

'S' equals state-of-the-art

Greg Dunstone describes how Airservices Australia's new Mode-S capable terminal area radar will provide air navigation service providers (ANSPs) with state-of-the-art terminal area surveillance capabilities.

Airservices is about to install new terminal area radar which include Mode-S capabilities. The equipment will continue to operate correctly with existing ATC Mode A/C transponders, but advantages will flow to those equipped with Mode S transponders.

The new radars will be installed progressively and commissioned at major city airports from the end of 2008, with the new radar installed at the same location as these airports' existing terminal area radar.

Mode S provides a number of significant new features to improve radar performance and functionality. For example, each Mode S-capable aircraft can be individually interrogated, eliminating garbling of data which occurs with today's radar when two aircraft are in close proximity.

It is this ability of the radar to 'select' an individual aircraft through an addressed interrogation that gives Mode-S its name (Mode-S – select). Unlike current ATC transponder transmissions, down linked Mode-S data is subject to comprehensive error detection and correction algorithms. Mode A/C transponders don't even transmit a parity bit and hence are subject to transmission errors.

Better tracking and reduced false conflict alerts to air traffic control can be expected once the new radars come on-line.

In Europe, several countries have mandated additional Mode-S requirements, which require transponders to be connected to call-sign entry panels and other systems to allow ground systems to gather airborne data. When only a call-sign is transmitted, this capability is called 'elementary surveillance': when extra data is included it is known as 'enhanced surveillance'.

Information such as selected flight level, heading and speed reports can also be down linked and displayed to controllers, allowing them to pick up any discrepancies quickly — for example, a selected flight level not matching cleared flight level. The ability to flag TCAS resolution advisories to controllers is also possible. As a consequence of the European mandate, a significant percentage of international aircraft in Australia have this capability.

The first of the Mode S radars have been under test for several months and the first will soon be commissioned at Coolangatta. Whilst Mode S interrogations from the radar will trigger replies from only Mode S capable transponders, mode A/C transponders will be interrogated separately by a special interrogation which inhibits Mode S transponders from replying at the same time. In this way garble between Mode S and Mode A/C transponders is avoided.

If you are considering a new transponder, there are a number of issues to take into account such as the advantages of Mode-S, whether the transponder supports elementary and enhanced surveillance and whether the transponder supports ADS-B transmission.

Mode-S secondary surveillance radar has been implemented successfully in several countries around the world. However, implementation has identified that a number of Mode-A/C and Mode-S transponders have displayed anomalous behaviour in Mode-S environments.

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'Elementary surveillance' allows the ATC system to use the pilot-entered call-sign which has been transmitted in the Mode-S messages. This means the ATC system will, in the future, no longer need four-digit octal codes for each individual flight, hence removing the workload and errors associated with the pilots and controllers using them.

The Australian ATC system is being modified to allow Mode S derived call-signs to be used to match the flight plan.

Details of these transponders have been published in Airworthiness Bulletins and Directives in New Zealand and the US. The CASA Airworthiness Bulletin 34-010 Issue 1, dated 17 September 2007, advised that any operators of these transponders should contact the manufacturer for a firmware upgrade.