



# ADS-B Flight Tracking

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Chicago FM Club



Total Aircraft: 61

Messages: 373.1/sec

With Position: 55

History: 5030 positions

Stats available [here](#)

Search:

Jump to Airport or Latitude, Longitude:

	Callsign	Route	Type	Squawk	Alt. (ft)	Spd. (kt)	Dist. (nmi)	RSSI
	LRC630	SJO-GUA-ORD	A20N	1727	▼ 6275	307	2.6	-8.0
	GTI8245	?? EHU-ANC	B748	7210	▼ 3650	171	3.6	-16.1
	N46VE		CL30	3725	3000	162	4.8	-8.4
	UAL959	LHR-ORD	B763	2574	▼ 3400	175	5.1	-16.9
	EJA965		C68A	3606	▼ 1425	100	5.6	-24.1
	AAL2644	LGA-ORD	B738	3351	3975	165	5.9	-23.7
	SKW5912	LNK-ORD	CRJ2	3656	▼ 2925	165	6.5	-11.8
	AAL2590	SNA-ORD	B38M	2053	▼ 1850	143	6.8	-21.6
	ENY3902	ORD-SYR-ORD	E75L	1442	▼ 2125	160	7.0	-23.5
	RPA3619	GSP-ORD	E75L	5776	▼ 5500	198	7.5	-26.5
	ENY4174	SGF-ORD	E170		▼ 1900	146	7.9	-28.6
	N900CY		TBM9	4115	26000	287	8.7	-14.7
	RPA3485	CVG-ORD	E75L	6727	4000	206	9.3	-24.7
	ANA8402	NRT-ORD	B77L	0576	5000	196	10.1	-20.8
	SWA4745	MDW-PVD	B737	3256	▲ 2300	238	10.1	-26.3
	SWA653	DAL-MDW	B738		3000	194	10.6	-25.1
	VTE3548	TBN-ORD	CRJ2	2121	5000	257	10.8	-24.1
	DAL1544	MSP-ORD	BCS1	3071	▼ 5050	307	11.2	-25.9
	ENY3600	ORD-YUL-ORD	E75L		7000	256	11.9	-20.2
	N109TD		C56X	2461	36000	404	13.4	-23.5

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- How does it work?
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- What can I do next?

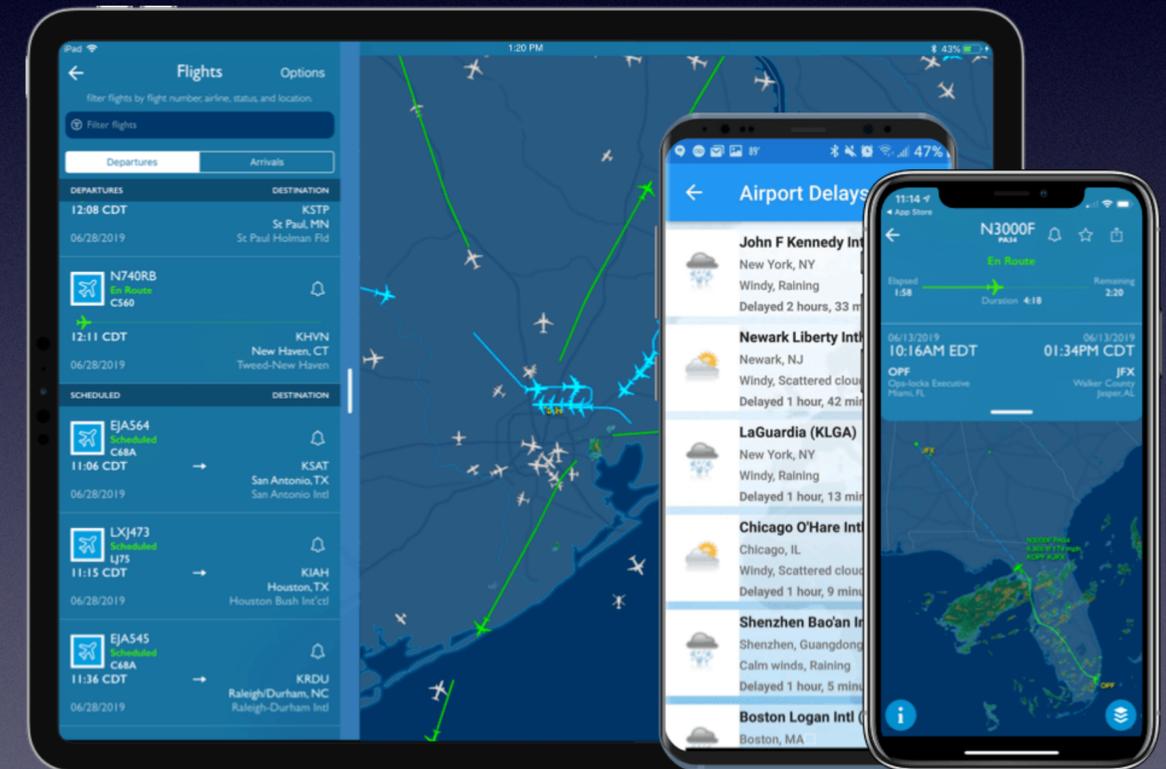
# What can I see?

- Callsign / operator / aircraft registration
  - Airline ICAO code then flight number (usually)
  - Charter flights not predictable
  - General aviation uses “tail” (registration) number
- Airplane type
  - B38M = Boeing 737-8 MAX
  - [Unfamiliar? Search here](#)
- Route (maybe)
- Altitude / speed / heading
- Distance from you
- ADS-B hex identifier / “squawk” code
  - Hex identifier doesn’t change, can view airplane history
  - Squawk code changes every flight

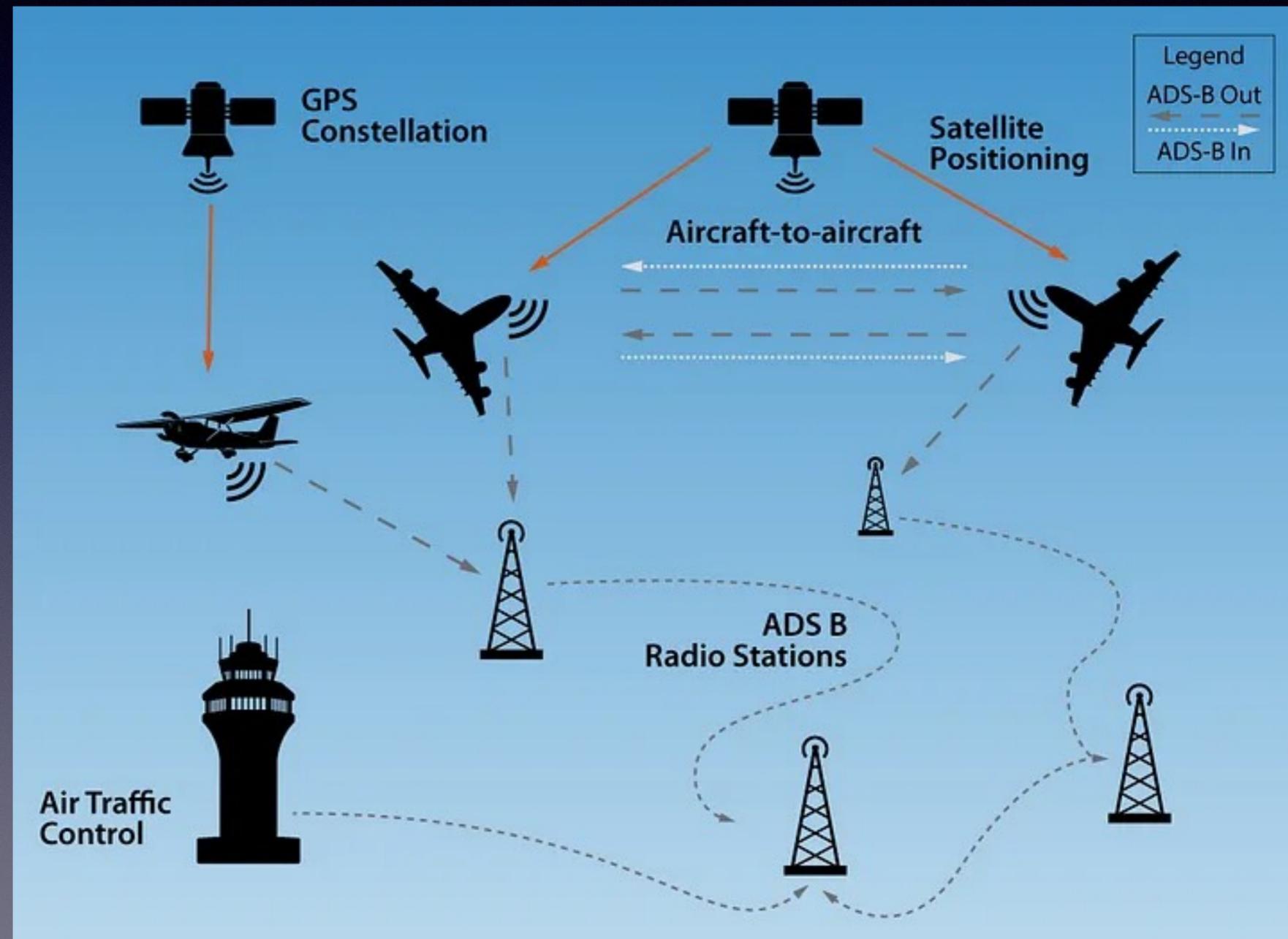


# Why would I do this?

- Aviation enthusiast
  - See “hidden” planes
- Curious about what is flying over your house
  - Free subscription to sites/apps (FlightRadar24, Flightaware, etc.) that you feed with your data
- Fun radio project
  - UHF line-of-sight propagation principles
  - Think of it as another digital mode that you can decode
- Have most of the parts sitting around already (Pi, SDR)
  - It's a great way to put that gear to another use



# ADS-B: Automatic Dependent Surveillance - Broadcast



Mandatory in the US since 2020

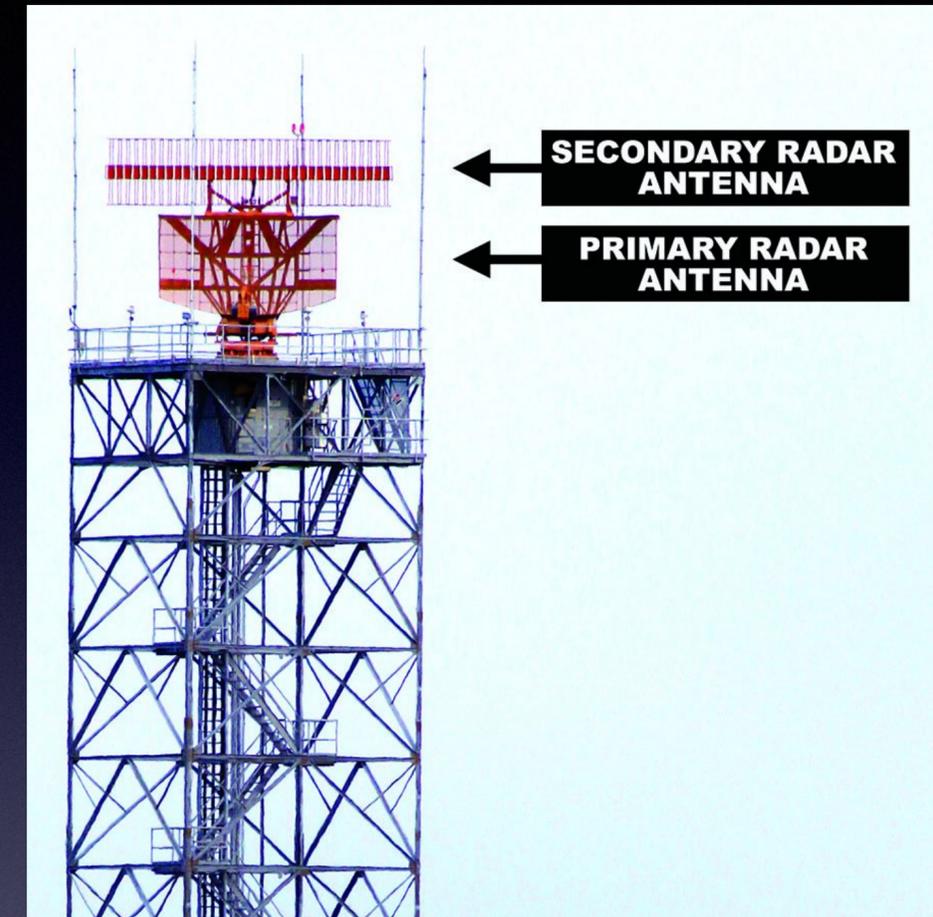
with a few exceptions

1090 MHz  
(large airplanes)

978 MHz  
(small/general aviation)

# History Lesson

- How did planes report their position prior to ADS-B?
  - They didn't — they were interrogated by ATC by a process called *secondary surveillance radar* (SSR)
  - Ground radar sends (*primary & secondary*) → Aircraft transponder receives (*Mode S or Mode C, 1030 MHz*) → Aircraft replies with transponder code & altitude (*1090 MHz*) → Collated by radar system and displayed to controller
- This is kept around as a backup to ADS-B
  - We can still receive these signals from Mode S transponders, and using **multilateration** (MLAT), identify their location using other participating receivers nearby



# 1090 vs 978

- What's the difference?
  - Aircraft transponders replied on **1090 MHz** prior to ADS-B, so the FAA reused the existing frequency
    - This is sometimes called **1090ES**
    - **Focus your efforts here**, it will be way more interesting than 978
  - Concerns about frequency congestion drove the need for **978 MHz** (also called **978 UAT**) for smaller/general aviation aircraft
    - Aircraft with 978 are not allowed outside of the US, or above 18,000 ft.
    - If you live near a small airport, consider running both 1090 & 978



# What do I need?

- **Raspberry Pi** (or Orange Pi, or similar) ~\$50-75
  - Best price/value points to Pi 4 at this point
    - 1 or 2 GB of ram is fine, any more is overkill
    - 512 MB is possible but with limits in number of sites to feed
- **Power supply** (get the branded one)
- **microSD card**
  - Buy a name-brand **endurance** model
  - Storage needs are low (32-64 GB is plenty)
- **A case**, or 3D print one in PETG!
- *Maybe:* **Wifi power plug**, if it's in a remote location



# What do I need?

- **USB SDR adapter** ~\$40
  - Some come with filter/LNA, some do not
  - If you want to run both 1090 & 978, you will need one SDR for each band

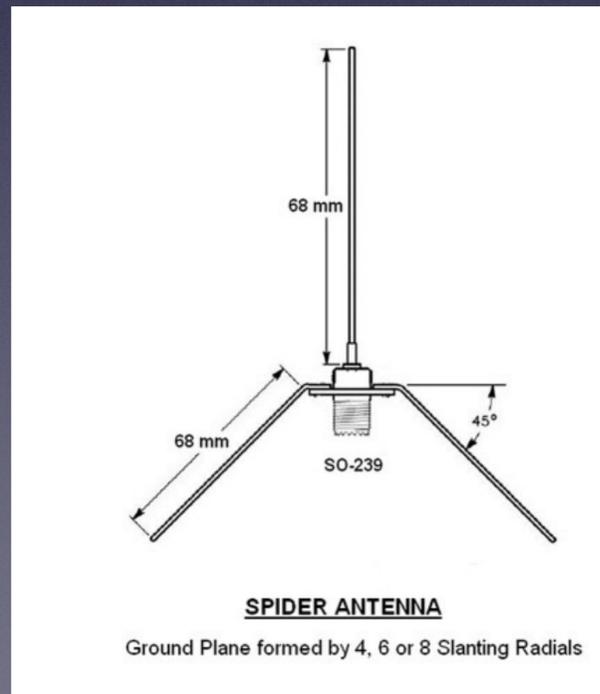


## Supported Software Defined Radios (SDRs)

- Airspy Mini (expensive, but by far the best supported SDR for ADS-B/1090MHz)
- NoName Chinese 1090MHz SDR (directly from AliExpress, also comes in various branded versions like airplanes.live, airframes.io, ADSBexchange) -- this is a fairly good RTL SDR with 1090MHz filter and a low noise amplifier - and it's in a blue metal housing which really helps with heat dissipation and longevity
- Rtl-Sdr.com v3 and v4 dongle (it appears that the v3 is slightly better for ADS-B use cases)
- FlightAware pro stick (includes 1090MHz filter and a low noise amplifier - because of the plastic housing I prefer the one above)
- RadarBox green stick (includes 1090MHz filter and a low noise amplifier - this appears to be slightly lower quality than the ones above)
- RadarBox red stick (includes 978MHz filter and a low noise amplifier -- for UAT978)
- Nooelec NESDR SMARt and SMARtTee
- Most other RTL2838 based USB sticks should work
- SDRplay RSP1a and RSP1b - other models might work as well

# What do I need?

- **Antenna** – outdoors, if possible, mounted as high as you can ~\$50
  - Consider obstacles: even a small increase in height can dramatically increase range
    - Check with [heywhatsthat.com](http://heywhatsthat.com), but doesn't know about buildings
  - Type-N connector (*antenna*) → SMA (*USB SDR*)
- Common antennas for ADS-B:
  - Quarter-wave ground plane (spider)
  - Colinear antenna

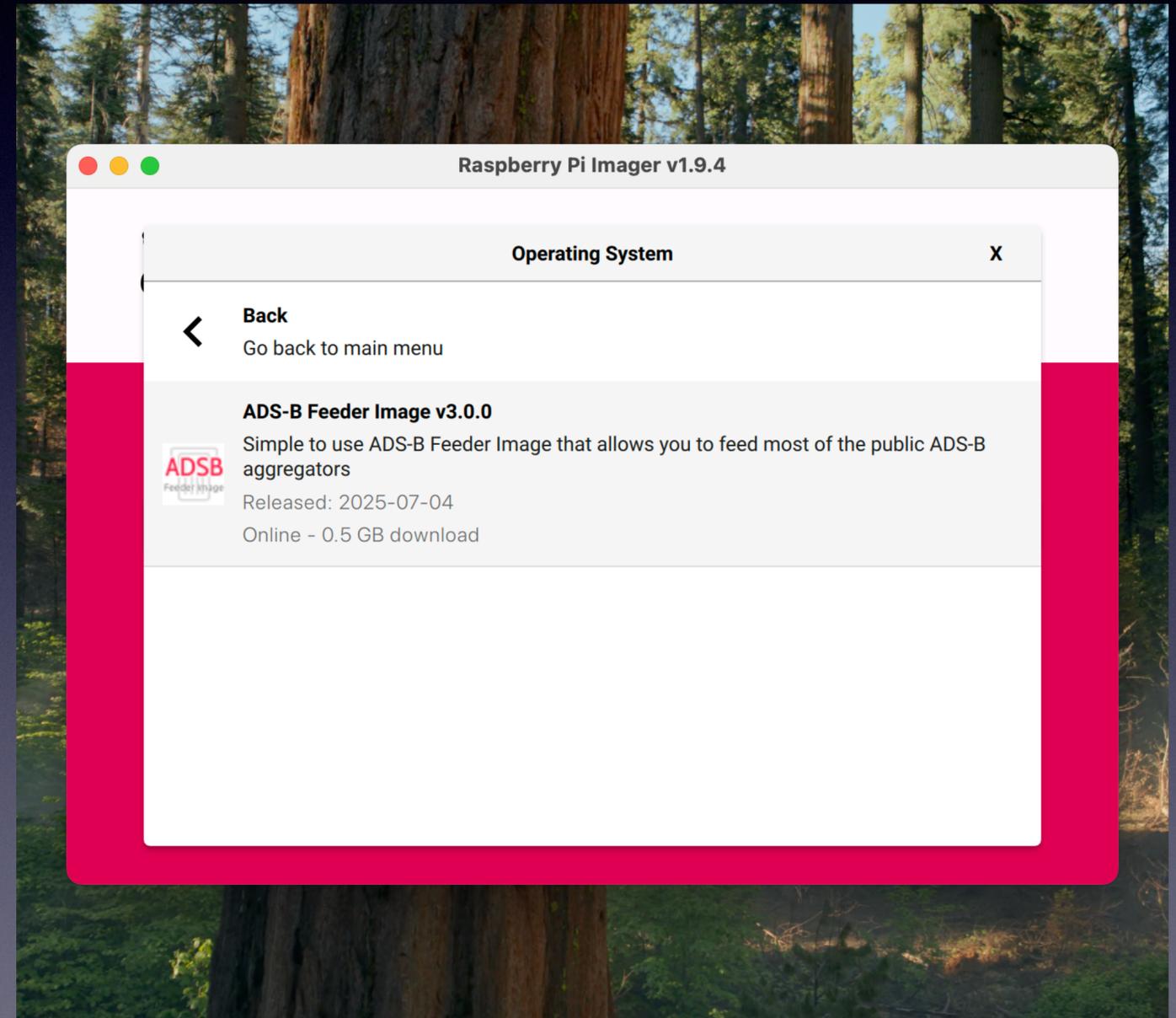


# How to install

- Pick your feeder image
  - **PiAware**
    - *Easy, but only because of limited configuration*
      - Directly supports FlightAware, but can support anything with more work & terminal access
    - Even if you don't use the PiAware image, their forums are great
  - **ADSB.im**
    - *My recommendation*
    - Allows you to feed numerous sites at once, easy install, has a web-based interface, no terminal/ssh needed (unless you like that sort of thing...)

# How to install

- Use the Raspberry Pi Imager to copy the image to your micro SD card
- ADSB.im is built into the Pi imager
  - “Other specific-purpose OS” → “ADSB Feeder Image”
  - You can either set up wifi in the imager, or if you don’t, it will create a hotspot that you can connect to & share wifi credentials
    - SSID: *adsb-im.feeder*
  - <https://adsb.im/howto>



# How to install

- For ADSB.im:
  - Try <http://adsb-feeder.local/>
  - Connect to its hotspot if you didn't configure wifi
- Once you connect to the website, you will need:
  - Latitude
  - Longitude
  - Altitude of antenna
  - <https://www.mapcoordinates.net>

ADSB Feeder [LIVE MAP](#) Setup ▾ System ▾

## Setup required parameters

If you are new to the ADS-B Feeder Image, please fill out the data below. You can use the [location and elevation finder tool](#) to find your Latitude, Longitude, and Altitude based on your address.

If you are setting up a **stage 2** feeder to connect with already running micro feeder(s), indicate this below and fill out the data here for the position you want to be the center of your combined map display.

If you re-installed the ADS-B Feeder Image and have made a backup of your configuration, you can also simply restore those settings [RESTORE PREVIOUS BACKUP](#)

Station Name (shows up on public maps if enabled later)

Latitude (-90 .. +90 – please use 5 decimals, e.g. 45.12345)

Longitude (-180 .. +180 – please use 5 decimals , e.g. -122.12345)

Altitude above mean sealevel, rounded to whole meters

Timezone [UPDATE TIMEZONE](#)

Which [semi-anonymous](#) aggregators do you want to feed? (Stage 2 setup unsupported with 907 MB of memory (1800 MB required))  
 All  Aggregators with privacy policy  Pick individually  None (micro feeder)  Stage 2 setup (select these later)

[SUBMIT](#)

# How to install

- Feeders upload your data to commercial/enthusiast flight tracking sites, which combine your data with all participating users
  - *Commercial:* [FlightRadar24](#), [FlightAware](#), [AirNav Radar](#), etc.
    - **These sites will give you the highest-tier membership** in exchange for feeding your data.
    - **An account is required** so they can update your profile, or associate it with a sharing key that you load into your feeder
  - *Enthusiast:* [ADSBExchange](#), [ADSB.fi](#), [OpenSky Network](#), etc.
    - **Typically, no account is required**, although some do require one
    - Some sites have geographic restrictions

ADS-B Feeder   Maps ▾  Data Sharing  Setup ▾

## Data Sharing Setup

[APPLY SETTINGS - TAKE ME TO THE WEBSITE](#)

Enable privacy flag (ON = your site won't be visible at all on public aggregator maps – OFF = your site will be visible at an approximate location.)

Enable MLAT (for selected aggregators supporting MLAT)

Select the account-less ADS-B aggregators you want to feed:

adsb.lol     Fly Italy ADSB     AVDelphi     planespotters.net     TheAirTraffic.com     adsb.fi

HPRadar     airplanes.live     ADSBExchange

[SHOW UUIDS](#)

Select the account based ADS-B aggregators you want to feed:

flightradar24

Enter your two FR24 sharing keys (first one for ADS-B/1090, second one for UAT). For either or both of the fields you can also enter your email address and the feeder will request the corresponding key for you. Please note that requesting a feeder key by entering an email will fail if you already have three feeders associated with that email address. In that case you will need to email FR24 support and request that they manually add another key for you (or simply use a different email address).

# What's next?

- Optimize!
  - Reconsider antenna placement?
  - Consider a filter or LNA? - [Shopping list](#)
- Add 978 UAT tracking?
  - Will need another SDR, maybe another antenna
- Add other stations and combine them?
  - [ADSB.im "stage 2" setup](#)
- Other aviation related things that are not flight tracking?
  - [ACARS decoding?](#)
  - [VHF Data Link \(VDL2\)/HF data link decoding?](#)
- [AIS tracking \(marine/ships\)?](#)
- [External access with Zerotier](#)



**Questions?**