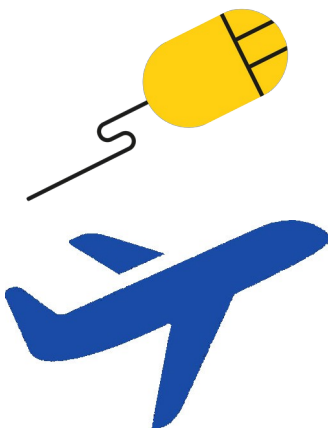
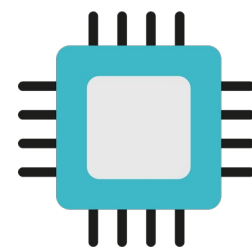
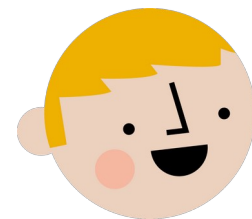
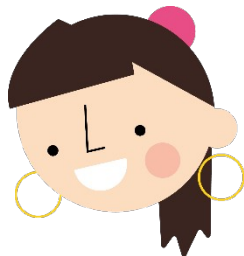


BOGNOR REGIS RASPBERRY JAM

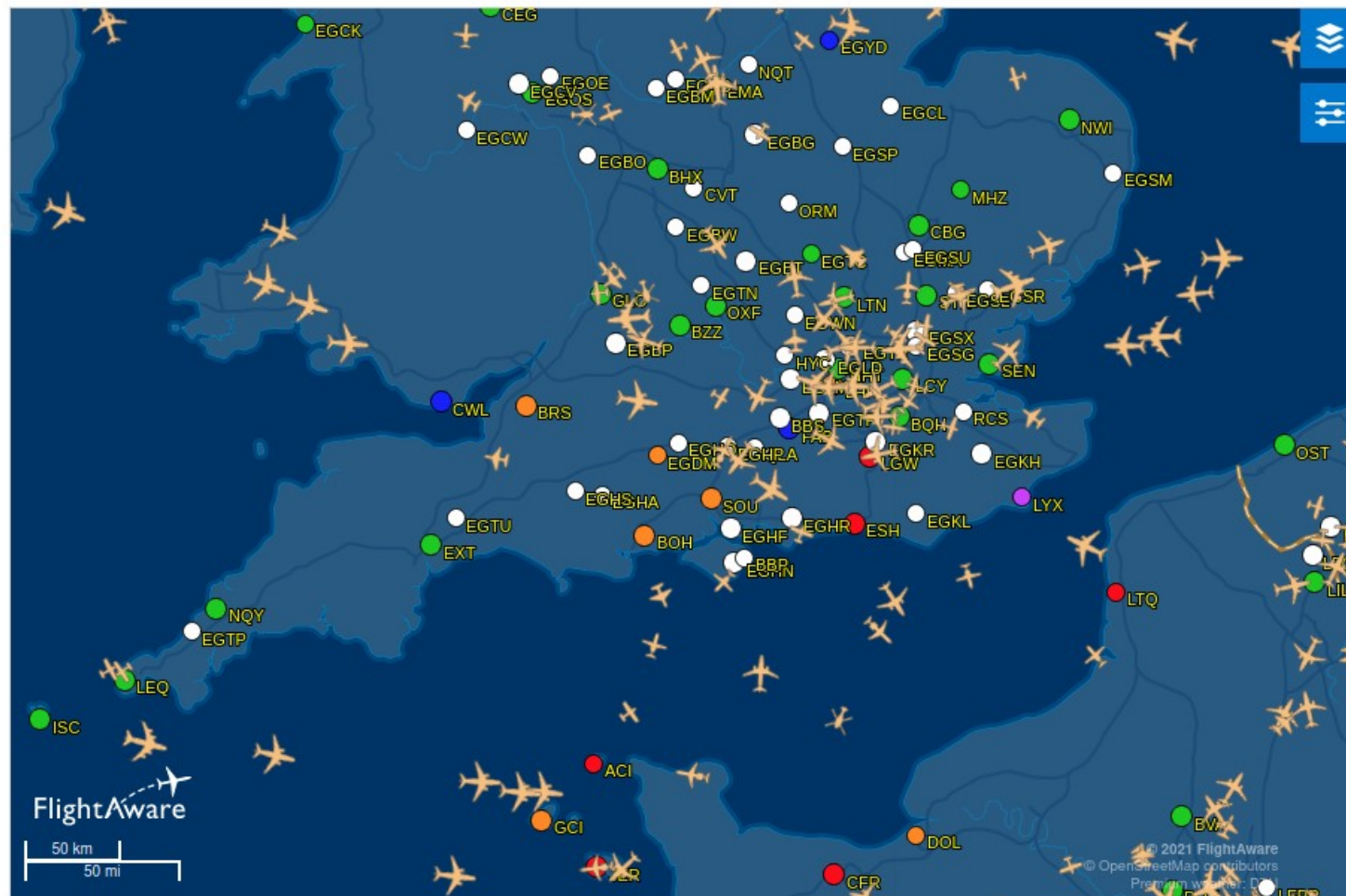


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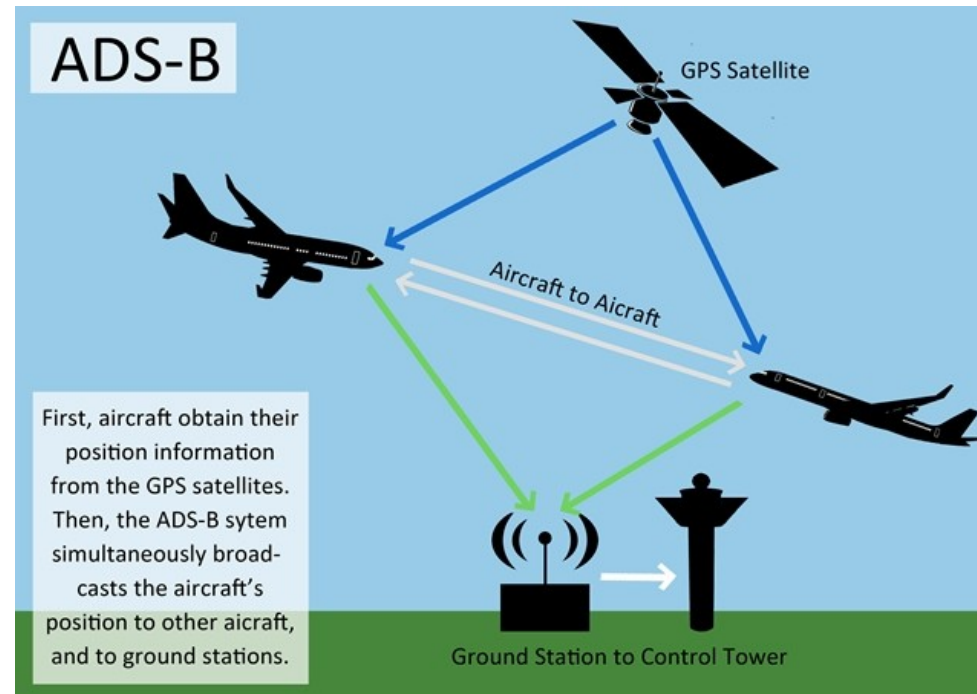
Aircraft Tracking on the Raspberry Pi



Aircraft Tracking on the Raspberry Pi

What's it all About?

- Almost all aircraft transmit position information using a system called ADS-B.
- The signal can be picked up and then transferred to a Raspberry Pi for decoding and displaying on your computer.
- *Q: What does ADS-B stand for!?*



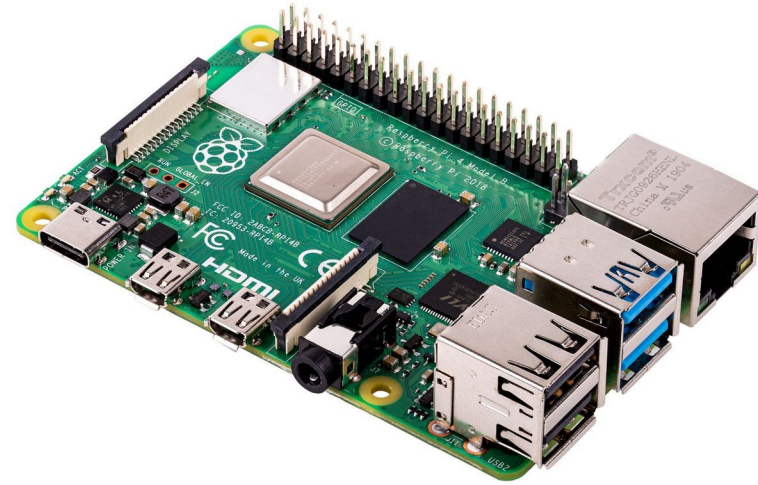
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Aircraft Tracking on the Raspberry Pi

You will need...

- A Raspberry Pi 2 / 3 / 4 (B or B+) with power supply.
- An Internet connection (cable or wifi).
- A micro SD card (8GB+) with operating system.



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Aircraft Tracking on the Raspberry Pi

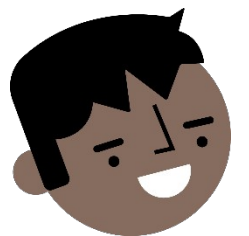
You will also need...

- USB SDR (Software Defined Radio) adapter (aka 'dongle' or 'stick').
- Antenna.
- FlightAware software package.
- FlightAware account (free).

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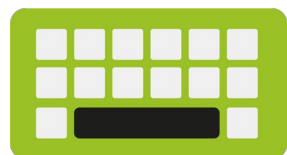
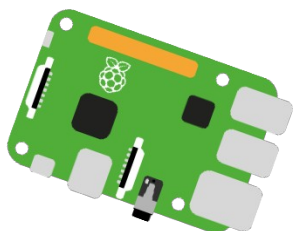
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Aircraft Tracking on the Raspberry Pi



You'll need an SDR Dongle

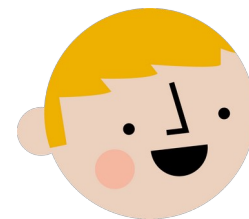
- Generic – approx. £16
- Rtl-sdr v.3 – approx. £25
- ProStick (Pi Hut, Moonraker) – £21-£25



Make sure the dongle uses the RTL2832U chip

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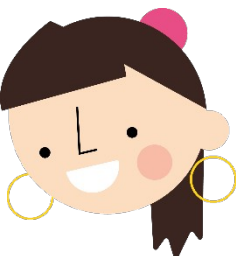
rtl-sdr.com v.3



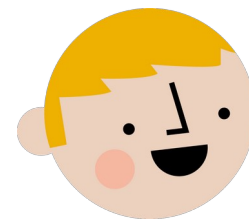
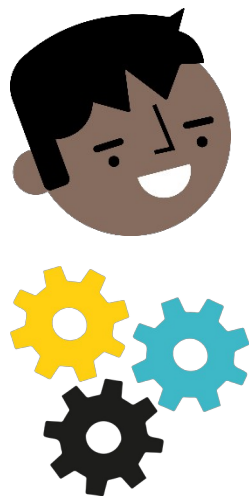
ProStick



Generic



Aircraft Tracking on the Raspberry Pi



Buy a dongle...

Available from:

- Amazon
- Ebay
- Specialist shops
- RTL-SDR and FlightAware stores:

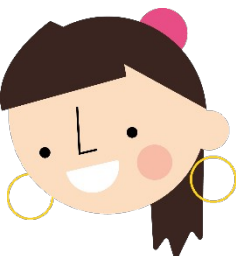
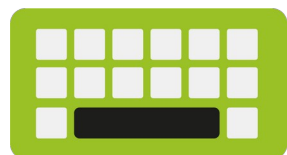
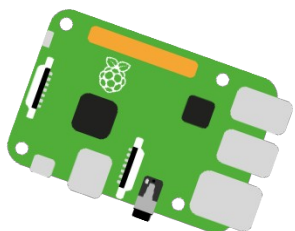
<https://www.rtl-sdr.com/buy-rtl-sdr-dvb-t-dongles/>

- <https://flightaware.com/adsb/prostick/>
- Search for "RTL-SDR"

See the additional notes at the end of this presentation

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rtl-sdr.com v.3



ProStick



Generic

Aircraft Tracking on the Raspberry Pi

You'll need an antenna

- Generic SDR sticks often come with an antenna.
 - but it's the wrong length for ADS-B.
 - we can fix that! – see Appendix.

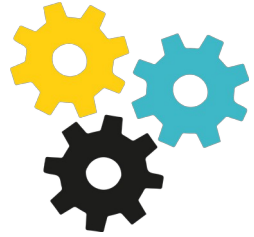
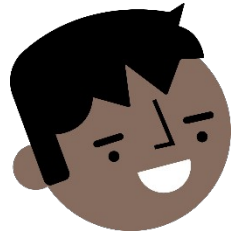


- You can buy a basic antenna kit ("RTL-SDR antenna kit") for about £18.

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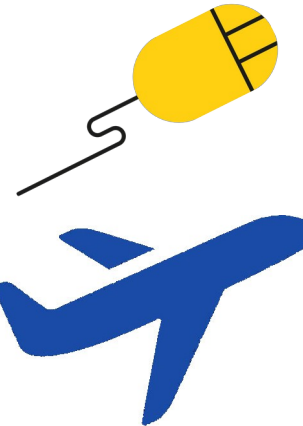
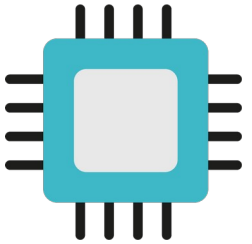
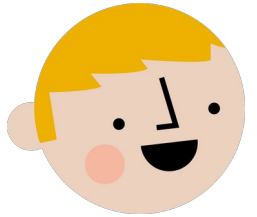
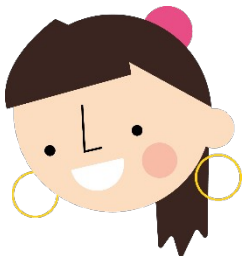
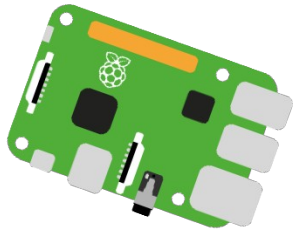
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Aircraft Tracking on the Raspberry Pi



Antenna Kit in Use

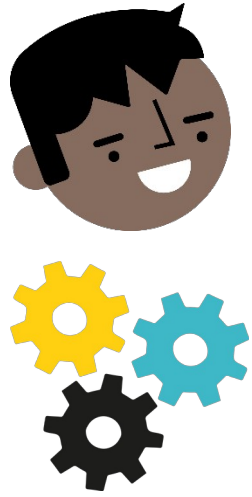
- Short telescopic parts used fully closed – this makes them ~68mm long.
- Trees!



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Aircraft Tracking on the Raspberry Pi

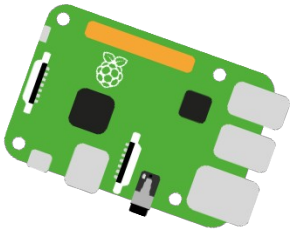
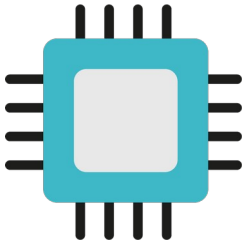
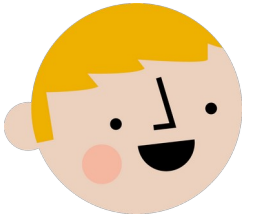


Wavelength

- Wavelength = Speed of light / frequency
- Speed of light = 299,792,458m/s
- ADS-B frequency = 1090MHz = 1090,000,000Hz
- ADS-B Wavelength = $299792458 / 1090000000 = 0.275\text{m} = 27.5\text{cm} = 275\text{mm}$
- $\frac{1}{2}$ wavelength = 137.5mm $\frac{1}{4}$ **wavelength = 68.75mm**
- *Idea: Write a program to calculate wavelengths from given frequency!*

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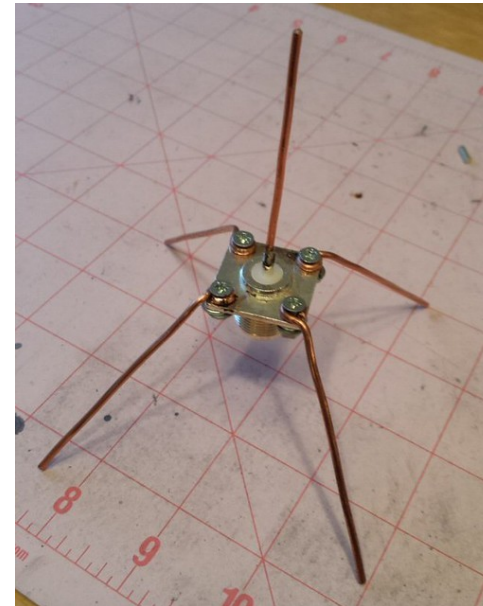


Aircraft Tracking on the Raspberry Pi

You'll need an antenna - make your own...



Cantenna

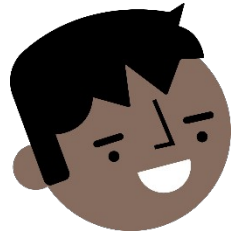


Spider

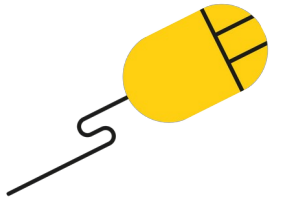
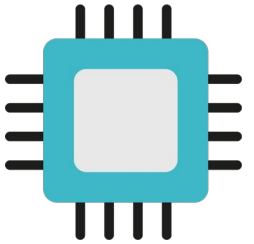
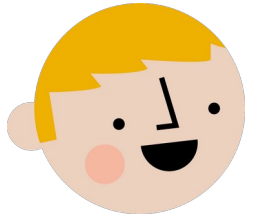
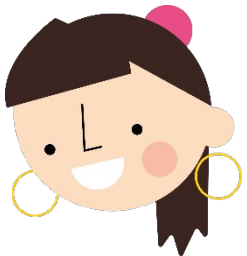
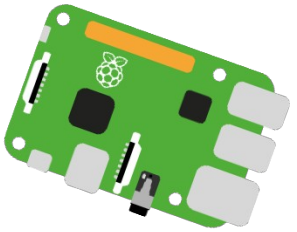
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Aircraft Tracking on the Raspberry Pi



Make your own...



Spider

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Aircraft Tracking on the Raspberry Pi

FlightAware Software

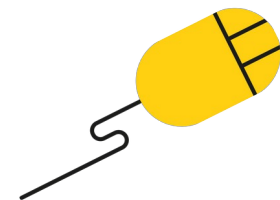
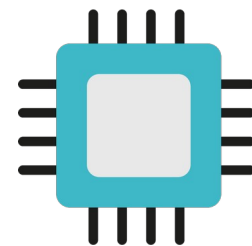
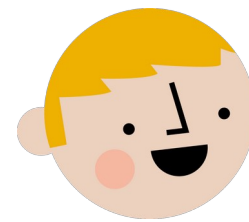
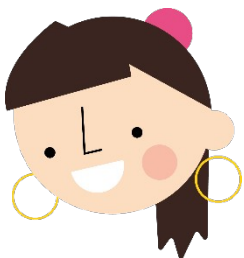
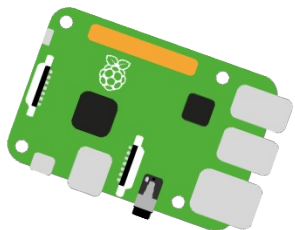
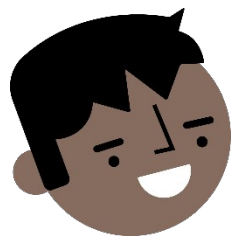
- Follow the instructions at:

<https://uk.flightaware.com/adsb/piaware/build>

Or see the third-party instructions at:

<https://discussions.flightaware.com/t/install-piaware-5-0-on-x86-64-machines-and-rpi-armv7l-aarch64/74699>

You can also use a full Raspberry Pi OS image with PiAware preinstalled (requires a blank microSD card) – see the Appendix.



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Aircraft Tracking on the Raspberry Pi

FlightAware Account

- Instructions are on the PiAware setup Web page.

5 Claim your PiAware client on FlightAware.com

You should wait about four or five minutes for your PiAware to start and then you can associate your FlightAware account with your PiAware device to receive all the benefits.

Once your device is running, please:

Look up the IP address in your router admin and go to the assigned IP address in a browser on the same network. If the device hasn't been claimed a link to claim the PiAware device will display.

Or

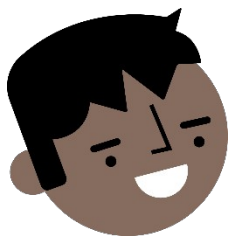
[Claim your PiAware client on FlightAware.com](#)

If after 5 minutes your device hasn't displayed as claimed try restarting the device, if that still doesn't work re-confirm the Wi-Fi settings (if using Wi-Fi) are correct. Lastly contact us at ADSBSupport@FlightAware.com. Check your stats page (link below) to confirm it was claimed.

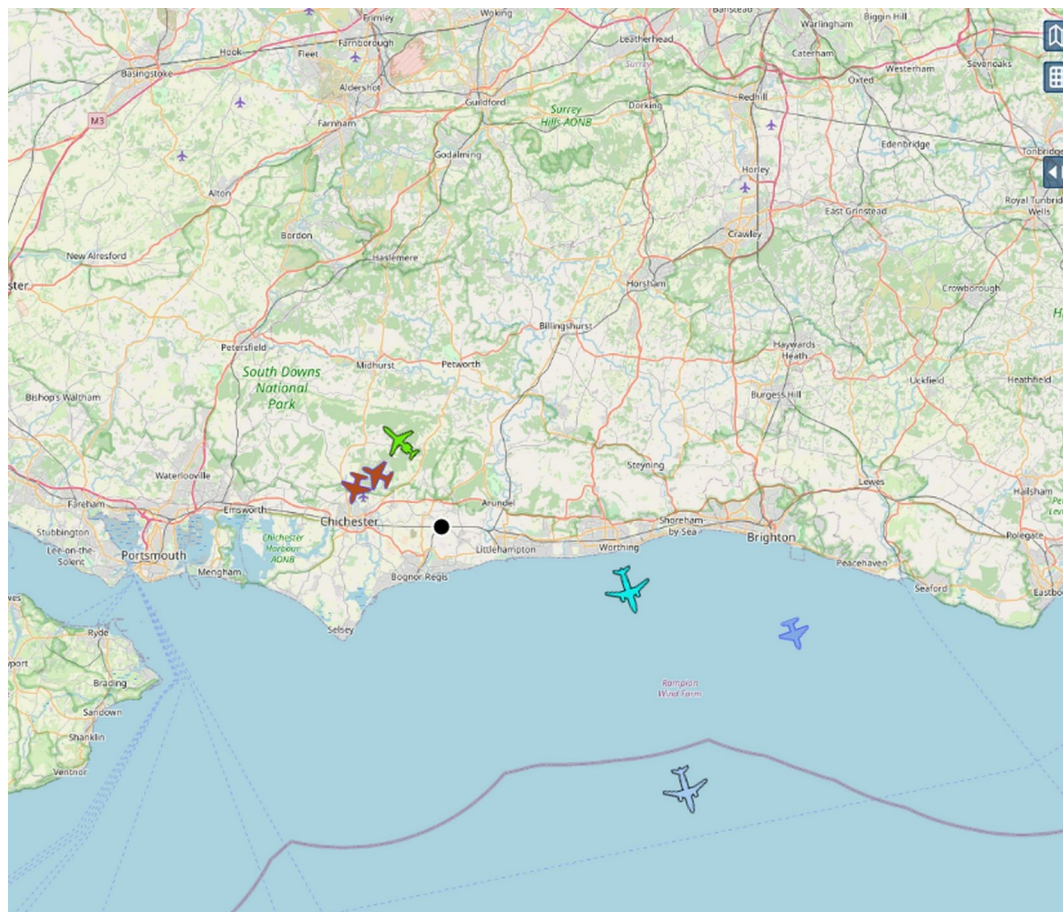
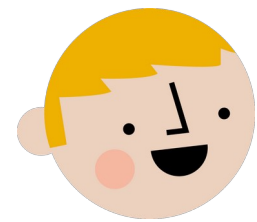
6 View your ADS-B statistics

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Aircraft Tracking on the Raspberry Pi



Go to My ADS-B Statistics Page SkyAware 6.0~dev

Total Aircraft: 8
With Positions: 6
Position History: 410

ADS-B Message Rate: 12.6/sec
UAT Message Rate: 0.0/sec

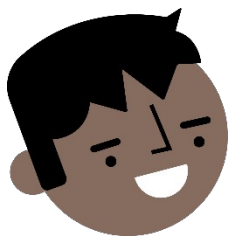
Filters (0 Enabled) Select Columns

ICAO	Ident	Squawk	Altitude (ft)	Speed (kt)	Distance (NM)	Heading	Msgs
406E77	GSDTL		625	73	4.8	294°	1400
4016A5	GATXA		25 ▼	60	5.4	195°	727
407538	VCG1EG	1425	7,000	234	5.5	312°	639
345116	VLG75FD	0530	17,250 ▲	358	11.4	162°	344
44083F	EJU98CG	2044	23,325 ▲	376	20.7	163°	1514
3B75ED	CTM2050	6353	24,000	308	21.3	160°	164
4CAA59	EI-EVT	5212		438		161°	30
3CC1DB	D-CASH						5

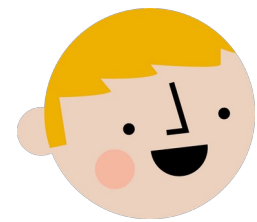
☒ ADS-B ☒ UAT ☐ MLAT ☐ Other ☐ TIS-B

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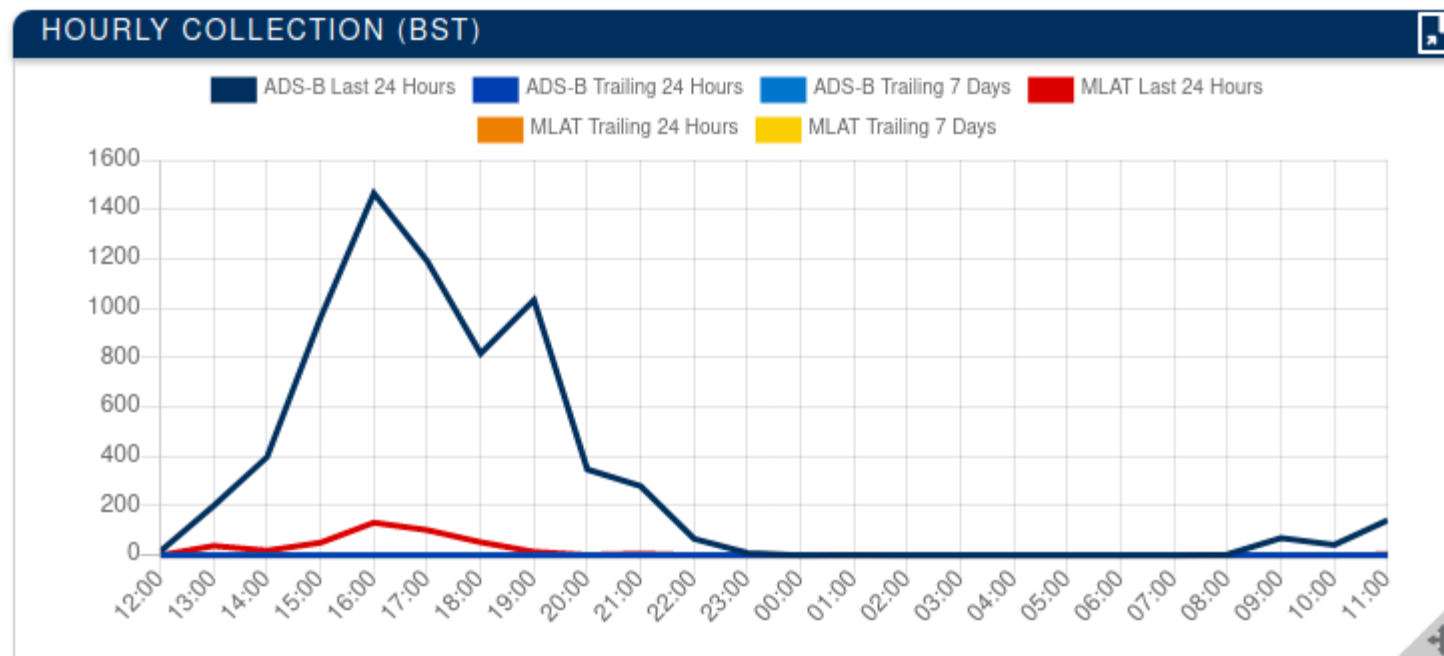
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FlightAware Account

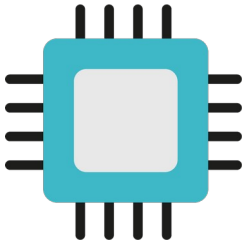
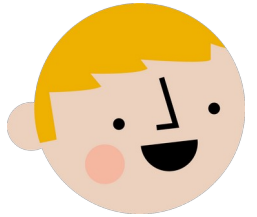
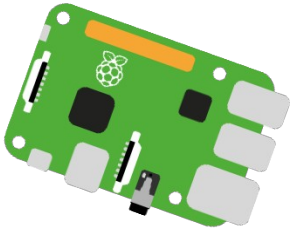
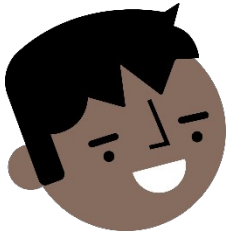


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Any Questions?



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Thank you!

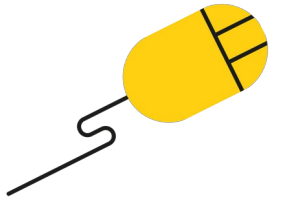
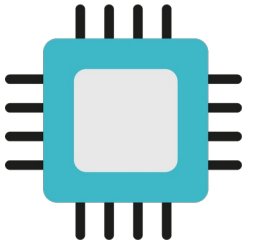
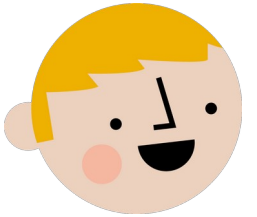
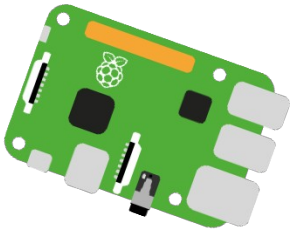
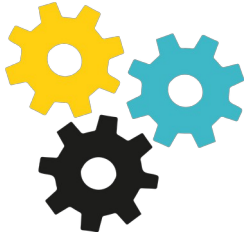
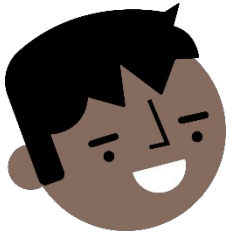
Nigel Kendrick (Twitter: @linker3000)

You'll find a copy of this presentation at:

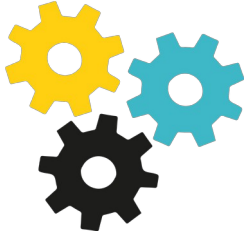
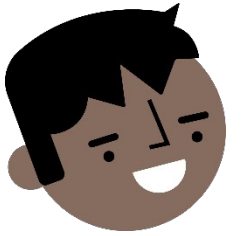
<https://github.com/linker3000/Raspberry-Pi-Jams>

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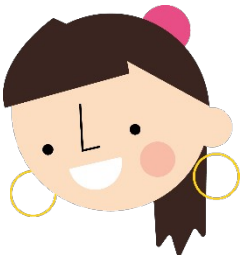
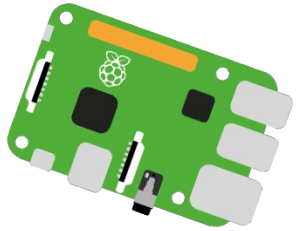
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Appendix

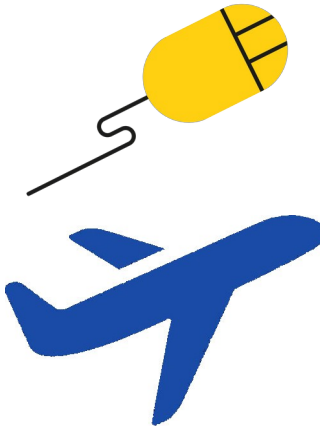
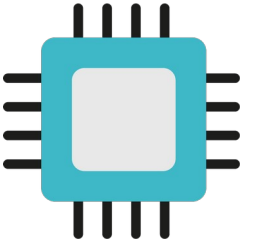
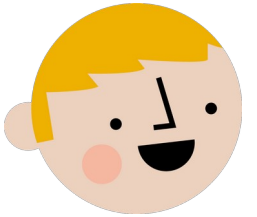
Things to help you get started!

- Modifying a DVB-T antenna
 - Making your own antenna
 - Antenna connector adapter
 - Additional resources
- *ADS-B = Automatic Dependent Surveillance-Broadcast*



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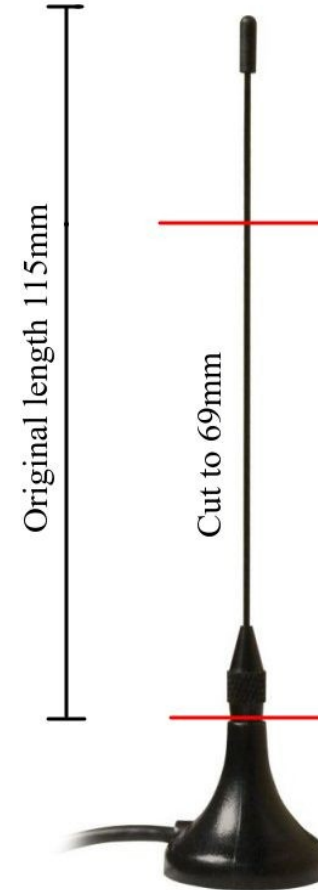
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Modifying a DVB-T antenna

- Antenna length is optimised for Digital TV (DVB-T).
- ADS-B is transmitted at a different frequency.
- Cut antenna to 69mm.

Take care when cutting the antenna:

- The metal is sharp and quite hard.
 - If using snips, the bit being removed can fly off.
 - Ask an adult to perform the operation ...or just buy an antenna kit!
- After the antenna is cut, it's no longer the right length for digital TV!*



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Making your own antenna...

- Check out some handy sites:

<https://lucsmall.com/2017/02/06/making-antennas-for-1090mhz-ads-b-aircraft-tracking/>

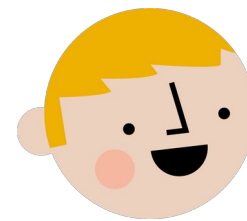
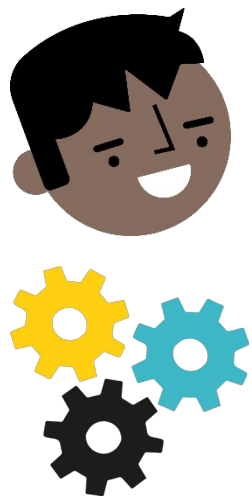
- <https://discussions.flightaware.com/t/three-easy-diy-antennas-for-beginners/16348/3>

- Radio frequency connectors come in many sizes and are not easy to fit onto cable – you may require assistance.
- The UK ADS-B system operates at 1090MHz. You might see references to 978MHz, but that frequency is not used in the UK, so you don't need to follow any instructions to enable support for it.

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Aircraft Tracking on the Raspberry Pi



You might need a connector adapter

- Most generic DVB-T SDR dongles (blue dongle on the far right) are fitted with a connector type called MCX
- Most antenna kits come with SMA connectors (like the first two dongles in the picture)
- For dongles with MCX connectors you need an adapter!
- Search eBay (or your favourite store site) for:

“sma female mcx male”

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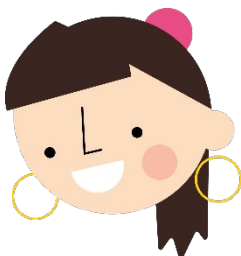
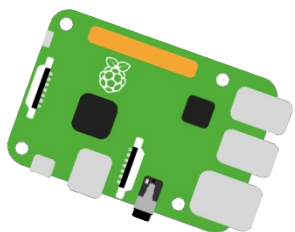
rtl-sdr.com v.3



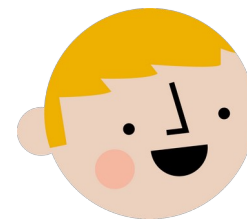
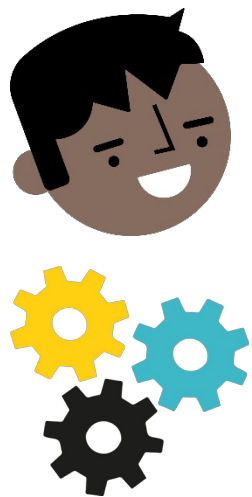
ProStick



Generic

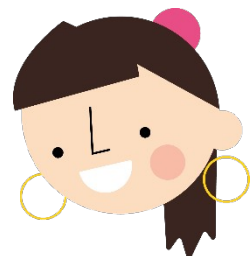
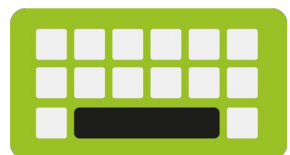
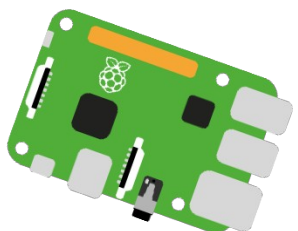


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You might need a connector adapter

- Example (below). A pigtail lead puts less stress on the dongle's MCX connector...



Free postage



MCX SMA

MCX Right Angle Male to SMA Female Bulkhead mount - RG316 Pigtail
- UK Seller

★★★★★ 2 product ratings

Condition: New

Quantity: More than 10 available
267 sold / [See Feedback](#)

Price: £3.95

Buy it now


Add to basket

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You might need a connector adapter

- ...but you can get a straight adapter if you wish...

MCX

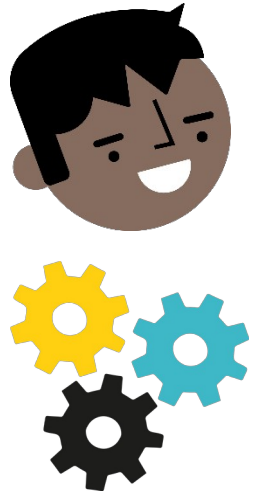


SMA

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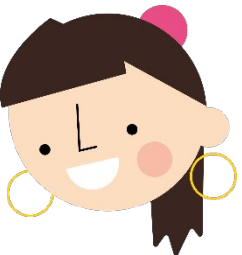
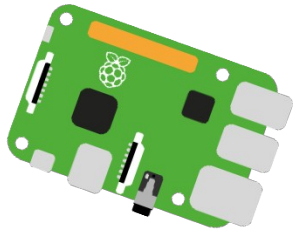
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Aircraft Tracking on the Raspberry Pi



PiAware Image

- A complete Raspberry Pi OS installation image with PiAware preinstalled.
- Follow instructions at:
- <https://discussions.flightaware.com/t/how-to-install-and-configure-piaware-5-0-sd-card-image-quickstart-guide/48262>



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