AirNav Radar Box

Many radio amateurs have interests outside of the conventional areas of the hobby – one of the most popular, it seems, is an interest in aircraft

ON REVIEW. The AirNav Systems RadarBox 2009 is a very compact, yet powerful, decoding system that can receive ADS-B broadcasts from aircraft and plot the results on a map. The amount of information available and frequency of update is amazing – you even get photos of the aircraft you're receiving!

The setup reviewed here comprises the AirNav RadarBox receiver and software along with the optional 1090MHz Radar-Extender antenna and masthead preamplifier. Waters & Stanton are the UK agents for AirNav Systems and have kindly loaned the review model.

RADAR BACKGROUND. Before I delve into the details of the RadarBox it may help if I provide an outline of how aeronautical radar has developed to its current sophisticated level.

Early radar, whilst a revelation at the time, was very crude and relied on measuring the propagation delay and signal strength of a short, but high powered, blip of microwave energy. The result was displayed on a monitor for the air traffic controller (ATC). The only information available was range, direction and a rough indication of aircraft size from the size of the blip. The first real improvement came with the introduction of Secondary Surveillance Radar (SSR) that included the use of transponders on board the aircraft. These transponders would send a simple code on receipt of a radar blip that would help identify the aircraft. This system was developed further with an additional interrogation type known as Mode C. This provided access to the aircraft's height data so giving the ATC range, bearing, height and identity. The frequencies used for these aeronautical radar systems are 1030MHz for ground to air and 1090MHz air to ground. The next major development came through the introduction of Mode S, which brought a much more sophisticated transmission system using Continuous Phase Shift Keying (CPSK) and a data rate of 4Mbps ground to air and 1Mbps air to ground. The current system and the one that makes the RadarBox possible is Automatic Dependent Surveillance Broadcast (ADS-B). The key point is that whilst all the previous systems provided a response when requested by an external radar signal, ADS-B broadcasts aircraft information at a rate of about 2 broadcasts per second. It is this detailed broadcast information that provides a wealth of data that units such as RadarBox can use to produce radar-like displays for all manner of purposes as we shall see here.

INSTALLATION. One of the attractions of the RadarBox is the ease of setup that works very smoothly. If we set the antenna to one side for the moment, the only connection required is a single USB lead between the RadarBox and your PC. This provides power as well as communication and with no controls on the RadarBox you can tuck it away neatly without having to clutter the desk with more kit. Once connected you, just insert and run the supplied CD ROM to install the RadarBox drivers and software. When you first run the software you need to enter the username and password that are supplied on the front of the CD ROM packaging but there is an option for the software to remember these detail so you don't have to re-enter every time you start. If you want to make use of the RadarBox network information you will also need an internet connection to your PC.

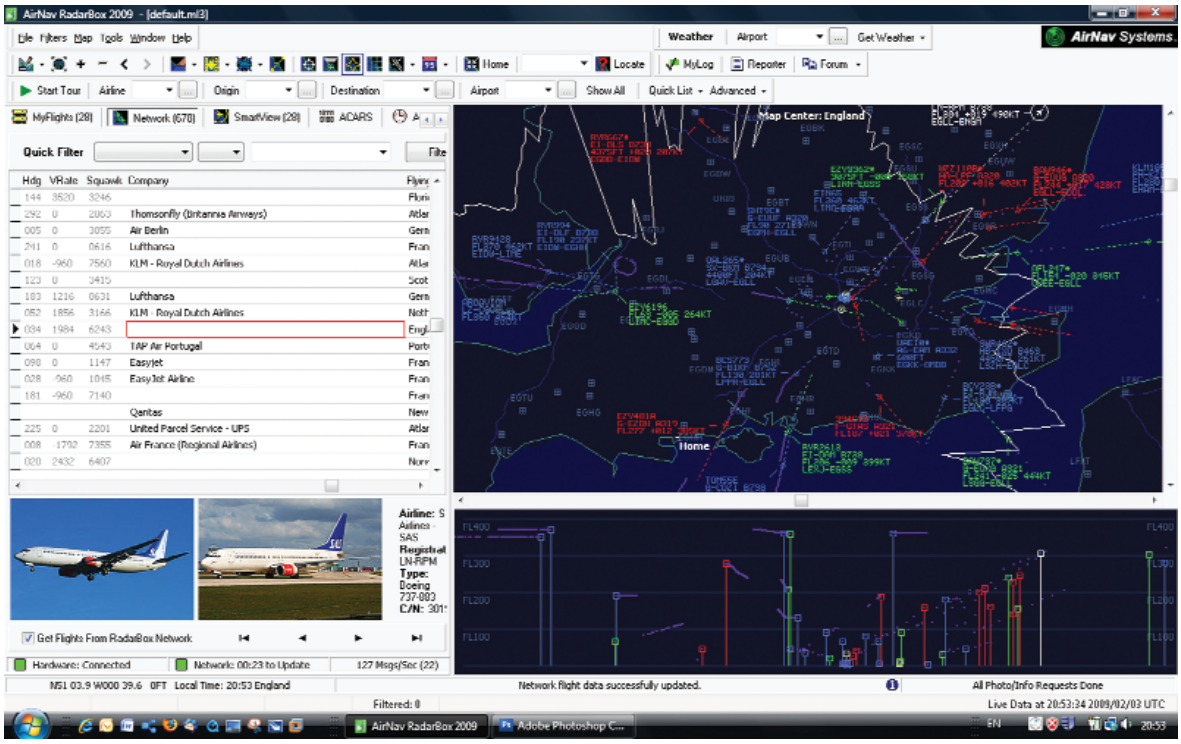
The RadarBox unit and the supplied antenna.

ANTENNA. The antenna installation is critical for good results, especially as we're dealing with signals at 1090MHz. However, the situation is eased as most of the transmitters (ie aircraft) are at significant heights so many will have an uninterrupted line of sight to your location. The trick is to mount the antenna as high and clear as possible. The RadarBox is supplied with a small mag-mount whip and about 3m of coax complete with a miniature SMA plug that mates with the antenna socket on the RadarBox. This small antenna is fine for testing the system and if you are at a particularly good location may be good enough long-term. However, for most people, using an external antenna is the best choice as this will bring two benefits: a) It will extend the useful range of the system considerably and b) it will enable you to receive more aircraft at low altitude so you can track aircraft in and out of airfields. For this review I used the WATsON Radar-Extender antenna, which comprises 4 x 5/8th wave elements for 1090MHz. This was supplied with the A12 masthead 1090MHz preamplifier and the matching BT-12 Bias Tee. The antenna was supplied with all the necessary mounting kit and all the external connections used 'N'-type connectors. There were no leads in the pack so these had to be made up. The BT-12 Bias Tee provides the power feed point for the masthead amplifier and required an external 12V supply. For the final connection I used a good quality BNC patch lead with a BNC-SMA adaptor to link to the RadarBox.

GETTING GOING. With all the setup complete getting down to receiving and tracking flights was remarkably easy. When the program starts you are presented with a fairly busy screen with a received flight list and photos on the left. To the right of the screen is the main display area with a map containing all the received flights and a very useful Vertical Tracking View at the bottom.

The map is the main attraction of the package and this can be zoomed

The antenna that was mounted as high as possible for best results.



RadarBox main display.

Close-up of the individual aircraft display.

in and out using the mouse wheel so it's very easy to take a closer look at any flight/airfield. As you can probably see from the screenshots, each aircraft is represented by an aircraft symbol and there is a call-out box showing basic flight details such as flight number, callsign, aircraft type, flight level and speed. Each flight also has a tracking line added to show where it's been and where it's going, which is a nice touch. As soon as you hover your mouse over a flight it becomes highlighted and the appropriate entry in the left-hand flight display is highlighted. This made it very easy to find out lots more about any particular flight. One aspect of the RadarBox is the way in which it uses its built-in database and internet connection to supplement the ADS-B information. Using this system, the raw ADS-B message is supplemented with more complete details of the flight routing including photographs and a small thumbnail icon that's stored in the aircraft list.

The vertical tracking view located just below the map was very useful as it provided a very clear indication of how all the flights were dispersed vertically. Each of the tracks was plotted with a tail so you could easily see the direction of travel and whether the flight was cruising, climbing or descending.

NETWORKING. The addition of networking makes the RadarBox able to track flights way beyond the range of your antenna. The network is setup as a peer-to-peer network with other users sharing their data. This data is routed to the AirNav server where it is checked against a number of algorithms to make sure it is valid before being added to the main data file. As a security precaution, the network delays flight information by 5 minutes before being made available to other users. This delay doesn't seem to be a problem in practice, you just occasionally notice an aircraft jumping a few miles (up to 40 miles at 420 knots) when a flight arrives within your antenna's catchment area. Once the network shared data is consolidated at the server, it is made available for all registered users to download. The software is set up to retrieve the data file every 30 seconds, which proved to be a reasonable update time for distant flights. Although the RadarBox network is a subscription service, it is free for the first year after purchasing so you have plenty of time to decide whether or not it's worth the 5 Euro per month subscription.

ADVANCED OPERATION. RadarBox includes a host of more advanced features so you can make the most of all the flight data. The Alert system was very useful as you could set the unit to generate an alert whenever a flight was detected that met your alert parameters. For example, I could set an alert for a particular flight number and leave it working unattended. As soon as the alert condition was met, I could set the RadarBox to beep, show a message, send an e-mail or even execute a file. The range of triggers available was very comprehensive and included any aircraft within a user specified radius of a given location.

The SmartView option provided sophisticated filtering where I could enter a list of flights and aircraft including wild cards. Once entered, I could use it to show the detailed information from flights that met the filter criteria. I could also restrict the map display to show only SmartView flights. This was particularly useful for monitoring an airline as I just entered the first part of the flight number followed by a wide card to catch them all, eg BAW* for British Airways.

Logging is fully automated with RadarBox and all the received flights are stored in a local database that can be examined, edited and exported if necessary.

SUMMARY. Airborne radar has certainly come a long way and the AirNav RadarBox takes full advantage of the developments to produce a fascinating and surprisingly easy to use aircraft monitoring facility. Reception will naturally be best with an external antenna and preamplifier and many users seem to do perfectly well with the supplied version. However I found that the external antenna and preamp I was loaned did a very good job for me.

The RadarBox is available from Waters & Stanton priced £389.95 whilst the Radar-Extender Antenna costs £79.95. The A12-1090 masthead amplifier is £116.95 and the matching BT-12 Bias Tee is £37.95. All prices include VAT at 15%. My thanks to Waters & Stanton for the loan of the review items.