

SILICON CHIP



NOVEMBER 2008

ISSN 1030-2662



PRINT POST APPROVED
- PP255003/01272

\$850* NZ\$990
INC GST INC GST

AirNav

RadArBox: WOW!

TO BUILD:



Simple 12V Speed Controller

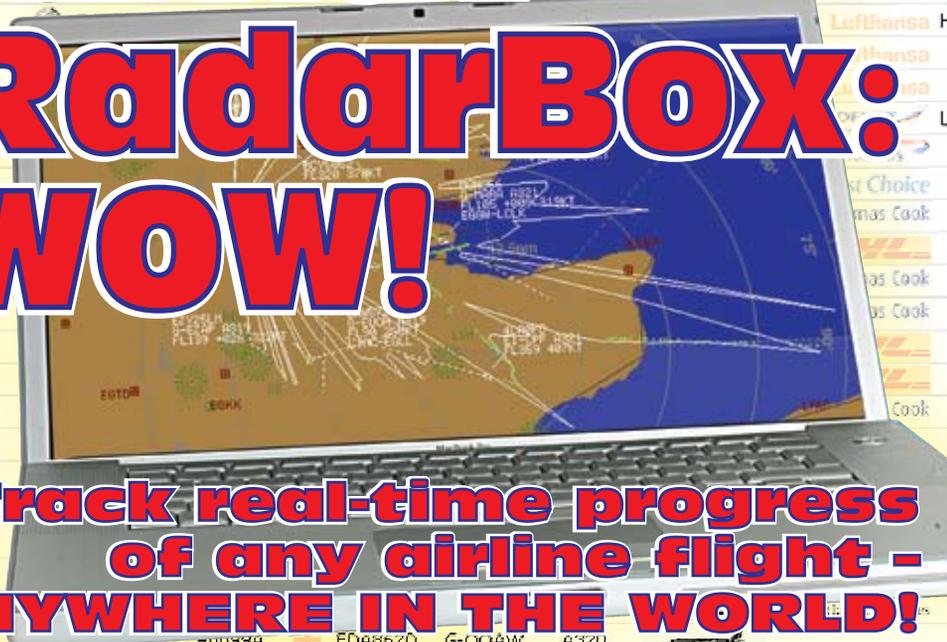


Engine Oxygen Sensor Display

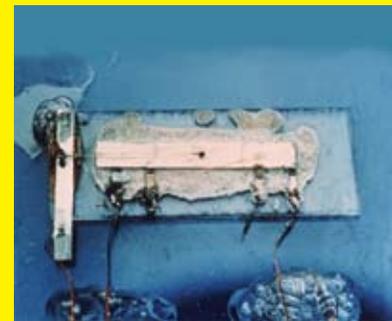


IrDA board for the Musicolour

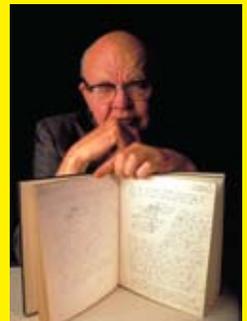
Track real-time progress of any airline flight - ANYWHERE IN THE WORLD!



Airline: Germanwings
Registration: D-AGWD
Type: Airbus A319-132
C/N: 3011
Flight: GW1935



Fiftieth Anniversary of the first INTEGRATED CIRCUIT





Ever wanted to be an air traffic controller? This will let you experience it all – from the comfort of your PC!

AirNav RadarBox

by
Ross Tester

We get to see a fair amount of new software and hardware here at SILICON CHIP. Most of it is pretty ho-hum – in many cases a new way to re-invent the wheel.

Every now and then, though, something comes along that leaves us open-mouthed. Gobsnacked, even.

For example, Google Earth (and its latest variant, Google Streetview) was/is such a program. I don't know about you but I still find the sheer concept of it absolutely amazing.

Well, now there's another piece of software (or more correctly, software **and** hardware) which has left all of us here saying "WOW!" (capital letters intended!).

It's called AirNav Radar Box

As the package says, it's the closest you can be to real world aviation without leaving your computer chair. If you are at all interested in aviation (and even if you're not!) we're sure you will agree with our first reaction. WOW!

Let's see if we can paint a picture for you.

We'll imagine great-aunt Mabel is flying from her home in the far north of Scotland to sunny Sydney to spend some time with you. She's sent

you her itinerary, telling you each of the flights she's catching: from her home town of Wick to Edinburgh on RyanAir, from Edinburgh to London (Heathrow) on British Airways then from London to Australia on Qantas via the Kangaroo Route of Bahrain, Singapore and Sydney.

Of course, you can see from her itinerary (or look up on the web) the (hopeful?) departure and arrival times of each flight.

But with AirNav Radar Box and your PC, you can see so much more. You can "track" great-aunt Mabel all the way, knowing precisely where she is at any time.

You can "zoom in" on any or all of these airports and see each flight's progress on a "radar" screen, with virtually all of the information an air traffic controller at each of those locations: its exact location, the aircraft identification, aircraft type (even, in most cases, with a photograph of the actual aircraft, not just an aircraft of the same type), its heading, its height, its rate of climb or descent. . . just about everything.

Click on any of the airports along the way and you can follow great-aunt Mabel's progress all the way! Or you can store great-aunt Mabel's flight details and AirNav Radar Bpx will alert you when it finds the flight.

You'll even know that great-aunt Mabel's flight is running late (or early) as it approaches Sydney, probably even before the Captain has told great-aunt Mabel and the other passengers – so you could delay your journey to Sydney

A quiet afternoon in south-east Australia, as shown by the screen at right. Perhaps this is more a limitation of the antenna's field of view, being somewhat blocked in the direction of Sydney airport. Compare that with the screen of London Heathrow on the laptop at right – and again, this was a relatively quiet time!



**Inside the AirNav RadarBox receiver and signal processor.
Actual box size is 125 x 105 x 20mm.**

International Airport until the last minute and therefore avoid the huge parking charges!

Impressed? We were! But how much more impressed would you be if we told you that you could do this from any location in the world, for (almost!) any location in the world?

But wait, there's more – so much more. Want to explore the world of aviation? You can look up data for any (well, we believe all identified) commercial airports in the world and get the same information a pilot gets: length of runway, VOR, NDB, FIX, airways and ATC boundaries, weather. (If you don't know what those abbreviations and terms mean, you'll learn very quickly!)

Incidentally, they stand for/mean:

VOR – VHF omni range (ground-based radio navigation aid);

NDB – non-directional (radio) beacon,

FIX – position of an aircraft on its flight route;

Airway – approved flight route;

ATC – air traffic control.

Weather? Ummm . . .

There's also more than a million map locations including detailed shore lines, country boundaries, elevations, roads and much more. A 3D, multi-window display on your PC lets you select multiple features at the one time.

We found looking at the "radar screen" window for an airport like Sydney fascinating. Then we changed to airports such as London Heathrow, Chicago O'Hare and Atlanta Hartsfield-Jackson.

As three of the busiest airports in the world, the amount of air traffic around them was simply unbelievable. Those air traffic controllers might be highly paid – but they're worth every cent and then some!

What's In the box?

There's a small (105 x 125 x 22mm) aluminium "Radar-Box" which contains all the electronics, a USB cable, a short (~300mm) 1090MHz vertical wire antenna with magnetic base and (we presume) a ground-plane baseplate plus a CD

containing the RadarBox Software. There is no power supply, because none is needed - RadarBox gets its power via the USB interface.

Setting up the AirNav

There can't be anything simpler: plug the antenna lead into the SMC socket on the back of the RadarBox (it works best close to a window and better still if that window is oriented somewhat in the direction of the nearest major airport, then connect the USB cable between the RadarBox and any vacant USB slot on your PC.

Next, run and install the software from the CD provided. We found quite a delay (maybe a minute or so) from the time we activated the AirNav RadarBox – perhaps it takes that time to receive information from around the world. The first time you run the software, it will interrogate you for password and username which will be supplied at time of purchase

Once it's running, you can start tracking flights in real time! There's no power switch; the RadarBox will spring into life as soon as it's plugged in to the USB port.

How it works

AirNav Radar Box operates in two ways.

First, in real time, the receiver picks up data from aircraft using ADS-B (Automatic dependent surveillance-broadcast – see the panel "what is ADS-B) within range of the simple antenna and displays their data on the PC screen. Without you even being aware of it, this information is also relayed via the 'net to all other AirNav Radar Box users

Second, delayed by about five minutes for security reasons (we won't mention the "T" word) similar information is obtain from the many thousands of AirNav Radar Boxes around the world. In many ways, it's similar to peer-to-peer file sharing works, relying on the fact that at any time of the day or night, there will be many computers on around the world with an AirNav Radar Box receiving data. However, it doesn't rely on a connection to another computer; instead all data is sent to a central AirNav server.

After being processed and passing some validation algo-

What is ADS-B

As we explained, the AirNav RadarBox relies on commercial aircraft transmitting and ADS-B signal. But what is ADS-B and how does it work?

First, to set the record straight, it has nothing whatsoever to do with ADSL as applies to broadband – it's an unfortunate co-incidence of acronyms. ADS-B, which stands for Automatic dependent surveillance-broadcast, is a form of air navigation assistance and safety aid for both pilots and air traffic controllers – and now anyone with a suitable receiver and software.

It is similar to the Automatic Identification System (AIS) now becoming widely used in commercial shipping.

Unlike conventional radar, ADS-B can also work at low altitudes and on the ground, so that it can be used to monitor traffic on the taxiways and runways of an airport. It's also effective in remote areas or in mountainous terrain where there is no radar coverage, or where radar coverage is limited.

One of the greatest benefits of ADS-B is its ability to provide the same real-time information to both pilots in aircraft cockpits and ground controllers, so that for the first time, they can both “see” the same data.

Unlike an aircraft transponder, which transmits its aircraft identification when it receives a radio (or more usually radar) signal, the ADS-B transmits its information via a digital data link without any prompting – and often (ADS-B data is updated several times per second).

Furthermore, it works out its own positional information, speed, altitude, etc. to a large degree independently of the aircraft navigation system, from the GPS (global positioning system) satellite signals which we are all becoming very much more aware of, given the plethora of GPS receivers now on the market.

Given the fact that GPS is now routinely accurate to just a couple of metres or so – and in aircraft, flying closer to the satellites without any obstructions, this accuracy would be at its maximum – the ADS-B data is very accurate indeed.



Garmin GLD 90
Data Link Sensor and GPS antenna.



ADS-B offers increased, timely information for both pilots and air traffic controllers, increasing safety for all aircraft. (Courtesy ADS-B Technologies LLC).

An important factor is that this data is transmitted without any interaction by the pilot or crew – in fact, in an ADS-B system the crew has no input whatsoever.

Pilots in the cockpit see the traffic on a Cockpit Display of Traffic Information (CDTI). Controllers on the ground can see the ADS-B targets on their regular traffic display screen, along with other radar targets.

ADS-B provides traffic information to pilots that is currently unavailable to them. Because the system has an effective range of more than 150 miles, ADS-B provides a much greater margin in which to implement conflict detection and resolution than is available with any other system.

Pilots and controllers using ADS-B data will be able to determine not only the position of conflicting traffic, but will clearly see the traffic's direction, speed, and relative altitude. As the conflicting traffic turns, accelerates, climbs, or descends, ADS-B will indicate the changes clearly and immediately.

A plane equipped with ADS-B can theoretically fly closer to other aircraft because the locating data is more accurate and more real-time. Therefore the controller does not have to factor in as much a margin for error.

Its name comes from its components: it's **Automatic** – It's always ON and requires no operator intervention; it's **Dependent** – it depends on an accurate GPS signal for position data; it provides “radar-like” **Surveillance** services; and it continually **Broadcasts** aircraft position and other data to any aircraft, or ground station equipped to receive ADS-B.

There are 57 ADS-B receivers at 28 ground stations around Australia. Indeed, Australia (along with the US) was the first country to trial and later implement ADS-B.

There is considerable discussion (argument?) at the moment about ADS-B being extended to GA (General Aviation) aircraft; the most telling is the cost (around \$10,000 plus installation) and annual maintenance for the private aircraft owner.

rhythms the data is stored on a queue for server upload. This is where the five-minute delay is built in.

The AirNav server processes up to 10,000 flight messages per second in peak periods. Data is then organized and properly processed (to add to each flight and aircraft as many details as possible - aircraft type, registration flight routing, photos) and an output file is created. Each connected AirNav Radar box computer can then download the updated list of network flights. This list often has more than 500 flights worldwide, with the list is growing daily as AirNav Radar Box gets more popular.

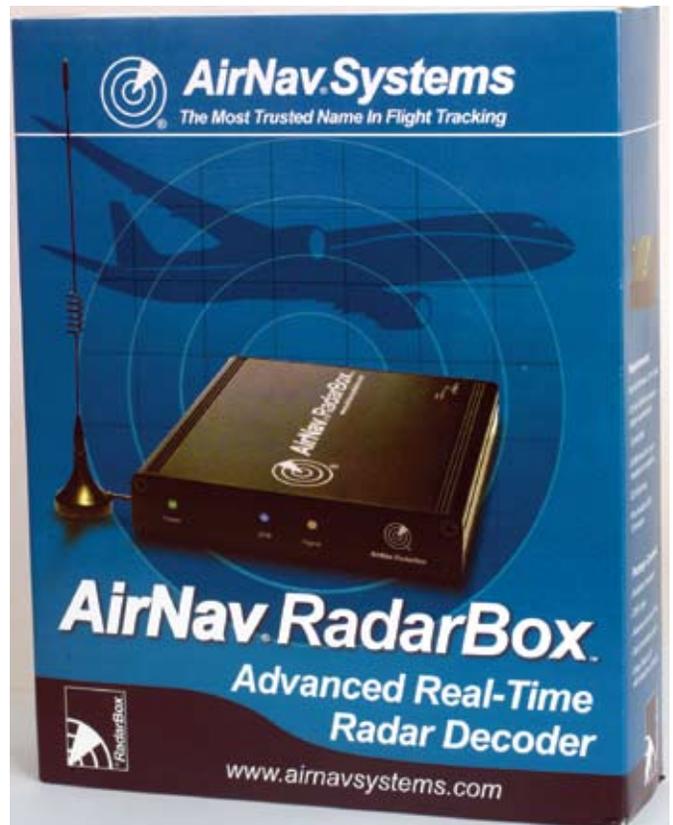
So instead of just "seeing" flights in and around your airport, you can "see" flights in and around the majority of world's major airports.

Data and reports can be exported directly from the system in XML, text and PDF and screen shots/logs can be sent automatically to other AirNav Radar Box users.

Where from, how much

The Australian distributors for the AirNav Radar Box are Hometech Consulting, PO Box 2110, Wattletree Road LPO, East Malvern, Vic 3145.

At time of going to press, (early October), the Australian dollar was in meltdown which made quoting a firm price rather difficult (in just one day the dollar had depreciated more than 4c!). However, Hometech's John Parncutt told us that he would try to hold the price at \$960 for as long as possible, assuming the dollar stayed somewhere close to its present level.



AirNav RadarBox 2009 - [default.m13]

Weather: Airport: DWD Get Weather

Start Time: Airline: Origin: Destination: Airport: Show All: Advanced

MyFlights: Network (170) ScanView AGARS Alerts

Quick Filter: Files: Show All

Changed	Trackid	Status	Mode S	Flight ID	Registration	Aircraft	Altitude	GS	IAS	Hdg	VRate	Squawk	Company	Flying Over	Latitude	Longitude	Dist (N)	
01:16:20	01:11:20	Descend	02020A	3FV372	OH-FRP	SP7A	17573	322	175	-1891	7312	JetView	Alaska	529	22.2	14821	49.6	9197.1
01:16:20	01:11:20	Cruise	02020A	3FV372	TS-81D	A330	34900	145	272	0	6210	Nozair	Saudi Arabia	125	53.1	2017	15.2	4946.1
01:16:20	01:11:20	Check	02020A	UB7247	TS-BJP	A330	32329	194	202	769	1357	Nozair	Austria	141	52.5	2015	51.4	4968.1
01:12:12	01:09:03	Departure	040305	ET-H01	ET-ALD	8763	8676	301	341	303		Qatar Airways	Virginia	120	06.9	14827	46.8	4455.1
01:16:20	01:11:21	Cruise	06A324	Q78804	AF-NCH	A332	43800	179	420	0		Qatar Airways	Saudi Arabia	127	53.2	2017	27.3	4941.1
01:16:20	01:11:20	Cruise	06A324	Q78844	AF-NMA	A335	43800	170	426	0		Qatar Airways	Saudi Arabia	127	53.2	2017	38.3	7011.1
01:16:20	01:11:20	Cruise	06A324	Q78844	AF-NMA	A335	37400	170	426	0	0010		Harland	129	53.7	14827	23.3	4956.1
01:16:20	01:11:20	Cruise	2H114F	B65013	EC-B1Q	A343	34900	158	329	0	4814	British	Algeria	127	31.8	14827	42.9	4979.1
01:16:20	01:11:20	Check	3F3104	BC3072	SC-FPA		36278	439	176	1769	7237	Swire	England	143	51.5	14821	24.3	1223.1
01:16:20	01:11:21	Cruise	3C4952	B82618	D-288	8738	35000	144	195	0	2612	Jet Blue	Germany	149	41.1	2015	46.5	4947.1
01:16:20	01:11:20	Cruise	3C7654	Q48205	D-AGWD	A319	30000	150	318	0		Lufthansa	Germany	149	19.8	2015	09.3	4927.1
01:16:20	01:11:20	Cruise	3C7654	Q48205	D-AGWD	A319	30000	150	318	0		Lufthansa	Germany	149	23.9	2015	03.0	4956.1
01:13:04	01:09:03	Departure	30A521	DJ4145	D-APFA	A343	37600	514	209	0	0023	Lufthansa	Connecticut	144	26.8	14827	09.9	4923.1
01:16:20	01:09:24	Landings	30A618	DU4014	D-AGGK	A343	580	341	329	-1891	6317	Lufthansa	Honshu, Japan	120	45.8	2140	24.5	4389
01:16:20	01:11:20	Cruise	30A618	DJ4093	D-ADGZ	A333	37475	427	520	0	2315	Lufthansa	Netherlands	120	24.4	2014	50.5	4932.1
01:16:20	01:09:04	Check	30K552	DJ4145	D-ADK1	A330	29570	502	375	794	1936	Lufthansa	Connecticut	144	47.8	14827	02.9	4929.1
01:16:20	01:09:03	Cruise	30K618	DJ4285	D-ADPT	A330	32805	439	319	0		Lufthansa	Netherlands	126	36.8	2015	12.5	4930.1
01:16:20	01:11:20	Cruise	40219R	AP-200	W-400	A319	37600	435	347	0	4416	American	Poland	155	44.8	2014	27.4	4942.1
01:16:20	01:09:24	Check	40219R	BAW358	G-BALV	8741	29428	500	326	1182	4605	British Airways	Washington	148	38.6	14821	11.1	4815.1
01:16:20	01:11:21	Cruise	40219R	PCA214D	G-OOOH	8752	30000	154	293	0	3014	First Choice Airways	Germany	149	52.6	2015	19.6	4903.1
01:16:20	01:11:20	Landings	40220D	TC019L	G-OALC	8763	145	320	321	-640	2733	HyTravel Airways	England	150	20.0	14827	15.9	9231.1
01:14:05	01:09:03	Landings	40220D	BC20519	G-OKXJ	8752	1475	296	0	0	2506	DFL Cargo	England	150	49.4	14821	20.1	9201.1
01:16:20	01:11:20	Cruise	400417	TCW14L	G-POLA	8752	36028	187	538	0	4271	Thomas Cook Airways	France	149	36.1	2015	13.3	9170.1
01:16:20	01:09:24	Cruise	400514	TCW12L	G-PCLD	8752	30000	160	314	0	2416	Thomas Cook Airways	Austria	149	43.6	2015	12.7	4964.1
01:16:20	01:11:20	Descend	400467	BC19544	G-B48E	8763	24476	160	376	-5368	4133	DFL Cargo	Germany	148	27.2	2014	47.6	4917.1
01:16:20	01:11:20	Check	40056A	BC30723	G-B48H	8752	33575	545	362	1254	3211	DFL Cargo	England	150	54.8	14827	29.3	9231.1
01:16:20	01:11:20	Cruise	40056A	TCW12L	G-P18D	A330	36000	138	274	0	7614	HyTravel Airways	Germany	149	25.8	2015	08.2	4916.1
01:16:20	01:11:20	Cruise	40050B	PCA122D	G-OOGE	A321	29400	182	320	0		First Choice Airways	Washington	148	38.6	14821	11.1	4815.1
01:16:20	01:11:20	Cruise	400711	TCV95L	G-OKXJ	8752	30000	168	527	1218		Thomas Cook Airways	Netherlands	120	31.2	2014	38.3	4143.1
01:16:20	01:11:20	Cruise	400754	TCF0903	G-VR4E	8752	30000	160	320	0	0236	Monocroft (Britannia Airways)	Italy	149	53.7	2011	11.0	4902.1
01:16:20	01:09:24	Cruise	400776	BAW122	G-VIIV	8772	37600	552	373	0	2301	British Airways	Harland	120	17.4	14827	03.8	4913.1
01:16:20	01:11:20	Landings	400789	PCA161D	G-BTVO	8752	2740	113	208	0	4204	First Choice Airways	Scotland	150	56.2	14827	09.9	9165.1
01:13:04	01:09:03	Landings	400836	NF1932	G-CREY	A1P	16075	0	0	0	0020	Midland Aviation Leasing Services Ltd.	Balkia Pass	81	1	0	0	8735.1
01:14:05	01:09:03	Cruise	40099A	FD4020D	G-OOAW	A330	30000	149	298	0	0220	First Choice Airways	Italy	149	11.6	2011	18.7	4966.1
01:16:20	01:09:24	Landings	400424	EX0000C	G-CBLY	8733	300	125	0	0	5010	Jet2.com	England	150	04.8	14821	26.9	9153.1
01:13:11	01:09:03	Cruise	400428	TCV141L	G-BH13	A321	32805	180	318	0		HyTravel Airways	Netherlands	149	25.8	2014	49.3	4926.1
01:16:20	01:09:24	Landings	400412	EX0000B	G-CBLY	8733	1450	142	248	-432	4074	Jet2.com	Northern Ireland	154	42.8	14820	04.9	9234.1
01:15:05	01:09:03	Landings	400338	EX0000F	G-COLO	8733	3275	155	301	-4216	7412	East Group PLC	Scotland	149	53.1	14820	09.0	9142.1

Altitude: 50000ft
Registration: G-ALPD
Type: Airbus A330-300
C/N: 3061
Flight: G-WS35

Get Flights From/Flights to Network

Hardware: Connected Network: 00:04 to Update 14Hz/2Sec (5) Data: 8047.5 NP1 Str: 294 F

880.20.9.0004 14.9 0P Local Time: 01:15 England Network flight data successfully updated. All Photo/Info Requests Done Live Data at 01:16:51 2008/10/09 UTC

There's an enormous amount of information presented on each flight, from its status, ID, the aircraft type and registration, airline, altitude, heading, vertical rate, squawk, the company flying, where it is at the moment . . . and much more!