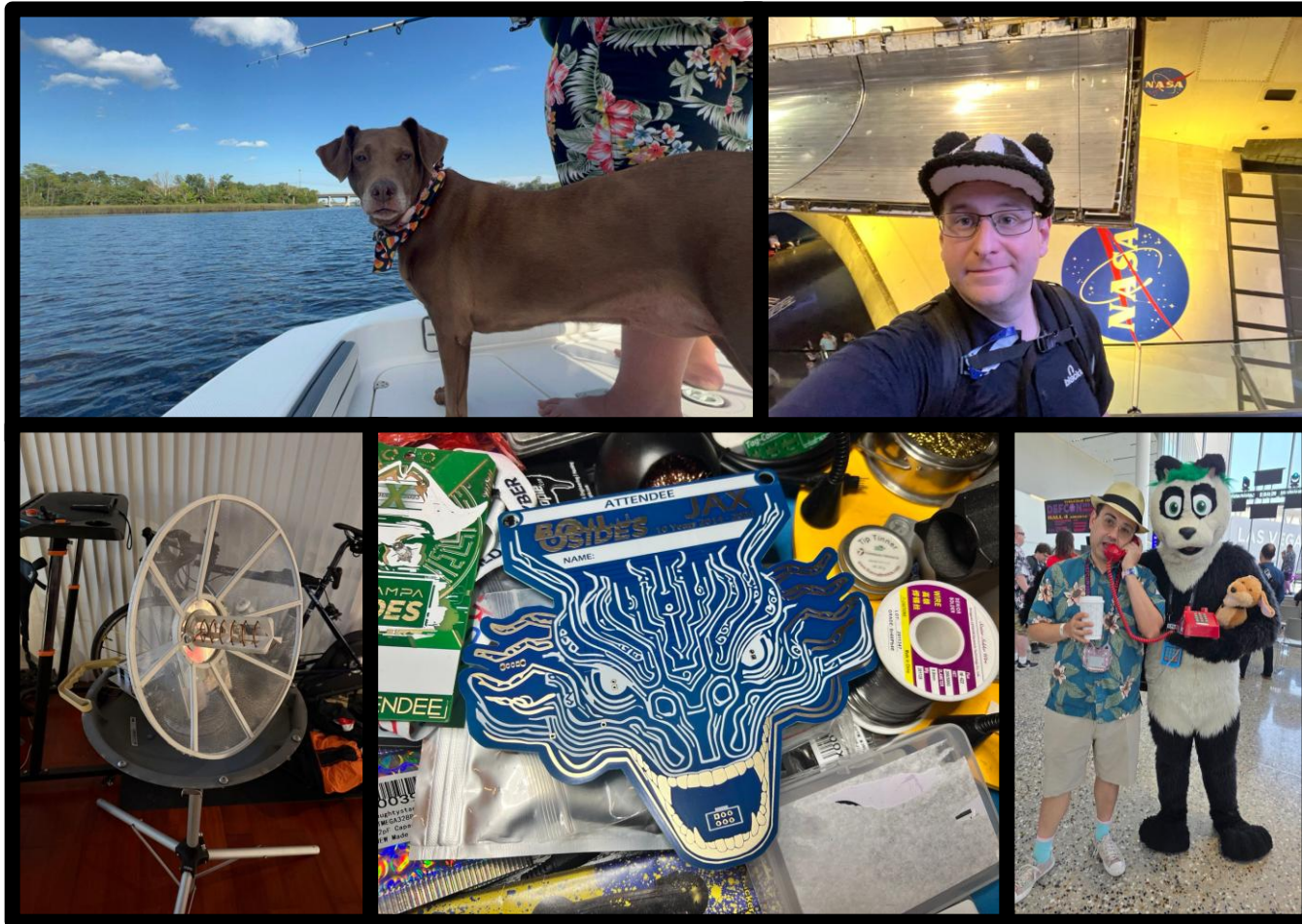# Talking To Satellites

BY JOHN "PANDA" AFF

Disclaimer

This presentation is for **educational and informational purposes only**. The content shared, including demonstrations, techniques, and discussions, are intended to raise awareness about cybersecurity risks and encourage research and the development of better security practices in the industry.

About Me

Targets

| Program Name	NAVSTAR GPS (Navigation Satellite Timing and Ranging – Global Positioning System)
Orbit Type	Medium Earth Orbit (MEO)
Altitude	~20,200 km (12,550 miles)
Mission Duration	~7.5 to 15+ years (varies by generation)
Operational Years	1978 – present
Number of Satellites	80+ launched across six generations; 31–33 typically operational at any time
Frequencies Used	L1 (1575.42 MHz), L2 (1227.60 MHz), L5 (1176.45 MHz), plus encrypted military M-codes
Users	U.S. Department of Defense, global civil and commercial users
Primary Use	Global navigation, timing, and positioning for military, aviation, maritime, and civilian applications
Still Operational	- Multiple satellites from Block IIR, IIR-M, IIF, and Block III generations - **Block IIIA satellites** (newest, highest-accuracy GPS tech) - **31+ satellites actively transmitting** on multiple frequencies as of 2025

Program Name	NOAA POES (Polar-Orbiting Environmental Satellites)
Orbit Type	Sun-synchronous Polar Orbit
Altitude	~850 km (530 miles)
Mission Duration	~5–15 years (varies by satellite)
Operational Years	1970s – present
Number of Satellites	20+ launched over multiple generations
Frequencies Used	L-band and other bands for data transmission and telemetry
Users	NOAA, NASA, U.S. military, international partners
Primary Use	Global weather monitoring, atmospheric sounding, climate research, storm tracking
Still Operational	- **NOAA-15** (launched 1998, limited functionality) - **NOAA-18** (launched 2005, operational) - **NOAA-19** (launched 2009, operational) - **NOAA-20** (launched 2017, JPSS-1) - **NOAA-21** (launched 2022, JPSS-2)

| Program Name	FLTSATCOM (Fleet Satellite Communications System)
Orbit Type	**Geostationary Orbit (GEO)**
Altitude	**~35,786 km (22,236 miles) above Earth**
Mission Duration	~10–15 years (varies by satellite)
Operational Years	**1978 – present** (gradual phase-out began in early 2000s)
Number of Satellites	8 launched (FLTSAT-1 to FLTSAT-8); FLTSAT-2 failed at launch
Frequencies Used	**UHF (225–400 MHz)** for general communications
Users	U.S. Navy, U.S. Air Force, NATO allies
Primary Use	Tactical and strategic communications for ships, aircraft, and ground forces
Still Operational	**FLTSATCOM-7** and **FLTSATCOM-8** remain functional and in orbit as of 2025

HAM Radio
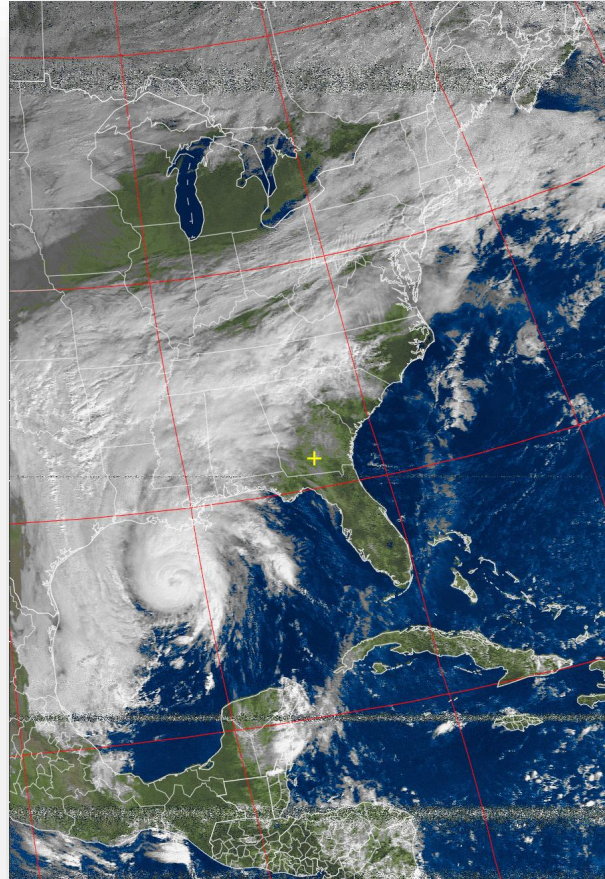
Software Defined Radio Hardware

Software Defined Radio Comparison

| Feature	RTL-SDR V5	HackRF One	BladeRF 2.0 Micro (xA4/xA9)	USRP B200/B200mini
Duplex Mode	❌ RX Only	❌ Half Duplex	✅ Full Duplex	✅ Full Duplex
RX Frequency Range	500 kHz – 1.766 GHz (realistically ~24 MHz – 1.7 GHz)	1 MHz – 6 GHz	47 MHz – 6 GHz	70 MHz – 6 GHz
TX Frequency Range	❌ None	1 MHz – 6 GHz	47 MHz – 6 GHz	70 MHz – 6 GHz
Sample Rate	Up to 2.56 MSPS	Up to 20 MSPS	Up to 61.44 MSPS	Up to 56 MSPS
ADC Resolution	8-bit	8-bit	12-bit	12-bit
Tuning Accuracy / PPM	~0.5 PPM (TCXO in V5)	~0.5 PPM w/ TCXO	Very stable; low-jitter VCTCXO	High precision, suitable for GNSS
USB Interface	USB 2.0	USB 2.0	USB 3.0	USB 3.0
Form Factor	Very compact (dongle-style)	Compact, portable	Portable, rugged aluminum case	Larger (board or case options)
Full Duplex	❌ No	❌ No	✅ Yes	✅ Yes
TX Power Output	❌ N/A	~10–15 dBm (varies)	~0–10 dBm	~0–10 dBm
Cost (approx.)	~$40+	~$300+	~$500+	~$1,300+
Use Cases	Basic reception, spectrum analysis	General SDR, replay, sniffing	Cellular (OpenBTS, LTE), full-duplex apps	Research, GNSS, MIMO, pro signal work
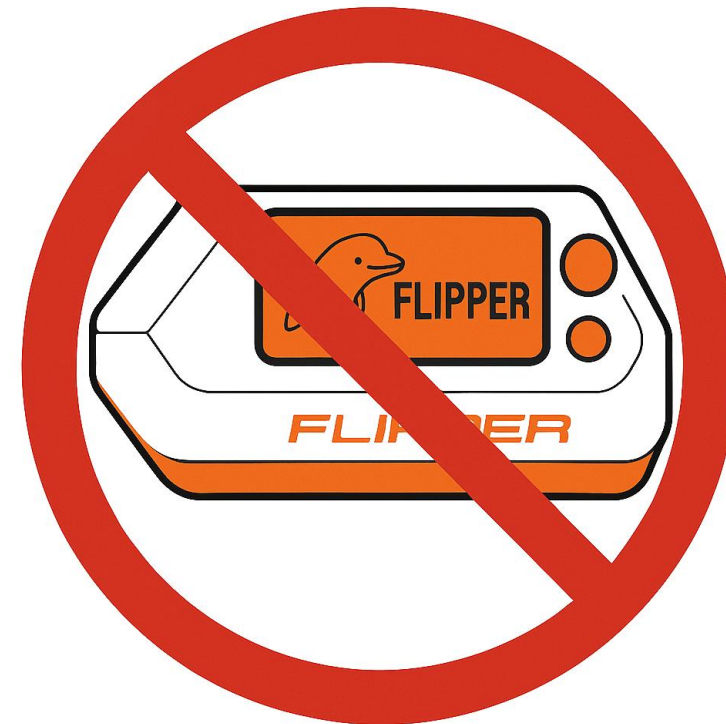
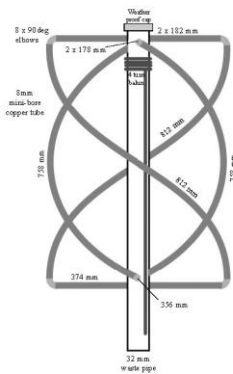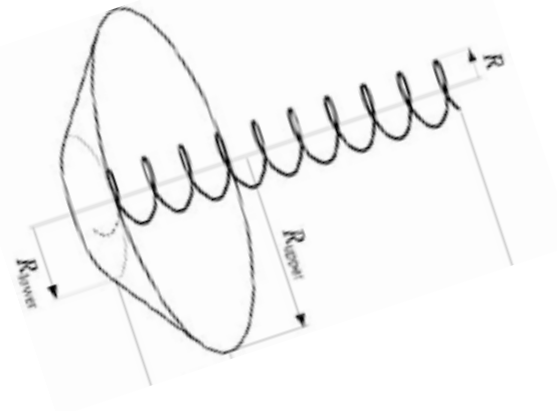**300 MHz to 348 MHz**, **387 MHz to 464 MHz**, and **779 MHz to 928 MHz**
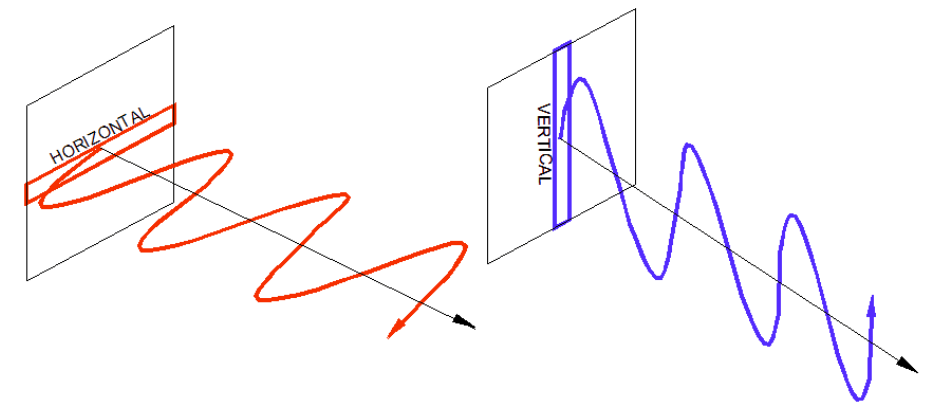
Antennas
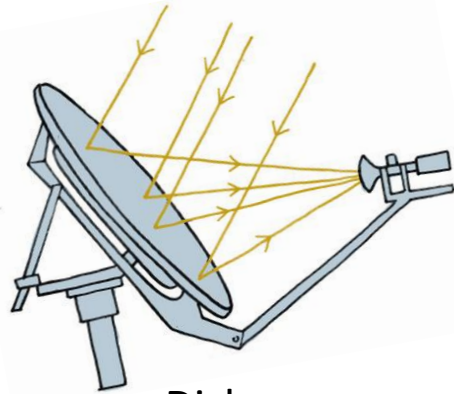
Dish
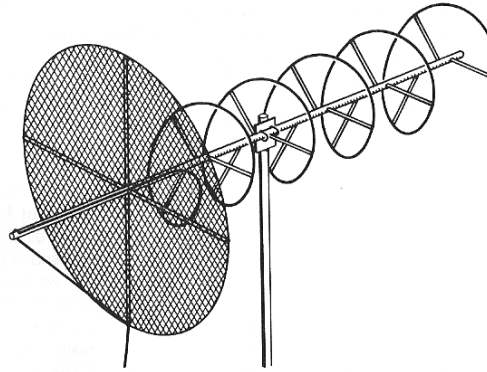
Helical

Polarization

Quadrifilar Helix (QFH)

Dish
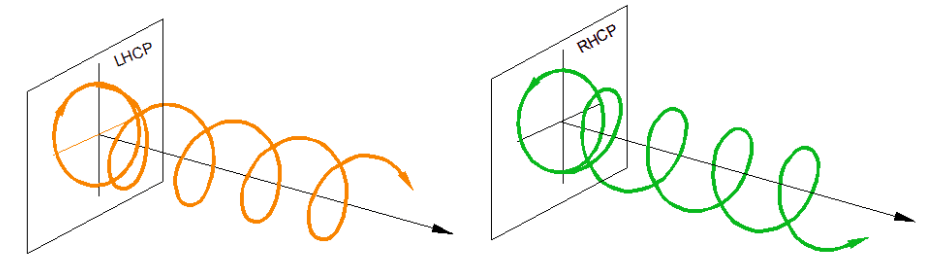
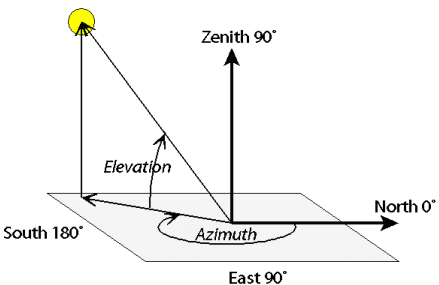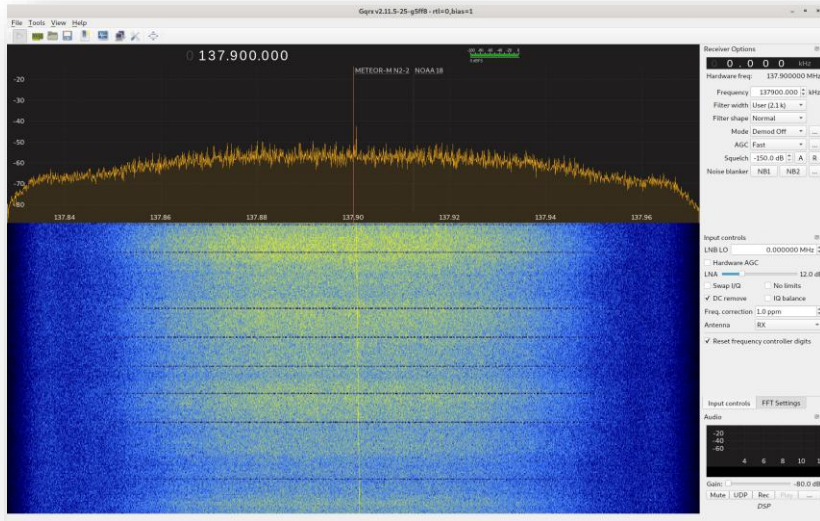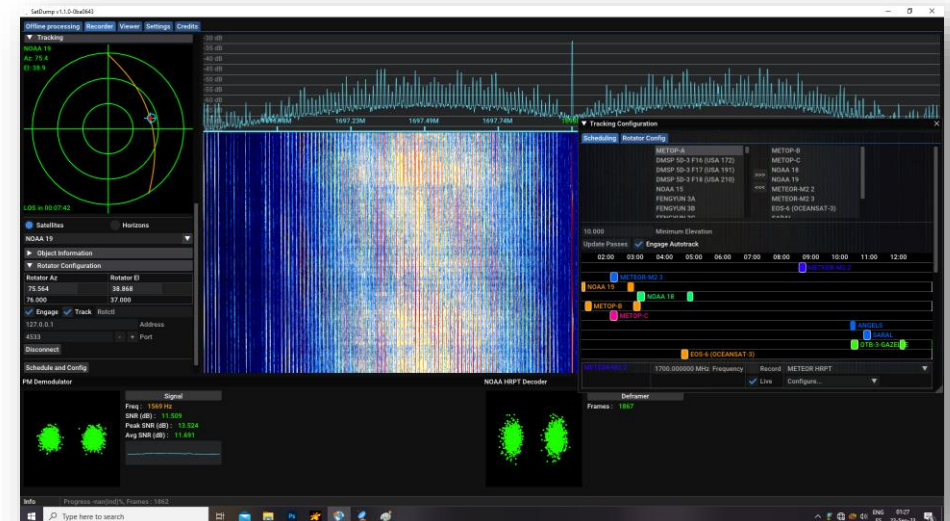# Filters
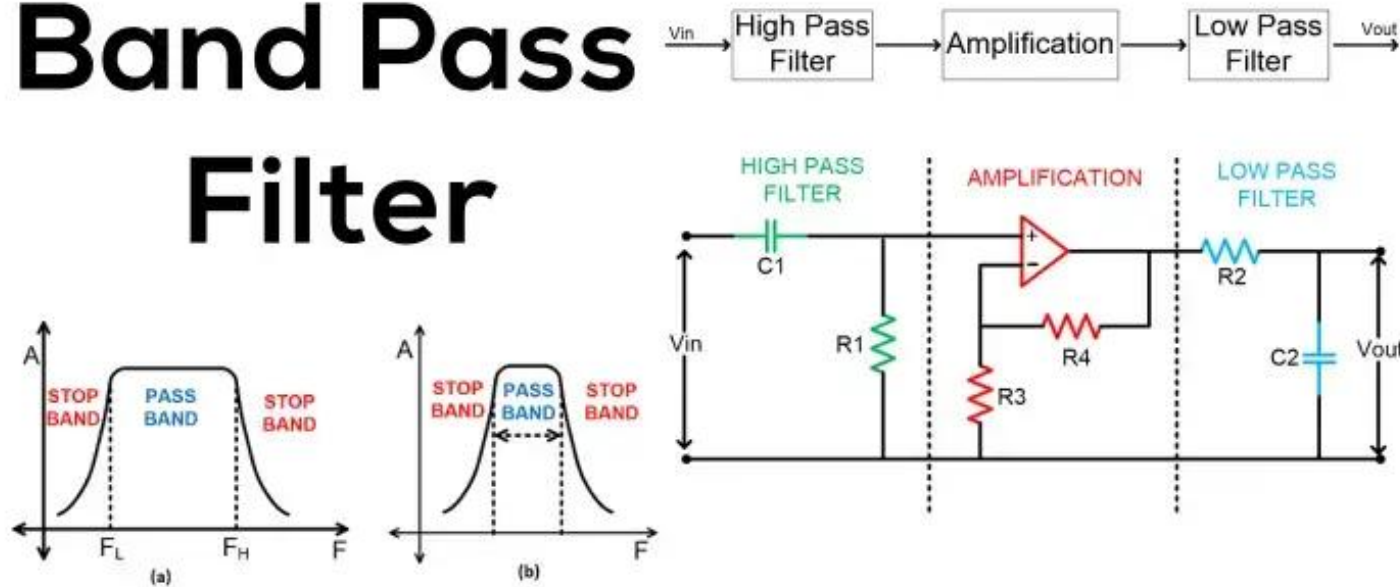
Tracking Software
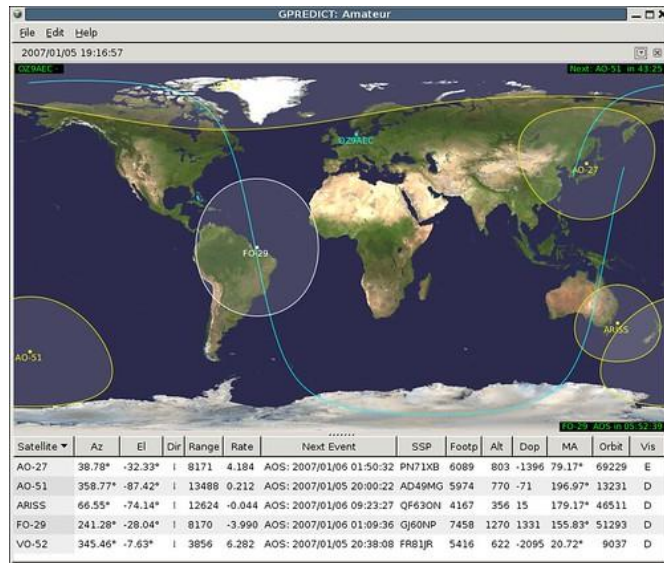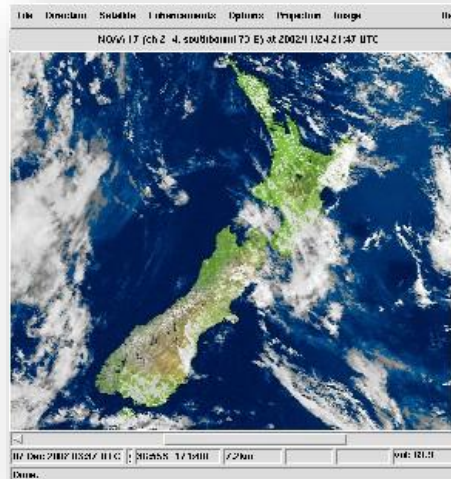

GPredict

Satellite Tracker
By Star Walk
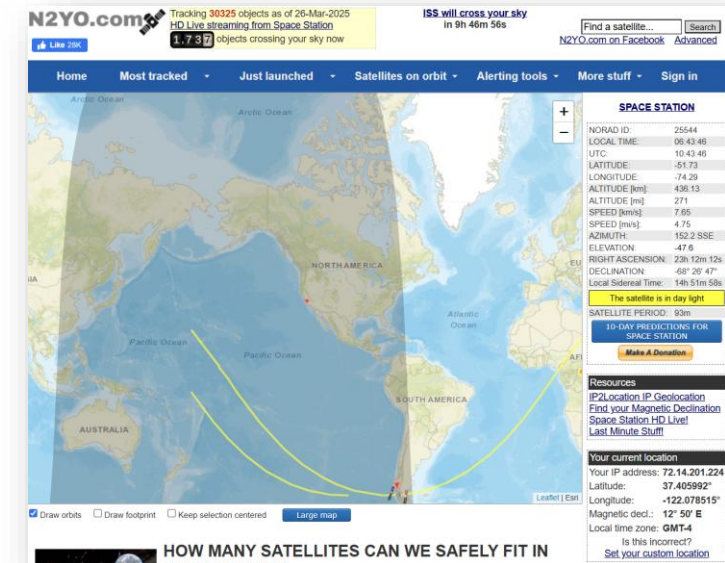
N2YO.com

Download and Decode

GQRX
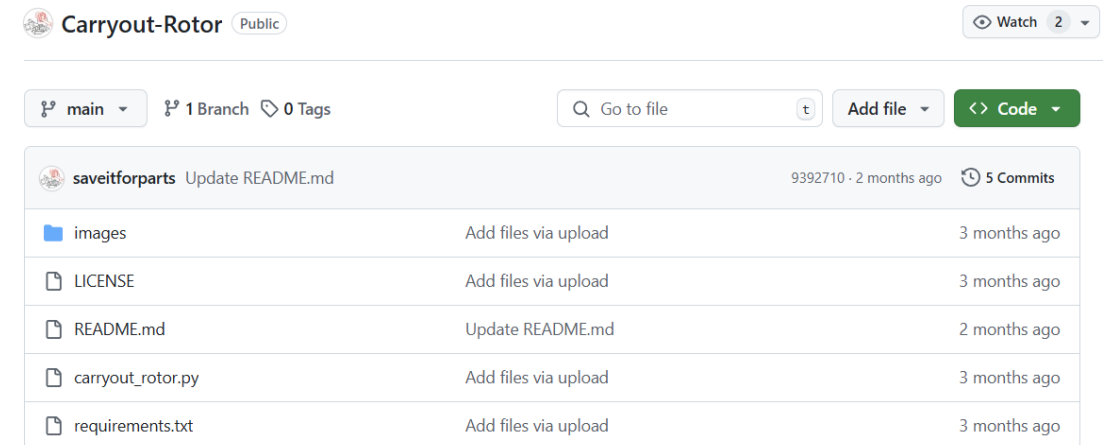

WXtoImg

SatDump

Rotor Control Project

Carryout-Rotor Public

main · 1 Branch · 0 Tags

Go to file · Add file · Code

saveitforparts Update README.md · 9392710 · 2 months ago · 5 Commits

images	Add files via upload	3 months ago
LICENSE	Add files via upload	3 months ago
README.md	Update README.md	2 months ago
carryout_rotor.py	Add files via upload	3 months ago
requirements.txt	Add files via upload	3 months ago

Goal: Gpredict Control of Rotor
Secondary Goal: New Dome

HRPT Images
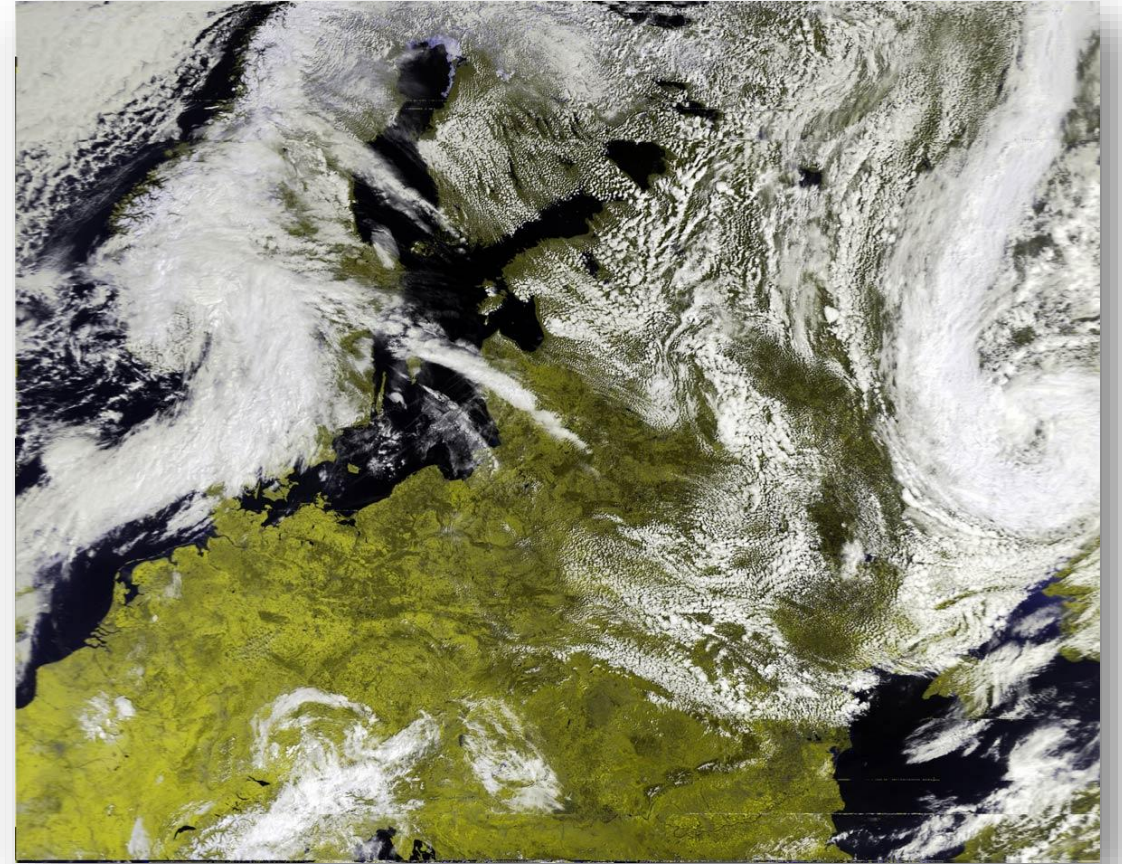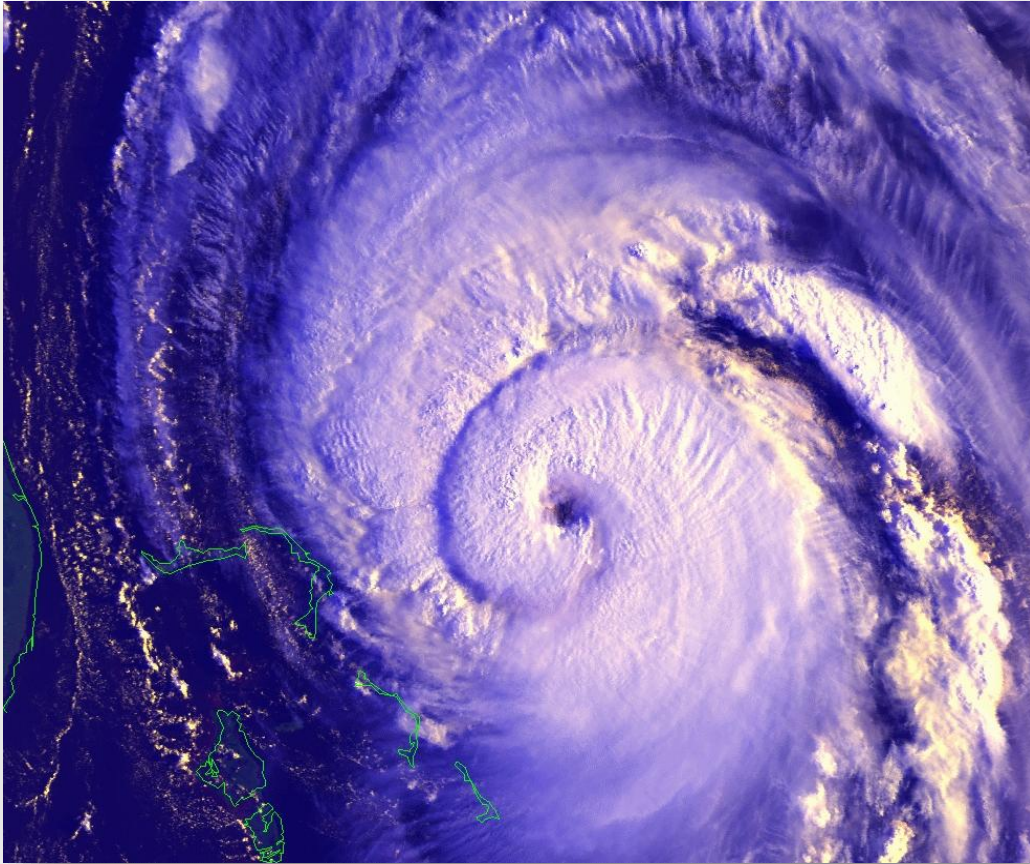
Questions?

LinkedIn

Slides