

Using an SDR to track planes with ADS-B

The screenshot displays the Virtual Radar SDR interface. The main window shows a map of San Antonio, Texas, with concentric radar range rings centered on the city. Several aircraft are visible on the map, with one highlighted in yellow. The aircraft data panel on the right provides the following information:

N949G
Private
Piper PA-28 181 Archer III
Altitude: 5225 ft Vertical Speed: -1 ft/s Speed: 121.0 kts Heading: 129.0° Distance: 16.58 mi Squawk: 2542 Engines: None Species: None
Wake Turbulence:
Route:
Route not known
www.airport-data.com · www.airlines.net · www.airframes.org
[Show on map](#) · [Disable auto-select](#) · [Submit issue](#)

Tracking 8 aircraft

Silhouette	Flag	Reg.	ICAO	Callsign	Route	Altitude	Speed
		N902BH	AD2425	N902BH		10300 ft	225.0 kts
		N8795J	AC397F	N8795J		5025 ft	114.0 kts
		N949G	AD2F2D	N949G		5225 ft	121.0 kts
		N039FE	AD279A	N039FE		4800 ft	177.0 kts
		6A-7077	ADFFA1	CLE4T2		18025 ft	448.0 kts
		N718DE	AP9A1S	N718DE		6725 ft	145.0 kts
		AB501B	CLE4T1			17925 ft	452.0 kts
		N483DH	ARCAAC	N483DH		4250 ft	201.0 kts

Powered by Virtual Radar Server

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Steps involved

- The Radio
- Make the antenna
- Load the software
- Track planes

But first – ADS-B (from wiki)

Automatic dependent surveillance–

broadcast (ADS-B) is a surveillance technology in which an aircraft determines its position via satellite navigation and periodically broadcasts it, enabling it to be tracked. The information can be received by air traffic control ground stations as a replacement for secondary surveillance radar, as no interrogation signal is needed from the ground. It can also be received by other aircraft to provide situational awareness and allow self-separation. There are several types of certified ADS-B data links, but the most common ones operate at 1090 MHz

The Radio

- This project is based around an RSP1a SDR
- The RSP1A is a 14bit SDR that covers the complete radio spectrum from 1kHz (VLF) to 2GHz (Microwaves) with up to a 10MHz visible bandwidth and the companion SDRuno software has all the popular ham bands and shortwave broadcast bands as “presets” for instant set-up.
- Used on my FTdx101D as a wide band pan adapter with cat control via SDR Uno software
- ADS-B decodes use the SDR Uno API

The Radio

- Available from Ham Radio Outlet

<https://www.hamradio.com/detail.cfm?pid=Ho-015965>



The antenna

- Remember you tech exam?
- $\frac{1}{2}$ Wavelength = $468/\text{frequency in Mhz}$
- $468/1090\text{Mhz} = 0.429358 \text{ ft}$
- $0.429358 \text{ ft} * 12 = 5.152294 \text{ in}$
- $5.152294 \text{ in} * 2.54 = 13.08683 \text{ cm}$
- $13.08683 \text{ cm} / 2 = 6.543413 \text{ cm}$ (length of each portion of the dipole)

- Thanks to Dave Casler (KEoOG)
<https://dcasler.com/home/> for the idea on the antenna.

The antenna

- I used a piece of RG-8x with a connector on the end.
- Strip back 6" of insulation
- Push the shield back over the coax
- Slip a piece of heat shrink over the shield
- Trim center conductor and shield to 6.54cm
- Heat shrink tubing to keep shield in place
- Tube mount is optional



The antenna

- Another view of the antenna, without the mount.



The software (SDR Uno)

- SDR Uno is available at <https://www.sdrplay.com/downloads/>
- This software is the SDR radio interface, and also provides the API used by the next software component (Dump1090).
- If you have an old version of SDR Uno installed, remove it and install the most current copy.

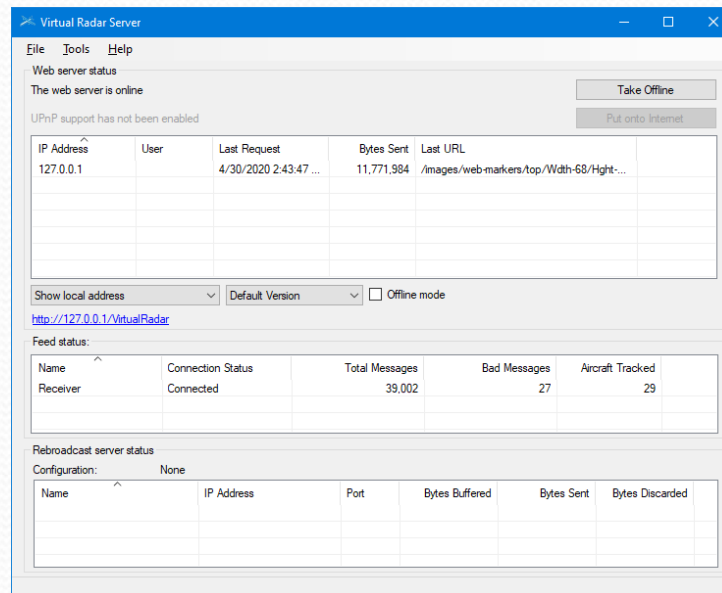
The software (Dump1090)

- Dump1090 from the SDR available at <https://www.sdrplay.com/downloads/>
- This strangely named software takes the ADS-B packets from the SDR, and converts them to text. Below is the output of DUMP1090.

```
CTRL-C to EXIT - v1.46 High Perf Interactive dump1090
Hex  Mode  Sqwk  Flight  Alt  Spd  Hdg  Lat  Long  RSSI  Msgs  Ti-
-----
A5E710 S    2550      8100  156  285  30.422 -98.489 -50.0  9  8
ADFF5F S    4562  COBRA17 11300  429  106      -50.0  39  7
AE003B S    4644  CLEAT1  17925  452  295      -50.0  44 50
ADFFA1 S    4000  CLEAT2  16900  446  274  29.551 -99.386 -50.0  59 20
ADAB45 S    4570  N980BH  10750  263  099  30.126 -98.382 -50.0 1401 0
AC097F S    1200  N875G   5300  119  134  30.151 -98.633 -50.0 1320 0
ADFF5B S    4000  BREW73  14375  498  298      -50.0  75 20
AD2F2D S    2542  N949G   5225  120  126  30.011 -98.544 -50.0 2872 0
A99A15 S    2517  N718DE   6725  145  007  30.257 -98.372 -50.0 3436 0
```

The software (VirtualRadar)

- Download from <http://www.virtualradarserver.co.uk/>
- This software takes the output of Dump1090, and plots it on a “radar” screen.



The software (VirtualRadar)

- Click on the link in the middle of the screen. Be prepared to set your Lat/Long to center the screen in your area.

The screenshot displays the Virtual Radar software interface. The main map shows a radar view centered on San Antonio, Texas, with concentric circles representing the radar's range. Several aircraft are visible on the map, with call signs and altitudes displayed. The right-hand panel provides detailed information for the selected aircraft, N949G, including its type (Piper PA-28 181 Archer III), altitude (5225 ft), speed (121.0 kts), heading (129.0°), distance (16.38 mi), squawk (2542), and engine status (None). Below this, a table lists 8 tracked aircraft with columns for Silhouette, Flag, Reg, ICAO, Callsign, Route, Altitude, and Speed. The aircraft N949G is highlighted in green in the table.

Silhouette	Flag	Reg	ICAO	Callsign	Route	Altitude	Speed
N985BH	AD0445	N985BH				16300 ft	229.0 kts
N875J	AD097F	N875J				8300 ft	114.0 kts
N949G	AD0F2D	N949G				5225 ft	121.0 kts
N939FE	AD079A	N939FE				6800 ft	177.0 kts
69-7077	AD0FA1	CL6A12				18025 ft	448.0 kts
N718DE	A99A15	N718DE				6725 ft	145.0 kts
	AE003B	CL6A11				17925 ft	452.0 kts
N408DH	A4CAAC	N408DH				4250 ft	201.0 kts

Conclusion

- ADS-B is not limited to the RSP1A. Other SDRs can be used.
- RTL-SDR - <https://www.rtl-sdr.com/a-high-performance-rtl-sdr-ads-b-receiver-build-guide/>
- Review of low cost ADS dongles - <http://www.radioforeveryone.com/p/group-ads-b-test-19-dongles.html>