
A30 – Boeing Wedgetail



Boeing E-7A Wedgetail A30-001 of No 2 Squadron takes off from the United States Air Force's Nellis Air Force Base, Nevada, on a training mission during Exercise *Red Flag 16-1* in February 2016. Source: Department of Defence



Boeing E-7A Wedgetail A30-003 from No 2 Squadron flies in formation with three RAAF McDonnell Douglas F/A-18A Hornets and a Boeing EA-18G Growler during the Regional Presence Deployment to Guam in July 2020. Source: Department of Defence

Australia's first serious foray into the Airborne Early Warning and Control (AEW&C) domain was with the RAAF SP-2H Neptune through its AN/APS-120 radar, providing a limited capability. In 1986, Defence considered industry proposals for an AEW&C system after government articulated a requirement for Australia to focus on the defence of the air-sea gap to the north.

In 1989, Defence began planning the acquisition of an AEW&C aircraft and in May 1994 endorsed the project's first phase to conduct a project definition study. Initial approval for the RAAF to consider the acquisition of an AEW&C capability was given in December 1997 under Project AIR 5077.

Defence issued a competitive Initial Design and Tender release for the project in 1998. Initial contenders included the Lockheed Martin C-130J platform with an APS-145 radar, the Airbus A310/Elta radar combination through Raytheon E-Systems, and a Boeing proposal using the 737 airliner as the platform.

After selection of Boeing as the preferred tenderer in December 2000, the acquisition of four aircraft was

approved along with flight and mission simulators and logistics support, based on Boeing's Next Generation 737-700IGW (Increased Gross Weight) airliner. Two additional aircraft were ordered in April 2004.

The 'green' aircraft were manufactured at the Boeing Renton facility in Seattle, Washington, alongside regular 737s. The first two aircraft were modified in the US and the changes were extensive with the rear fuselage removed to enable the structure to be strengthened to accommodate the Northrop Grumman Multi-Role Electronically Scanned Array (MESA) radar, pedestal and top hat (colloquially referred to as the 'surf board'), the installation of two ventral fins to accommodate the HF antenna, and Elta's ALR-2001 Electronic Support Measures in the wingtips. The remaining four aircraft were modified in Australia at Boeing's RAAF Amberley facility.

Australia was the lead customer for what was named the E-7A Wedgetail, delivering a new AEW&C capability for Australia. The 737-700 aircraft was integrated with the 'new' Northrop Grumman mission system incorporating the MESA radar. As this radar had not previously been integrated on an operational



The distinctive addition of an advanced Multi-Role Electronically Scanned Array radar on the RAAF's Boeing E-7A Wedgetail is clearly evident in this image of an aircraft silhouetted by the setting sun in the Middle East, November 2017. Source: Department of Defence

platform, it presented a number of challenges which delayed delivery.

One of them was the serious issue that the MESA radar was unable to reach its designed output power. This required redesign of the radar pedestal by raising it 100mm (3.94in) and conducting further aerodynamic testing. Problems with radar performance continued to the point where an impasse was reached between Boeing and Australia in 2008, whereby the aircraft could not be accepted because it did not meet technical specification milestones. Operational testing could not continue because the aircraft could not be delivered.

An intensive effort to solve the problems was undertaken and these were addressed through a modified test and evaluation program through close cooperation with the then Defence Science and Technology Organisation and a number of US Government agencies. An operational utility demonstration was successfully conducted in Australia in April 2009.

The first Wedgetail (A30-001) had meanwhile recorded its maiden flight in the US on 20 May 2004 wearing the US civil registration N378BC. The Wedgetail made its Australian debut in 2005 when A30-001 appeared at the Australian International Airshow at Avalon, but it would be several more years before service with No 2 Squadron at Williamtown, NSW, could begin.

The first Australian-modified Wedgetail (A30-003) flew from Boeing Australia's Amberley facility on 23 January 2008. The intensive rectification effort paid off, resulting in a highly capable platform. In April 2010, the RAAF accepted two aircraft in order to commence training and initial operations. The third aircraft was accepted in June 2010, the fourth in December 2010, and the final two in 2012.

While residual mission systems integration continued to challenge achievement of Initial Operational Capability (IOC) and then Final Operational Capability (FOC), No 2 Squadron continued introducing the Wedgetail into service. IOC was eventually achieved in November 2012 and FOC in May 2015.

The primary Wedgetail sensor is the long-range surveillance MESA radar. It incorporates a steerable beam, L-Band radar that can scan 360-degrees without any moving parts. The MESA radar, secondary radar, passive detection surveillance and tactical/strategic voice and data communications systems can simultaneously track airborne and maritime targets. This enables the mission crew to direct the control of high-performance fighter aircraft whilst continuously scanning the operational area.

The 'top hat' portion of the radar provides a practical solution for fore and aft coverage, while the low drag portion of the dorsal array system enables left and right coverage. This flexibility



Four Boeing E-7A Wedgetails (A30-002, A30-005, A30-004 and A30-006) of No 2 Squadron on the tarmac at RAAF Williamtown, New South Wales, July 2019. Source: Department of Defence



The lineage of the Boeing E-7A Wedgetail from the Boeing 737-700 commercial airliner are obvious in this front-on view. Source: Department of Defence



Boeing E-7A Wedgetail A30-004 of No 2 Squadron takes off from RAAF Williamtown during Exercise *Diamond Shield* in March 2019. Source: Department of Defence

enabled installation of the MESA radar on the Boeing 737 platform without significant detriment to performance.

The Wedgetail's capability enables the RAAF to execute airborne air control of about four million square kilometres over a ten-plus hour mission, providing Australia with arguably the most advanced airborne battlespace management capability in the world.

Since 2010, Wedgetail has participated in a number of local and overseas exercises and operational deployments. They include Operations *Spate*, *Atlas*, *Southern Indian Ocean* (to assist with air asset control in the search for the missing Malaysian Airlines Flight MH370 in 2014), *APEC Assist* and support to Operation *Okra* in the Middle East until being withdrawn in September 2020.

On *Okra*, No 2 Squadron's commanding officer stated *'the Wedgetail had responsibility for the command and control of all Coalition aircraft in the battlespace management area, routinely managing more than eighty combat aircraft during a single mission. In an integrated force, the Wedgetail shared information with other Coalition aircraft, which allowed the force to have situational awareness across air, land and sea domains.'*

The operational success of the Wedgetail made it the aircraft of choice with Coalition partners after its arrival in the Middle East in 2014. The aircraft

operated over Syrian and Iraqi airspace in support of Coalition forces attacking Daesh ground forces, with an availability rate in excess of ninety per cent.

With aerial refuelling, the Wedgetail completed a record-breaking seventeen-hour mission over Iraq and Syria, the longest of any Boeing 737 in the world. The Wedgetail was so reliable that whenever the United States Air Force (USAF) operated its F-22 Raptor fighter in-theatre, it invariably asked for the Wedgetail to support the operations. The Wedgetail's Middle Eastern operations demonstrated unprecedented availability of a software-intensive technology of this complexity in a hostile operating environment.

The Wedgetail is further tested annually through a variety of exercises with the US and its allies such as *Red Flag* in the US, *Cope North* at Guam, and *Talisman Sabre* and *Pitch Black* in Australia. One typical exercise sortie would see up to sixty fighter aircraft participating with a single Wedgetail providing battlespace surveillance of the exercise, enabling communication with a range of intelligence, surveillance and reconnaissance platforms to build an overall picture of the exercise. This enables the Wedgetail to provide robust command and control of moving aircraft in and out of the airspace, whilst controlling tactical flight and battle management.

Other operators of the 737-700IGW AEW&C platform include the Turkish Air Force's four 'Peace-Eagle' aircraft and the Republic of Korea Air Force's four 'Peace-Eye' aircraft. The UK announced in March 2019 that the RAF would acquire five E-7As to be modified in the United Kingdom (UK) by Marshall Aerospace with first delivery scheduled for 2023.

The USAF's E-3 Sentry and E-8 J-STARS aircraft, based upon the Boeing 707 airframe, are approaching retirement and the E-7A is a contender to replace them.

The Wedgetail platform provides the RAAF with a layered air defence system that enhances surveillance, air defence, fleet support and force

coordination operations in defence of Australian sovereignty and national interests. The RAAF expects to continue operating the Wedgetail into the late 2030s, requiring a very demanding evolution of its sensor suite with emerging technologies.

The proliferation of fifth generation fighters, improved surface-to-air missiles and UAVs, which all increase battlespace complexity, means that future proofing will be challenging. Future upgrades may include increased data management across the battlespace, with growth in sensor upgrades, EW self-protection, Mode 5 IFF, future data links and information exchange requirements.

TECHNICAL DATA: Boeing E-7A Wedgetail

DESCRIPTION:

Airborne early warning and control aircraft (Boeing model 737-7ES); flight crew of two and mission specialists, ten mission consoles.

POWER PLANTS:

Two 121.4kN (27 300lb) thrust CFM International CFM56-7 turbofans.

DIMENSIONS:

Span 34.31m (112ft 7in); length 33.63m (110ft 4in); height 12.57m (41ft 3in).

WEIGHT:

Maximum take-off 77 565kg (171 000lb).

PERFORMANCE:

Patrol endurance (without aerial refuelling) nine hours at 555km (300nm) from base; operational ceiling (12 495m (41 000ft)).



Boeing E-7A Wedgetail A30-001 of No 2 Squadron conducting trials of air-to-air refuelling with Airbus KC-30A A39-005 of No 33 Squadron in the airspace near RAAF Williamtown, New South Wales, in June 2015. Source: Department of Defence