaluation Program.

Final testing of the new tanker with RAAF receiver aircraft is scheduled to be conducted in Australia during the first half of 2009. The RAAF will also conduct refuelling trials with aircraft of other air forces as part of the extended OT&E program following. This type of testing is normally required for clearance of aircraft as receivers, and will be an ongoing task for every new Australian or allied aircraft type to be refuelled by the A330 MRTT.

Much as it has been doing with its crews for the Wedgetail AEW&C system, the RAAF is looking for opportunities for pilots and boom operators to gain experience in boom refuelling operations prior to delivery of the A330-200 tanker.

However, ongoing training of flight crews and boom operators will be a RAAF responsibility once the aircraft are in full service. For this reason it plans to acquire a full flight simulator along with a Part-Task Trainer (PTT) for the boom operator. ADM tried using EADS's own PTT at Getafe and found it very life-like and challenging – it factors in turbulence, cloud, twilight and darkness and employs the same 3-D goggles used by the boom operator.

EADS CASA is conducting a competitive tender process to select the simulator supplier – ADM understands that the contenders include CAE Inc and Thales Training and

Simulation – and will provide a proposal to the Commonwealth for consideration by the third quarter of this year, with a source selection expected to be announced by year's-end.

Boeing has dominated the global tanker market for nearly 60 years – over 500 of its boom-equipped KC-135s are still in service, and Boeing has been developing a new tanker based on its B767 wide-bodied airliner to replace them.

However, with so many American-built fast jets such as the F-16 serving in air forces around the world, and especially in Europe, EADS believes there is a global market for well over 600 new boom-equipped tankers worth between US\$20 and US\$25 billion, the majority of these, naturally, in the US. The company believes it can sell at least 150, sufficient to justify investing US\$11 million of its own money in the development of the boom refuelling system and to establish an American modification and integration centre to support its USAF bid.

Recent probity scandals over Boeing's proposal for a USAF mixed lease/purchase of the KC-767 have delayed the USAF's new tanker program for a while, but Boeing has just rolled out the first of four KC-767s ordered by the Italian air force.

Unconfirmed reports suggest Boeing could be looking at skipping a generation and developing a tanker based on its new B787 Dreamliner, but it's uncertain whether the timeframe for the USAF program would allow development of an all-new refuelling platform – Boeing may have to contest the USAF requirement with the same KC-767 which has lost out twice already to the A330-200, in the UK and Australia.

The USAF is expected to issue an RFI around mid-2005 for its tanker program with an RFP by the end of the year. EADS is already looking at potential centres in the US to carry out aircraft modification and integration and a successful A310 flight test program will be vital to boosting its chances in the US market, where Boeing has remained unchallenged for decades.

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