



BUILDING AN ADS-B RECEIVER

BARC TECH NIGHT

FEBRUARY 17, 2026

JOHN WESTERKAMP, W8LRJ

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- Always interested in radio and have always been a SWL
- Extra Class Operator and BARC Member since April 2018
- Manage the BARC repeaters and networks

- Bachelor of Electrical Engineering from University of Dayton
- Ph.D. in Electrical Engineering from Purdue University
- Specialized in Digital Signal Processing/Communications
- Electrical Engineering Faculty at U.D. for 17 years
- Computers and Networking for 10 years
- Retired and enjoying a great hobby

- **LRJ stands for Lori, Rachel, and Jacob (wife and two kids)**
- Nephew is Jordan Westerkamp, football player University of Nebraska



WHAT IS ADS-B?



- **Automatic Dependent Surveillance–Broadcast (ADS-B)** is an aviation surveillance technology in which an aircraft determines its position via satellite navigation or other sensors and periodically broadcasts its position and other related data, enabling it to be tracked.



- Aircraft can be tracked by other aircraft, via satellite, or via groundstations.
- **Your ADS-B groundstation can feed aircraft flight information to the FlightAware network where others can track their flights.**
- ADS-B data can be decoded with free software and if desired, displayed with a GUI.
- The ADS-B GUI allows you to select aircraft and display information about the flight (flight number, origin, destination, speed, altitude, squawk code) and the equipment.
- Looks a lot like what Air Traffic Control might see.

ADS-B FLIGHT TRACKING



Thu Jan 29 12:50 PM

W8LRJ - Digital Voice Das x W8LRJ-hAP3 admin x (50) PiAware SkyAware x +

Not Secure http://w8lrj-adsb.local.mesh:8080

Startup Monitor Websites Mesh Weather BARC Node-RED: w8lrj.sytes... Market News & Progra... Pat - Mailbox

FlightAware PiAware SkyAware 1/29/2026, 12:50:37 PM Reset Map Show All Tracks Hide All Tracks

Go to My ADS-B Statistics Page SkyAware 7.2

Total Aircraft: 50 ADS-B Message Rate: 267.7/sec
With Positions: 44
Position History: 5048

Filters (0 Enabled) Select Columns

ICAO	Ident	Squawk	Altitude (ft)	Speed (kt)	Distance (NM)	Heading	Mags
A6C855	N536SP	1200	2,700	106	8.4	202°	1640
A91856	DAL1294	2355	35,000	447	10.1	183°	2968
A2644F	ATN3203	3545	2,675	197	12.0	37°	2935
A68183	N530MC	5301	3,000	129	13.9	160°	3597
A5170C	RPA4797	4004	33,000	517	16.9	62°	3736
A2588F	N25SK	1200	4,400	73	18.3	143°	181
ABAD6C	SWA1422	2711	18,225	412	21.8	64°	4294
AA2791	AAL2061	6730	37,325	442	21.9	180°	2287
A6F600	JIA5325	6633	14,125	272	25.4	232°	1555
ABCFEA	CST44	1441	40,000	368	32.2	225°	1193
AA887A	RPA9651	6754	26,500	467	32.5	86°	1034
ABF396	SWA2377	7106	36,000	356	32.5	263°	9993
A1314E	AAL2309	5772	30,025	377	34.4	257°	2572
A2870D	UAL2853	5654	35,000	548	34.7	118°	2269
AAE181	RPA4936	1354	27,200	362	35.8	268°	2200
A76F68	UAL1734	6676	34,025	377	36.0	288°	9018
A32846	EDV5135	6650	31,000	510	37.5	61°	5597
AA1E38	SKW4718	1722	28,200	396	39.4	328°	6554
A15397	DAL934	1342	39,000	535	40.5	55°	1783
A2FA71	AA945	3254	22,075	442	42.7	161°	243
AB271F	AAL118	7341	38,975	565	43.0	68°	1274
ACEF18	N932WN	11,750	▲	308	44.6	272°	91
AAF656	VXP54	1567	37,000	506	45.4	70°	3418
ABC397	FDX1647	1105	28,000	379	45.7	269°	4797
A98743	N725MS	3527	40,000	350	48.1	331°	2673
A26689	N254DV	3172	40,000	468	48.6	175°	2641
A1103K	DAL1228	6772	36,000	407	50.0	205°	1608
AB2840	AAL1873	4014	38,000	352	50.8	248°	9099
A12440	UAL1719	9,725	▲	52.3	52.3	230	
A10A83	JBU223	1604	32,000	369	57.2	270°	3341
A30112	CRE345	2043	43,000	358	58.2	318°	5095
A10811	RPA5822	4012	32,000	363	58.2	266°	703
AS2C68	RPA4802	4025	19,575	416	59.4	87°	97
A1CB85	JBU224	7264	35,000	534	60.2	72°	3268
A19910	JBU289	2633	32,000	388	60.4	271°	4429
A2075A	N23NG	1747	41,000	546	62.4	80°	861
A75959	DAL1106	3121	31,750	385	63.8	332°	6233
C07C78	ACA1358	35,000	480	70.9	33°	418	

N530MC A6B183 [Close](#)

Registration: N530MC
Country of registration: United States
Aircraft Type: P28R [See Photos](#) [Visit Flight Page](#)

LOCATION

Altitude scale: 0, 1,000, 2,000, 4,000, 6,000, 8,000, 10,000, 20,000, 30,000, 40,000+ ft

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John Westerkamp, W8LRJ

ADS-B FLIGHT TRACKING



FlightAware Enterprise User | 01:04PM EST | English (USA)

Emirates 255

UAE255 / EK255 / UAE81W / A6-EWG
EN ROUTE AND ON TIME
Arriving in 3 hours 9 minutes

BCN
BARCELONA, SPAIN
left GATE E85
Barcelona Intl.: BCN
MONDAY 02-FEB-2026
10:30AM CET (on time)

MEX
MEXICO CITY, MEXICO
arriving at GATE E3
Lic. Benito Juarez Intl.: MEX
MONDAY 02-FEB-2026
(45 minutes early) 03:15PM CST

8h 36m elapsed | 4,300 mi flown | 11h 45m total travel time | 3h 9m remaining | 1,712 mi to go

NOT YOUR FLIGHT? UAE255 flight schedule

Flight Details

Departure Times

Gate	Departure	Takeoff
	10:30AM CET	10:48AM CET
	Scheduled 10:10AM CET	Scheduled 10:20AM CET

Taxi Time: 18 minutes
Average Delay: 10-20 minutes

Arrival Times

Landing	Gate Arrival
03:05PM CST	03:15PM CST
Scheduled 03:11PM CST	Scheduled 04:00PM CST

Taxi Time: 10 minutes
Average Delay: Less than 10 minutes

Aircraft Details

Aircraft Information

Tail Number	A6-EWG · Registration
Owner	Unknown Owner
Aircraft Type	BOEING 777-200LR (twin-jet) (B77L) Photos

Airline Information

Airline	Emirates · Emirates' all flights
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Flight Data

Speed	556 mph (Planned: 472 mph) graph
Altitude	36,000 ft graph
Distance	Planned: 6,181 mi (Direct: 5,898 mi)
Callsign	UAE81W
Route	5800N/05000W CUDDY N804C MT NOSIK CRL EWG MHZ LSU WAKHO M345 AXEXO UM345 PAZ UT154 ENAGA ENAGA3A decode

Top BOEING 777-200LR (Twin-Jet) Photos

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WHAT DO WE NEED (INDOORS)?

- Antenna tuned to 1090 MHz
- Short Coax (RG-195 or similar low-loss at 1090 MHz)
- **Bandpass filter centered on 1090 MHz**
- **Low Noise Amplifier (LNA) that passes 1090 MHz**
- **Receiver (USB dongle)**
- Computer (Raspberry Pi)
- Bias-T software (rtl-biast) to power LNA over coax
- ADS-B decoder software (dump1090)
- ADS-B GUI (PiAware)

Note: **Red** items can be combined.



“Headless”
WiFi or Ethernet
to home network

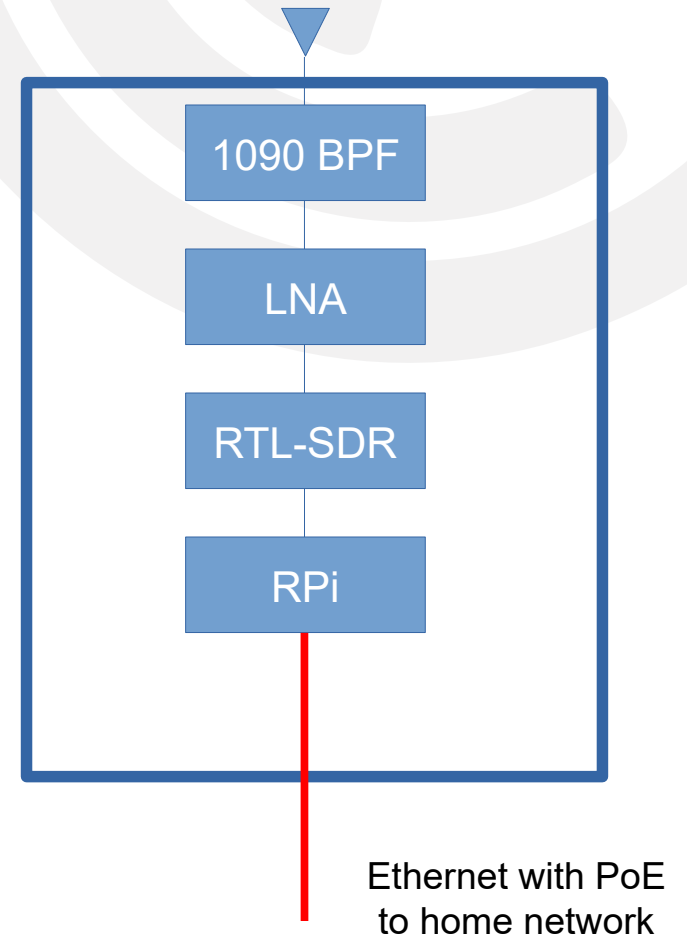
WHAT DO WE NEED FOR OUTDOORS?



- Antenna tuned to 1090 MHz
- Short Coax (RG-195 or similar low-loss at 1090 MHz)
- **Bandpass filter centered on 1090 MHz**
- **Low Noise Amplifier (LNA) that passes 1090 MHz**
- **Receiver (USB dongle)**
- Computer (Raspberry Pi)
- Bias-T software (rtl-biast) to power LNA over coax
- ADS-B decoder software (dump1090)
- ADS-B GUI (PiAware)

Note: **Red** items can be combined.

Weatherproof
sealed case



ENABLING BIAS-T



If you use the LNA4ALL, you will need to download and install *rtl_biast* and then make sure it runs before the *PiAware* software startup. This enables the Bias Tee output on the RTL-SDR to power the LNA. First, download and build the *rtl_biast* software using the following Linux commands:

```
git clone https://github.com/rtlsdrblog/rtl-sdr-blog
cd rtl-sdr-blog
mkdir build
cd build
cmake .. -DDETACH_KERNEL_DRIVER=ON
```

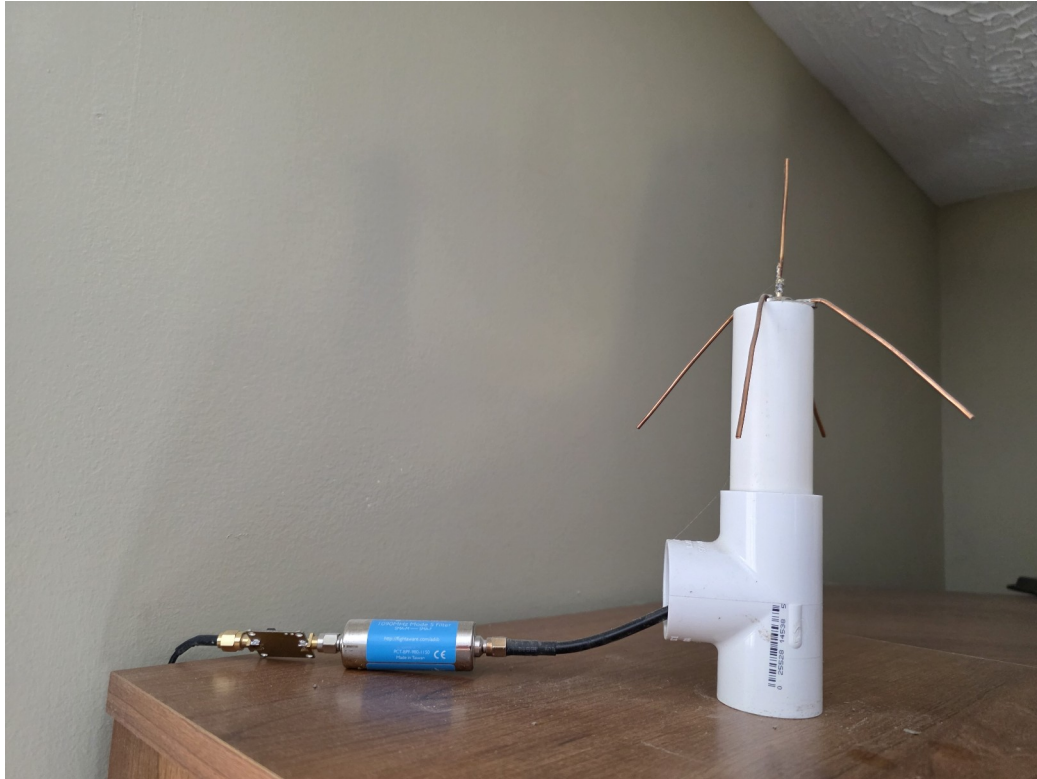
Next, copy the *rtl_biast* software to the */usr/bin* directory.

```
cd src
sudo cp ./rtl_biast /usr/bin/rtl_biast
```

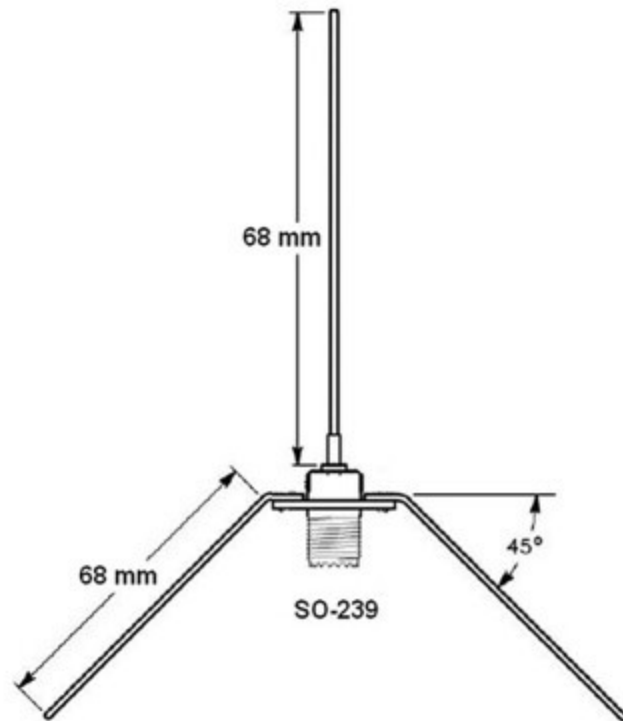
Now go to the directory */etc/systemd/system/dump1090-fa.service* and create a file called *bias-t.conf* and add the following to it with your favorite editor (you may need to use the *sudo* command with your editor).

```
[Service]
ExecStartPre=/usr/bin/rtl_biast -b 1
```

MY ADS-B STATION



QUARTER WAVE GROUND PLANE DESIGN



SPIDER ANTENNA

Ground Plane formed by 4, 6 or 8 Slanting Radials

$$\lambda = c/f = \frac{299,792,458 \text{ m/s}}{f (\text{Hz})}$$

$$f = 1090 \text{ MHz}$$

$$\lambda = 0.275 \text{ m}$$

$$\frac{\lambda}{4} = 68.76 \text{ mm}$$

Note1: 45 degree angle helps impedance approach 50 ohms.

Note2: N-connector would be better.

m0ukd.com/calculators/quarter-wave-ground-plane-antenna-calculator/

WEBSITES



- flightaware.com/adsb/piaware/build (Step-by-step instructions to build PiAware on RPi)
- rtl-sdr.com (General info on RTL-SDR and online store to purchase ADS-B parts)
- lna4all.blogspot.com (Site to purchase LNA4ALL from original designer)
- adsbexchange.com (Alternative ADS-B software)



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