Kinetic Avionics SBS-1 Real-Time Virtual Radar

By Lee Reynolds, KD1SQ

In the scientific world there exists a concept known as "convergent evolution" – the process whereby organisms not closely related independently acquire similar characteristics while evolving in separate and sometimes varying ecosystems. Think of the wing, for example, as used by bats, birds and insects.

Bet you didn't know we have it in the radio hobby too, eh?

For this column we are reviewing the SBS-1 from Kinetic Avionics in the UK (**www.kinetic-avionics.com**). Developed by folk from the professional aviation end of the spectrum for the commercial market, it's a fascinating device that just happens to be a really neat toy if you're into hobbyist-level plane spotting and monitoring (that's why I say convergent evolution!). It works, the software that goes with it is **very** well done, and it offers the enthusiast a window into aviation monitoring that was completely inaccessible until this device came along. It's even priced at a point where, if you save a few pennies, the individual can afford it. Allow me to explain…

What are we receiving?

For some time now, aircraft have carried radar transponders operating at 1090 MHz that can respond to requests from the ground by sending altitude and identity data back to the interrogating station – Secondary Surveillance Radar or "Mode S" as it is better known. This system has been developed as an improvement over the decades old radar addressing and response systems that have been used up till now for managing air traffic.

Optionally piggybacked onto this can be Automatic Dependent Surveillance Broadcast "ADS-B" capability, which not only transmits aircraft identity and altitude, but also airspeed and location many times a minute. Think of it as being an ACARS on steroids that tells you everything you might want to know about where that plane is, who it is, where it's headed for and how fast.

All this was very interesting in an academic way; a hobbyist could listen to the milliseconds-long data squitters on 1090 MHz if he had a good enough antenna and receiver – but that was all. Decoding this data was something that took commercial equipment and commercial funding levels. Not for the little guy, in other words.

Enter Kinetic Avionics and their entrepreneurial eye for a potential market! Kinetic already had a history in the avionics business, notably Distance Measuring Equipment or DME (which is an air and ground based system for defining how far an aircraft is from a given DME ground station), and the company decided that there was a demand for a low cost virtual radar system that could be marketed to small airfields, flight training establishments, ATC training schools and any other body that needs to monitor flight movements, and, somewhat incidentally, the hobbyist. With these markets in mind, Kinetic produced a commercially-targeted product that can decode Mode S and ADS-B data bursts and then display the derived data in a form that closely mimics the radar display and logging devices that the aviation professional may well already be familiar with.

What's in the box?

When the package arrived, the contents were laid out as you see in figure 1. The contents were:

- The SBS-1 receiver
- SBS-1 Basestation software on CD-ROM
- Magnetic mount base and antenna for 1090 MHz
- 3 meters of low loss coaxial cable with terminations for the antenna and the receiver
- USB cable
- Power cube *(the SBS-1 can also be powered via the USB connection)*
- European and UK connector power cables for the cube
- "Read this First" documentation intended to help you get up and running quickly
- Miscellaneous fliers, advertising materials and brochures for SBS-1 accessories

Notable for its absence is a printed user manual. A PDF format reference manual for the Basestation software is provided on the software CD-ROM. It's a good software reference manual, but I'd say that Kinetic is presupposing a certain level of knowledge of aviation traffic control, radar transponders, waypoints, etc., on the part of the customer and so has not included any detailed information for the absolute beginner.

System requirements are fairly reasonable; although you're not going to be running this setup on a PI-233, you *must* be using Windows 98 or later (for the USB hardware support in the Operating System). Testing suggests that you're best off using a system with a 500MHz Pentium III processor at least, a USB port and a minimum of 256MB of RAM. Fortunately nowadays that level of system can be purchased second hand pretty cheaply if you're presently using a computer that's not already up to those specs.

Putting it together

Assembly is very straightforward. You screw the coax cable connector and antenna element into the magnetic mount base and connect the BNC connector on the other end of the coax to the receiver. Then you plug one end of the USB cable into the receiver (leaving the other end disconnected), the PSU into the receiver and the PSU power lead into the mains. The connectors are unambiguous with only one of each type in the setup; you'd have to try hard to make a mistake putting the hardware together.

Installation of the Basestation software is simple; you can put the application wherever you'd like on your system. Pop the CD-ROM into the drive, tell the installer where you want it, and you're done.

Once the hardware and software are set up, plug the other end of that USB cable into your PC and install the SBS-1 drivers in the fashion appropriate to the particular version of Windows you have. Once done, start the Basestation software, answer two simple questions – connection type (USB or Ethernet between the PC and the SBS-1) and your geographical location, and you should be ready for business.

One caveat at this point is that when starting up for the very first time, the software looks for transponder messages coming from the receiver. It does this for 60 seconds before it times out (if it doesn't see any) and gives you the option of trying again or starting the software without communication with the receiver. What this means is that you need to have the antenna set up in a reasonable location where it's likely to be able to capture these gigahertz radar transponder signals – If you don't, you'll be scratching your head and retrying that software/receiver link for a very long time as the software looks for a data burst and fails to find it!

Figure 1

❖ Once it's all working…

…you'll be presented with a very credible reproduction of an Air Traffic Control (ATC) radar screen (*Figure 2*). The top left hand screen is the 'radar' screen itself – this shows the aircraft detected in just the same way as the professional's screen does, displaying the aircraft, its hexadecimal ADS-B ID, registration number, flight bearing, flight speed, squawk and altitude. Additional data such as geographic features, waypoints, airports and flight trails (to aid in visualization of flight course) can be selected/deselected by the user.

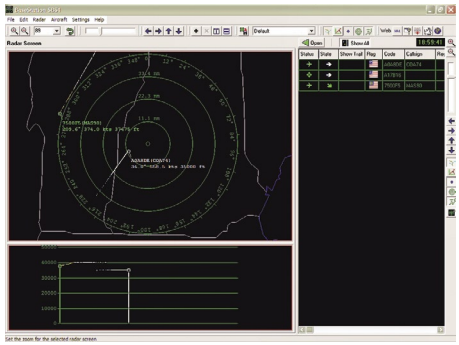


Figure 2

Below the 'radar' screen is a user-selectable window that displays the altitude of all flights being tracked in a graphic, easy-to-understand way.

On the right hand of the screen is the 'Aircraft Details' window. This window (which can be expanded to take up most of the screen, if desired) displays a large amount of user-selectable data on flights currently being tracked.

❖ How well does it work?

It works darn well! It *is* a very good simulation of what an ATC radar display would show for traffic in your area *(Figures 3 and 3a)*. These two illustrations show two flights that were being tracked – the first one in the "looking-down" radar display, the second is the accompanying display of altitude of the flights over time. Looking at them both, you can clearly see that flight MAS90 is heading SSW and has just begun to descend from 40,000 feet and is presently at almost 38,000 feet. Geographic detail is displayed, aviation ground data can be displayed, airport layout can be shown. Flights using ADS-B appear onscreen displaying user-selectable data about themselves, showing exactly where they are going and clearly displaying level, ascending or descending flight.

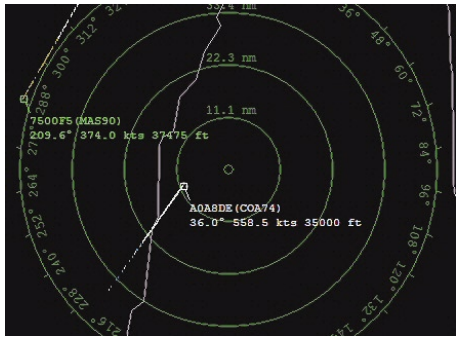


Figure 3

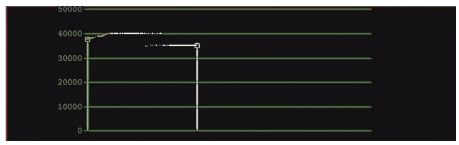


Figure 3a

In practice, I found that reception ranges were largely comparable to those obtained when receiving ACARS data in the 130 MHz region. Using an antenna that was only reasonably well placed (in a window on a steel sheet for a ground plane but with a clear view to the horizon), enabled me to receive aircraft over a hundred miles away. If I had used a mast mounted preamplifier and/or antenna cut to the right frequency (such devices can be purchased from Kinetic) I would have seen hits from further away still.

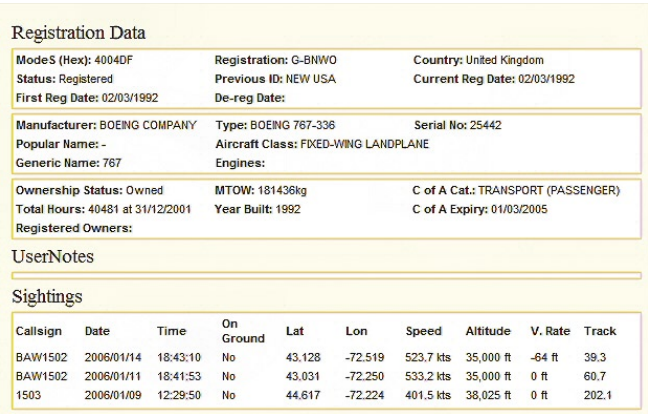
Flights that are not using ADS-B but Mode S only, cannot be displayed on the radar map because they do not transmit their location. They do, however, transmit their ID, squawk and altitude. This makes Mode S much like a standard ACARS squitter that contains no positional data – you know who you heard and that they're in the area, but not precisely where. These transmissions can be filtered out entirely or can be recorded, but you will only be able to see them in the Aircraft Details window and in the Basestation log files. Not bad at all, even so.

Reliability – I ran this application for a week under Windows XP. No problems, no exceptions, no Blue Screens of Death. I'd say the software can run indefinitely without a problem. (Windows may not do so, but this application can). The only item of note was that the software can pull down 24-25% of a 2.4GHz CPU's available processing power.

Logging – Here's where you can see that the SBS-1 came from a different parentage than most aircraft tracking packages we are familiar with: The software does do a very nice job of logging extensive details of flights heard (both ADS-B and Mode S), but instead of producing a delimited text file or straight (basically) formatted text file or Airmaster formatted log, it builds a card file, so to speak. Each aircraft has its own XML (it's sort of like HTML – both can be used to write web pages) "card" created and all the details of sightings are recorded therein *(Figure 4)*. They're nicely formatted and laid out, but they'd take a lot of massaging to turn them into something that, for example, AirNav Suite could import and use.

Data exchange – At this time the SBS-1 Basestation software does not use DDE to receive or send data to other applications that are running (this is another method of exchanging data commonly used between hobbyist applications).

A few minor observations are –



Registration Data

ModeS (Hex): 4004DF	Registration: G-BNWO	Country: United Kingdom
Status: Registered	Previous ID: NEW USA	Current Reg Date: 02/03/1992
First Reg Date: 02/03/1992	De-reg Date:	
Manufacturer: BOEING COMPANY	Type: BOEING 767-336	Serial No: 25442
Popular Name: -	Aircraft Class: FIXED-WING LANDPLANE	
Generic Name: 767	Engines:	
Ownership Status: Owned	MTOW: 181436kg	C of A Cat.: TRANSPORT (PASSENGER)
Total Hours: 40481 at 31/12/2001	Year Built: 1992	C of A Expiry: 01/03/2005
Registered Owners:		

UserNotes

Sightings

Callsign	Date	Time	On Ground	Lat	Lon	Speed	Altitude	V. Rate	Track
BAW1502	2006/01/14	18:43:10	No	43.128	-72.519	523.7 kts	35,000 ft	-64 ft	39.3
BAW1502	2006/01/11	18:41:53	No	43.031	-72.250	533.2 kts	35,000 ft	0 ft	60.7
1503	2006/01/09	12:29:50	No	44.617	-72.224	401.5 kts	38,025 ft	0 ft	202.1

Figure 4

- The user base and software are somewhat Eurocentric at the moment – Kinetic has mainly been marketing the product in the UK and Europe but hope to expand into the North American market.
- I've been reading the Kinetic online forums; user consensus is that Kinetic listens to them and responds to their needs.
- At present the ratio (in North America) of Mode S to ADS-B equipped aircraft is about 72/25 (it's higher in Europe). In the next few years, as more aircraft are ADS-B equipped, it's anticipated that their numbers will quadruple or better (this translates to many more trackable aircraft appearing on the virtual radar screen)!
- Antenna siting is all-important – if you live on Long Island you'll get by with the antenna sitting on the radiator in the radio room. If you're not living in Aircraft Central (like Long Island), you'll need to get the antenna up on a decent ground plane and outside with as unobstructed a view of the sky as you can in order to maximize the number of flights you can catch.
- Kinetic is working on a shared server system (accessible through the Internet, of course) that SBS-1 users will be able to log into to share data being received on a worldwide scale. If you're in Podunk, Vermont, you'll be able to see what's in the airspace over Baghdad International in real time. This will be a subscription service, unfortunately.

❖ Pros

- A window into a unique part of the aviation/avionics world
- Well written, reliable software with good ergonomics and user display
- Highly configurable by the user
- Excellent visualization tool for what that flight is *really* doing
- Authors have a reputation for listening to the user and implementing those "got-tahave" features we all love
- A realistic reproduction (within limits) of what the Pros use
- The manufacturer is responsive to enthusiast feedback and requests
- An active user community exists that is busy producing third party add-on utilities for the SBS-1

❖ Cons

- Moderately expensive
- A little heavy on CPU utilization (24% on a 2.4GHz P4 system)
- Does not support DDE links or produce logs in any format usable by other aviation enthusiast programs (at this time)

- A more fail-safe and informative method of making sure that the initial hardware and software setup is successful is needed – the user can be left wondering if things are fully functional or not. Part of this problem can be attributed to the shortcomings of Windows, but developers should work to minimize this gray area of uncertainty.

❖ Conclusion

This is a somewhat pricey, but very unique and informative, tool for the dedicated aviation enthusiast. It can decode, interpret and display far more information on a trackable flight than any ACARS decoder presently on the market and, because of this and the way it displays this data, it is invaluable for getting a really good gut-level feel for flight paths, waypoints, airports and aircraft behavior around them in general. Although its ancestry is rooted in the professional aviation world (as can be seen by the orientation of its feature set and lack of ability to talk to/work with other programs in common hobbyist use), I anticipate that we will see this product become even more hobbyist friendly in the near future and of greater use to us still.

❖ To learn more

The SBS-1 Virtual Radar is distributed worldwide by Martin Lynch & Sons Ltd (Outline House, 73 Guildford Street, Chertsey, Surrey, KT16 9AS; Email: *Kinetic@MLandS.co.uk*; Tel: 0845 2300 599 or +44 1932 567 333; Fax: 0845 2300 339 or +44 1932 567 222). Their price is £500 or $759.95 USD. MLS is seeking new international dealers. For a dealer in your area, check **http://www.kineticavionics.co.uk/communicationsdealers.php**

New on the market is also a scanner interface which will tune your scanner to the aircraft at the same time as you're watching the VR display. Interfaces are currently available for the ICOM IC-PCR1000, AOR 8200 and AOR 8600, and more are in development. Check **www.SBS-2.co.uk** for the latest products and accessories.

MT'S AVIATION CONTEST

Enter and Win the SBS-1!

As you see in our review, the SBS-1 Virtual Radar can be a cost-effective tool or a superlative toy, depending on whether you are a dedicated aero hobbyist or make your living in aviation. If you're into aviation, we have exciting news for you: Kinetic Avionics and their distributor, Martin Lynch & Sons, have donated our review model as a grand prize worth $800 in a contest open exclusively to MT readers.

To enter the contest, send us a short essay describing how you got started in radio, what radio and computer equipment you operate today, what you enjoy about aviation monitoring, how you plan to use the SBS-1 Virtual Radar and why you think we should award it to you. If your interest is professional, answer the same questions as they apply to your situation. The winner will be chosen on the basis of who has made the best case for why he or she deserves to win!

Send your entry (with your name, address, and daytime phone number) to Monitoring Times' Aviation Contest, 7540 Hwy 64 West, Brasstown, NC 28902, postmarked *no later than May 1st*; or you may email your entry to *editor@monitoringtimes.com*, subject line **MT Contest,** by May 1st. (If I receive your email, you will receive an acknowledgement from *mteditor@brmemc.net* by the next business day.)

The winning entry will be published in the July issue.