



Multilateration has been quickly recognised as a substitute for secondary surveillance radar (SSR).

The end of SSR?

➤ THE AVIATION INDUSTRY IS ALWAYS PUSHING TO INCREASE CAPACITY AND EFFICIENCY WHILE IMPROVING SAFETY AND MANY FEEL THAT MULTILATERATION SYSTEMS WILL HELP THE INDUSTRY ACHIEVE ALL THREE GOALS. **IVAN UHLIR** OF AIR NAVIGATION SERVICES OF THE CZECH REPUBLIC SHARES HIS THOUGHTS ON THIS NEW TECHNOLOGY, WHICH COULD REPLACE SSR.

The volume of air traffic keeps growing and there is mounting pressure to ensure higher safety standards in ever-more crowded skies. At the same time the cost to the industry must not be too great, so the demands on aircraft surveillance and air traffic control technology are growing heavier.

Can traditional radar cope? Probably not, at least, not on its own, two new technologies – multilateration and ADS-B – could ease the burden. At airports a multilateration system tracks aircraft and ground vehicles fitted with RF-emitting transponders by calculating the time difference of arrival (TDOA) of a signal from the transponder to a number of receivers in the network. The technology has the backing of EUROCONTROL, and has been in action at many of Europe's busiest airports for tracking surface movements.

In the terminal area it has been quickly recognised as a substitute for secondary surveillance radar (SSR). In fact, it has been so successful that countries like the Czech Republic, Austria and Germany are pushing it beyond the confines of the airport into the arena of en-route traffic control.

The example of the Czech Republic shows how the technology has rapidly grown to support wide area multilateration (WAM) applications. The country was the first to certify WAM technology, which was initially installed at Ostrava airport. 'We began testing the system in Prague in 1998, later in Ostrava to evaluate the principal. The Ostrava airport is a former military installation, so although it is not too busy it does handle a lot of large aircraft,' says Ivan Uhlir, surveillance specialist in the ANS planning and development division of the Czech Republic's Air Navigation Services.

'Two new technologies – multilateration and ADS-B – could ease the burden on traditional radar.'

'In 2001 we specified the performance criteria for the system and the following year we began two years of testing and certification. Our civil aviation authority had not seen equipment like this before. No one knew how to certificate it, so it took year to do,' he adds.

In 2004, specifications were drawn up for a WAM system in Prague, with a range of 120nm from a network of ten receivers, compared to the 80nm range of Ostrava's five receivers. Ostrava's

KEY FACTS

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- A WAM system weighs around 500kg and uses a maximum of 6kW of power
- WAM is very small, easy to install, safer and more



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network is to be upgraded, a system for the southeast of the country will be implemented in 2009, and in 2010 these will be linked to the Prague network to enable seamless coverage of the country's entire airspace.

Supplanting SSR

The development of WAM in the Czech Republic suggests that it has many advantages over SSR, not least because it is easy to install and operate. WAM is also much cheaper. Equipment and installation will cost less than for SSR, and it has lower operating costs.

Multilateration systems also have minimal maintenance requirements, although there is a price for the lines used to transmit the data. Its environmental costs are also lower than SSR, given that there is no structure to erect or maintain.

In fact, it is relatively easy to replace an entire WAM system. A WAM system is approximately 30% hardware, 70% software – the opposite of SSR. It has less chance of mechanical failure and is more economical to run. An SSR station weighs around 4,800kg and requires around 24kW of power, whereas a WAM receiver weighs around 500kg and uses a maximum of 6kW of power.

'WAM uses less power but has an identical effect. There are no new antennae structures to install as it can use existing infrastructure like mobile phone towers. It is very small, easy to install, safer and more secure. SSR is very expensive to duplicate,' says Uhlir. 'Multilateration is only partially affected if one of the receivers goes down. WAM has much better redundancy, and it has no mechanical parts,' he adds.

There is no doubt that WAM can have a positive impact on safety. It not only offers an extra layer of coverage, but also is more accurate than SSR, which is less precise the further away an aircraft is. 'There is only one resolution and it is better than that of SSR. It all depends on the layout of the receivers, but we can deploy the receivers in any pattern that we need. Multilateration systems are very flexible, and it is very easy to change the area of coverage,' says Uhlir. WAM can also see planes beyond the horizon. SSR, on the other hand, has a limited a radio horizon defined by the surrounding landscape.

As with any technological changes in an area as sensitive as air traffic control, there was initially caution about implementing WAM, particularly among controllers. 'Multilateration is different to

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SSR, but many of the differences are minor, so it can be used as classic SSR, and the controllers have exactly the same view of the information. People couldn't believe that it was sufficient for surveillance because it is such easy equipment to install and use,' says Uhlir.

'Once people were convinced about its capability then it started to grow exponentially. Initially the controllers wanted different symbols on the screen for SSR and WAM, but they soon decided that the systems were fully equal so different markers were unnecessary. WAM is very easy for controllers to use. They see identical images,' he adds.

Out with the old, in with the new?

In the Czech Republic WAM has been quickly embraced, but so far SSR is still in use. The two systems are not identical, so they are a strong combination. For now, the focus is on extending WAM beyond the country's borders, and discussions are under way with Poland about extending linking by multilateralism to Krakow and installing receivers on Polish territory.

Inevitably, this expansion is likely to strengthen the use of WAM, which will gradually replace SSR. 'In ten years in Europe I believe that ANS providers will use a 50/50 split of SSR and WAM. By 2020, around 70% of Europe will be controlled by WAM, and by 2040 it will be the only system in use,' predicts Uhlir.

He feels that the other important technology on the scene – automatic dependent surveillance-broadcast (ADS-B) – will also have a role to play, but he sees some problematic issues ahead. ADS-B relies on location data from the global satellite network and has the backing of the US Federal Aviation Administration (FAA), which sees potential gains in safety, capacity and efficiency.

'We have ADS-B today in our upgraded systems, but it will not be the only system for surveillance. It is complementary. Not all aircraft are equipped, and not all are accurate as some planes are not using GPS. Depending on the classification of the aircraft you must also think about whether the altimeter is accurate enough,' says Uhlir.

'We are responsible for accuracy in the ANS and for safety, and we make the decision over aircraft separation. If an aircraft is reporting its own position and the controller has no check on accuracy then you have to ask questions about who is responsible. So, we will use ADS-B in combination with multilateralism,' he adds.

Those who have experienced it in action, like Uhlir, believe it is the way forward. 'Each new installation becomes more accurate and has higher specifications because of our experience.

'I believe that multilateralism is the future, and perhaps it will eventually handle 100% of surveillance. Our two new radar systems will be the last classic SSR systems we ever buy.' ○



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