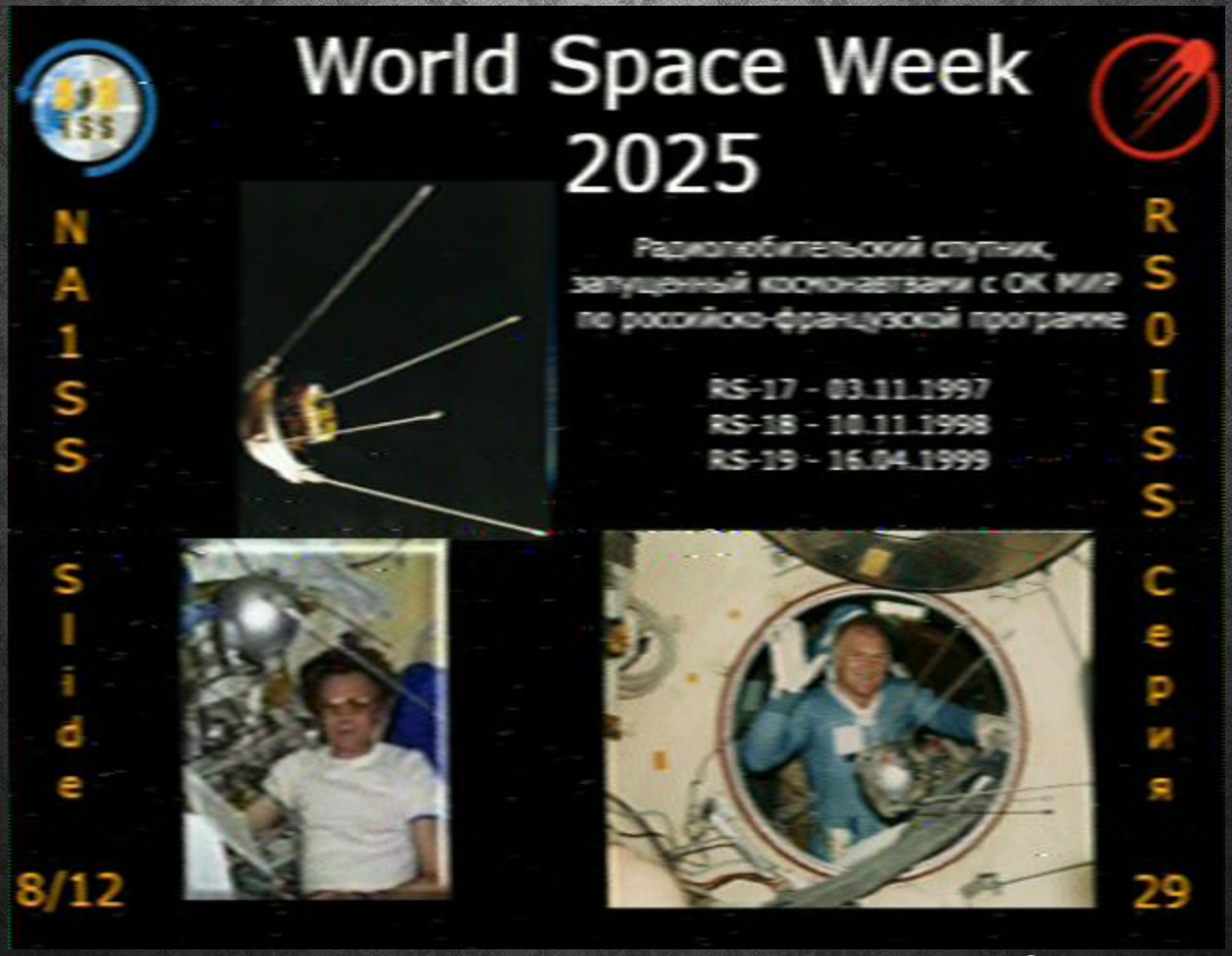
Amateur Radio Satellites
Mitch Ahrenstorff ADØHJ

Presentation Outline – Topics Discussed

Satellite Fun Without Transmitting (No License Options)
- ISS Slow Scan TV
- Arrow II Satellite Antenna
- NOAA Weather Satellites (LRPT)
- GOES Weather Satellites (HRPT)
- Weather Balloon Tracking
- Satellite Telemetry (AO-91 Example)
- SatNOGS / Libre Space Foundation
- Wow@Home SDR Telescope Network

Making Friends Everywhere (Amateur License Options)
- Three Flavors of Amateur Satellites
- Why Amateur Radio Satellites?
- Getting Started with Amateur Satellites
- DX Engineering Videos by Sean KX9X
- Games Satellite Operators Play (GridMaster + VUCC/r)
- Satellite Tracking with Your Smartphone
- Doppler's Effect on Satellite Operating
- Portable Satellite Equipment / Operating
- FM Satellite Equipment Example
- FM/Linear/ Satellite Example
- DX Contacts via AO-7, FO-29, and RS-44
- AMSAT History and Overview
- AMSAT / ARRL Awards

International Space Station Slow Scan TV

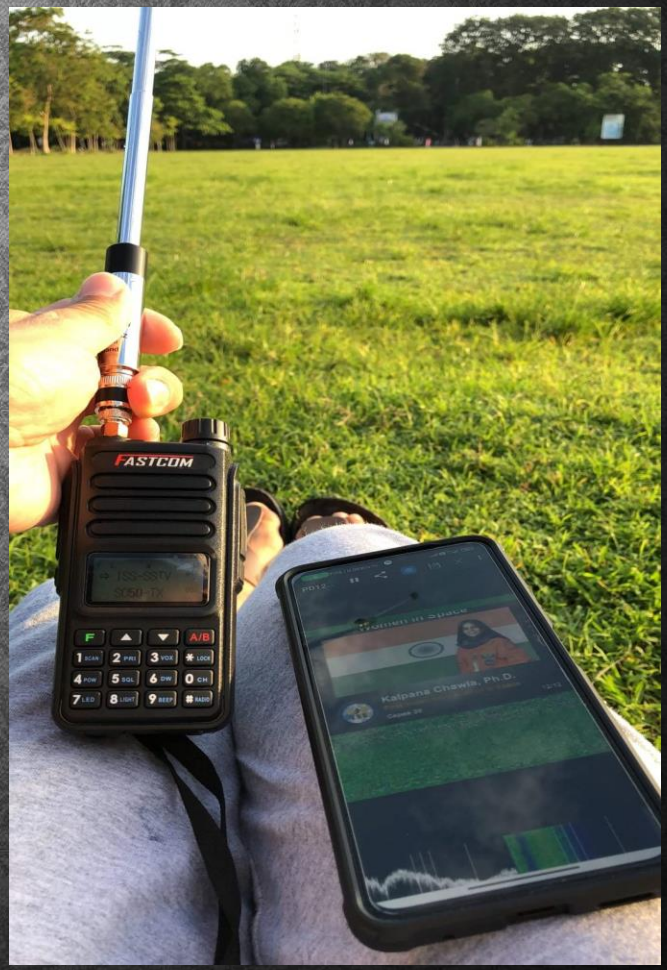


Decoded SSTV Image from ARISS October 2025 Event. Source: David Trolinger N5ZKK @david_trolinger

International Space Station Slow Scan TV

Reasons Why It's Popular
- Several ISS SSTV Events per Year
- Easiest Satellite Based Activity To Do
- Twelve Different Images to Collect
- Several Days / Week Event Duration
- Minimal Equipment Needed
- Popular Social Media Event
- Electronic Award Certificate

Why Minimal Equipment?
- High Transmit Power = Less Antenna
- VHF FM Downlink = Use Handheld Radio
- VHF Doppler Shift = Ignore Doppler
- Smartphone Satellite Tracking Apps
- Smartphone Slow Scan TV Apps
- Handheld Transceiver + Smartphone



Source: Juta Hariadi Soesilo YD9CKH @Jutahariadi

International Space Station Slow Scan TV

Smartphone Tracking Apps
- Look4Sat for Android
- GoSatWatch for iPhone
- ISS Detector Pro for Android
- ISS Detector for iPhone

Smartphone SSTV Apps
- SSTV Slow Scan TV for iPhone
- Robot36 for Android

ISS SSTV Expert Mode
- Mobile or Base Station Radio
- Arrow II Yagi Satellite Antenna
- Record Audio for RX-SSTV Decode
- Adjust Antenna Polarity During Pass
- Overhead Pass for More Images
- Go Portable / Good View of Horizon

Source: John Brier KG4AKV @SpaceComms1

International Space Station Slow Scan TV

International Space Station
- How Fast? 17,500 Miles/Hour
- Orbit Altitude? ~250 Miles
- Orbits Earth Every 90 Minutes
- Voice Repeater - Columbus Module
- APRS Packet - Service Module
- Astronauts (Most are Licensed Hams)
- Educational School Contacts
- Slow Scan Television

More Information
- ARISS Website: www.ariss.org
- amsat-uk.org/beginners/iss-sstv/
- ariss-usa.org/ARISS_SSTV/
- MagPi #80 Article: Pictures from Space via Ham Radio

Source: Vince Rosemann K7VNE @StaticAZ

Arrow II Satellite Antenna

Lightweight Portable Satellite Antenna

- Arrow Antenna / Cheyenne, WY
- Portable Satellite Antenna
- Lightweight Design ~1.2 lbs.
- www.arrowantennas.com
- Arrow II Satellite Antenna
  - 3 Elements for 146 MHz
  - 7 Elements for 437 MHz
  - 10-Watt Micro Duplexer
  - Split Boom Design Available
- Alaskan Arrow II Sat Antenna
  - 4 Elements for 146 MHz
  - 10 Elements for 437 MHz
  - 10-Watt Micro Duplexer
  - Split Boom Design Available

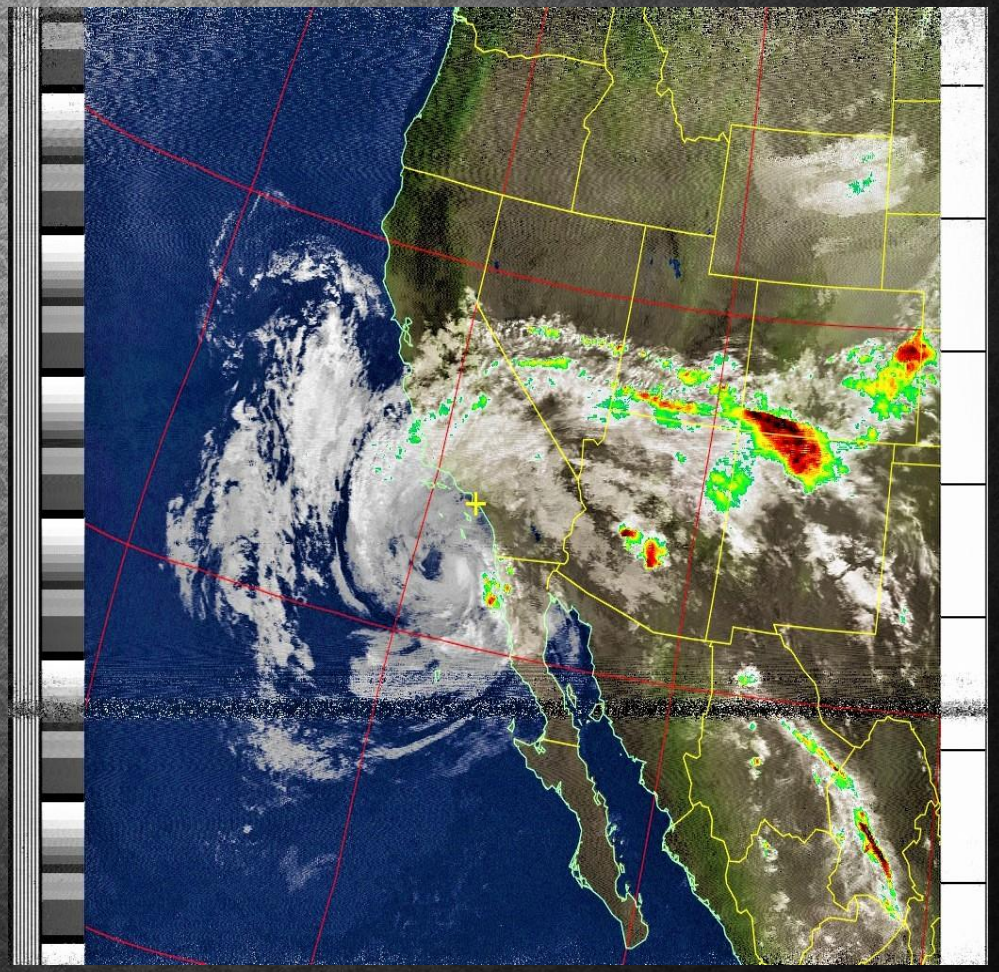
Source: Grace Papay KE8RJU @ke8rju

LRPT Weather Satellites (APT)

Automatic Picture Transmission

~~NOAA-15, 18, 19~~ / Meteor-M N2-3
- Orbit Altitude? ~500 Miles
- Orbits Earth Every 100 Minutes
- Downlink Frequency ~137 MHz
- Use Software Defined Radio
- 34 kHz Bandwidth FM Signal
- QFH (Quadrifilar Helix) Antenna
- Arrow II Satellite Antenna Works

More Information
- SatDump Website / Software
- WxtoImg Restored website
- RTL-SDR Tutorial: Receiving NOAA WX Satellite Images
- YouTube: Decoding WX Satellites Using An SDR Receiver NOAA-19



Source: Endaf Buckley N6UTC @N6UTC

Geostationary Weather Satellites
HRIT (High Rate Information Transmission)

NOAA GOES East / GOES West
- Orbit Altitude? ~22,236 Miles
- Geostationary Earth Orbit
- Downlink Frequency ~1.7 GHz
- Use Software Defined Radio
- Nooelec SDR + SAWbird LNA
- Modified 2.4 GHz Wifi Antenna

More Information
- GOES Website: www.goes-r.gov
- RTL-SDR Tutorial: GOES 16/17 Weather Satellite Reception
- YouTube: Pulling Clear Images Directly Off Satellites | GOES-15,16,17

Source: Earth Bot @GOES_Sat

Weather Balloons / Radiosonde Tracking

Easy Mode (https://sondehub.org/)

Graw DFM17 / Vaisala RS41
- Used to Measure Temperature, Humidity, Air Pressure, Wind Direction, and Wind Speed.
- GNSS (GPS, GLONASS, BEIDOU)
- Frequency Range: 400-406 MHz
- Output Power < 100 mW

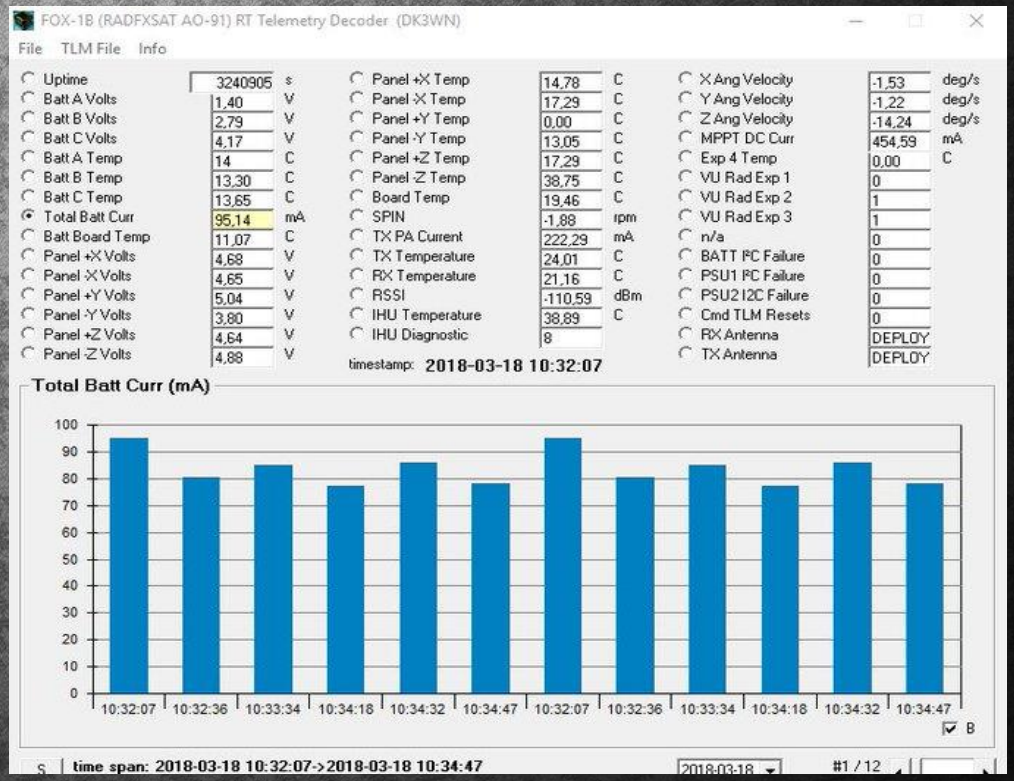
More Information
- YouTube: How To Track Weather Balloons Using SDR
- RTL-SDR Tutorial: Tracking Radiosondes With an RTL-SDR and Radiosonde_Auto_Rx
- coaa.co.uk/sondemonitor.htm

Source: NWS Atlanta @NWSAtlanta

Satellite Telemetry
Monitor Satellite Health / Parameters

- CW Telemetry on Some Sats
- AO-91 Uses "Data Under Voice"
- Telemetry Sent When Xmit On
- Data Under Voice 200 bps FSK
- Barely Audible During QSOs
- Fox Telemetry Decoder

More Information
- amsat.org/foxtelem-software-for-windows-mac-linux/
- AMSAT Cubesat Simulator
- FOX Telemetry Leaderboard
- Youtube: AO-91 Telemetry Decode. Pass over Costa Rica



Source: AMSAT-SM (SM0TGU Lars) @amsat_sm

SatNOGS

Global Network of Satellite Ground-Stations

- Collect Telemetry Worldwide
- Crowd-Sourced Dashboards
- Simple / Complex Stations
- SatNOGS Rotator + Antenna
- Raspberry Pi SatNOGS Client
- RTL-SDR / Other SDR Receivers
- Part of Libre Space Non-Profit

More Information

- SatNOGS Website + Wiki Page
- Libre Space Foundation Website
- YouTube: Crowdsourced Satellite Telemetry Collection w/ SatNOGS
- Hackaday: Wall-Mounted Ground Station Tames Unruly SatNOGS Node

Source: SatNOGS @SatNOGS

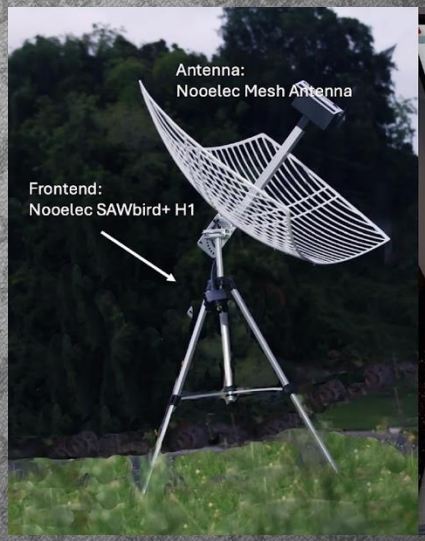
Wow@Home

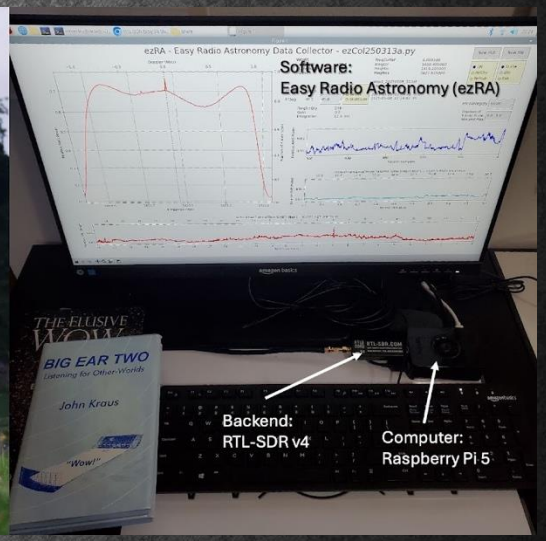
Wow@Home Radio Telescope (SETI)

- Worldwide coordinated observations
- 24/7 autonomous sky monitoring
- Rejects RFI with multi-station detection
- $500 DIY setup with off-the-shelf parts
- Captures transient astrophysical events
- Educational & citizen science focus
- Free open-source software

More Information

- Website: phl.upr.edu/wow/outreach
- phl.upr.edu/wow/outreach
- Easy Radio Astronomy (ezRA) starter software
- Society of Amateur Radio Astronomers (SARA)



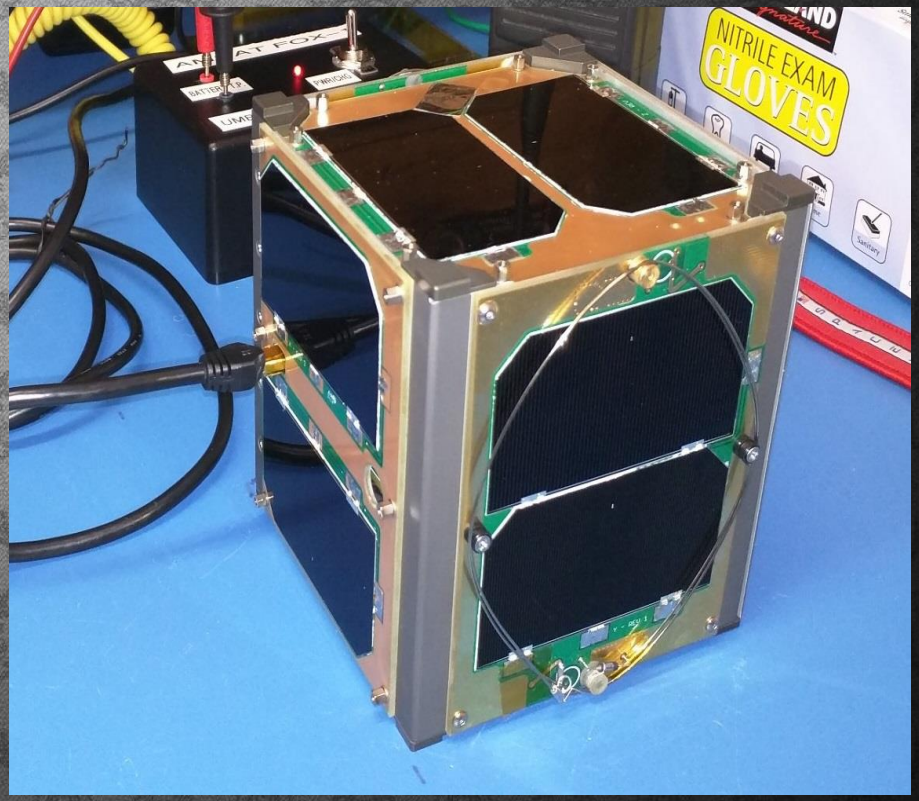


Source: PHL @ UPR Arecibo

Amateur Radio Satellites

AMSAT Satellite Status Page: amsat.org/status/

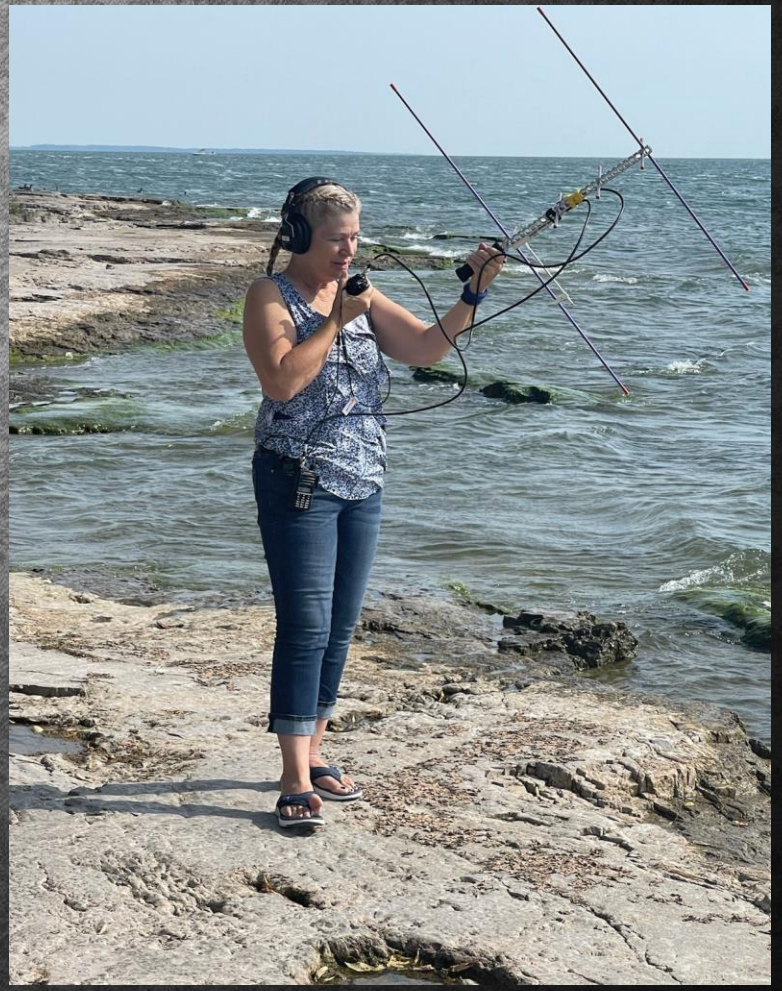
Three Flavors of Amateur Satellites
- FM Satellites (Flying FM Repeater)
  - SO-50
  - AO-123
  - ISS
- Linear Satellites (SSB / CW)
  - AO-07
  - RS-44
  - JO-97
- APRS / Packet Satellites
  - International Space Station
  - SONATE-2



Source: Jerry Buxton N0JY @N0JY

Why Amateur Radio Satellites?
Make Friends All Over North America / World

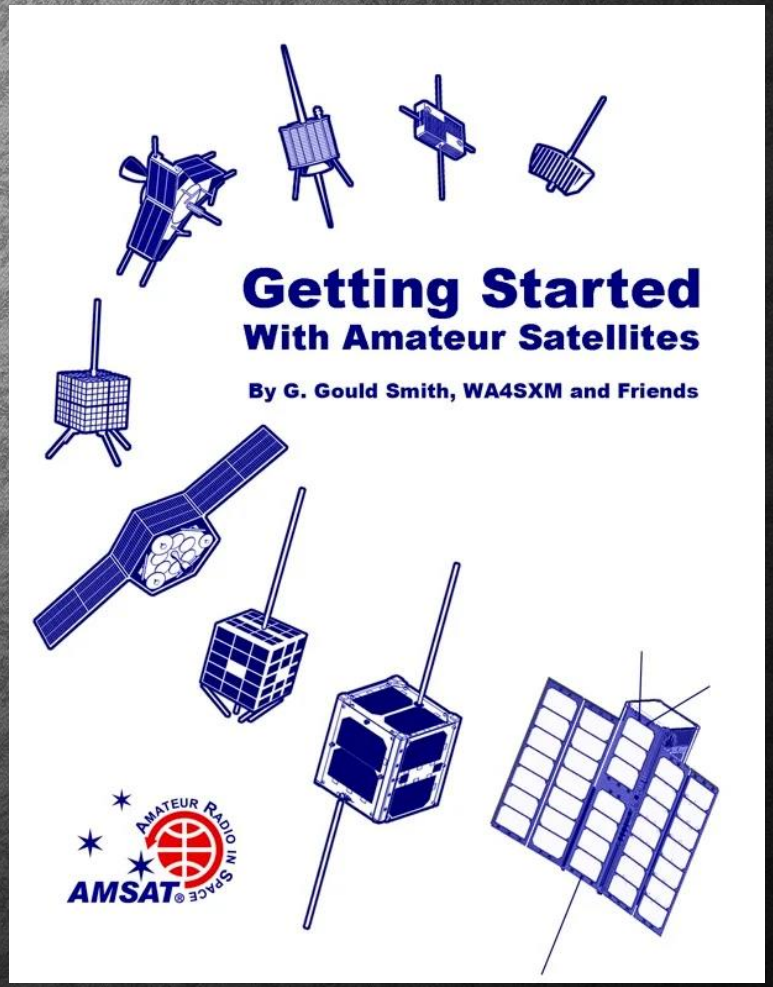
- Friendly Worldwide AMSAT Community
- Unique Technical / Operations Challenge
- Required Equipment Needs are Limited
- Portable Operation (No Restrictions)
- Satellite Passes Less Than 22 Minutes
- Available to Lowest Amateur Licensee
- Satellite Footprint Covers Large Area
- No Propagation / Sunspot Dependency
- AMSAT GridMaster Award (488 Grids)
- Operational Proficiency After Completing
- AMSAT Reverse VUCC (Rove 100 Grids)
- Rare DX in Your Town / State / Region
- Exploration / Adventure via Roving



Source: Nancy Livingston N9NCY @Nancy_N9NCY

Getting Started with Amateur Satellites

AMSAT Store Digital Download ($15.00)



Source: AMSAT @AMSAT

DX Engineering Videos by Sean KX9X

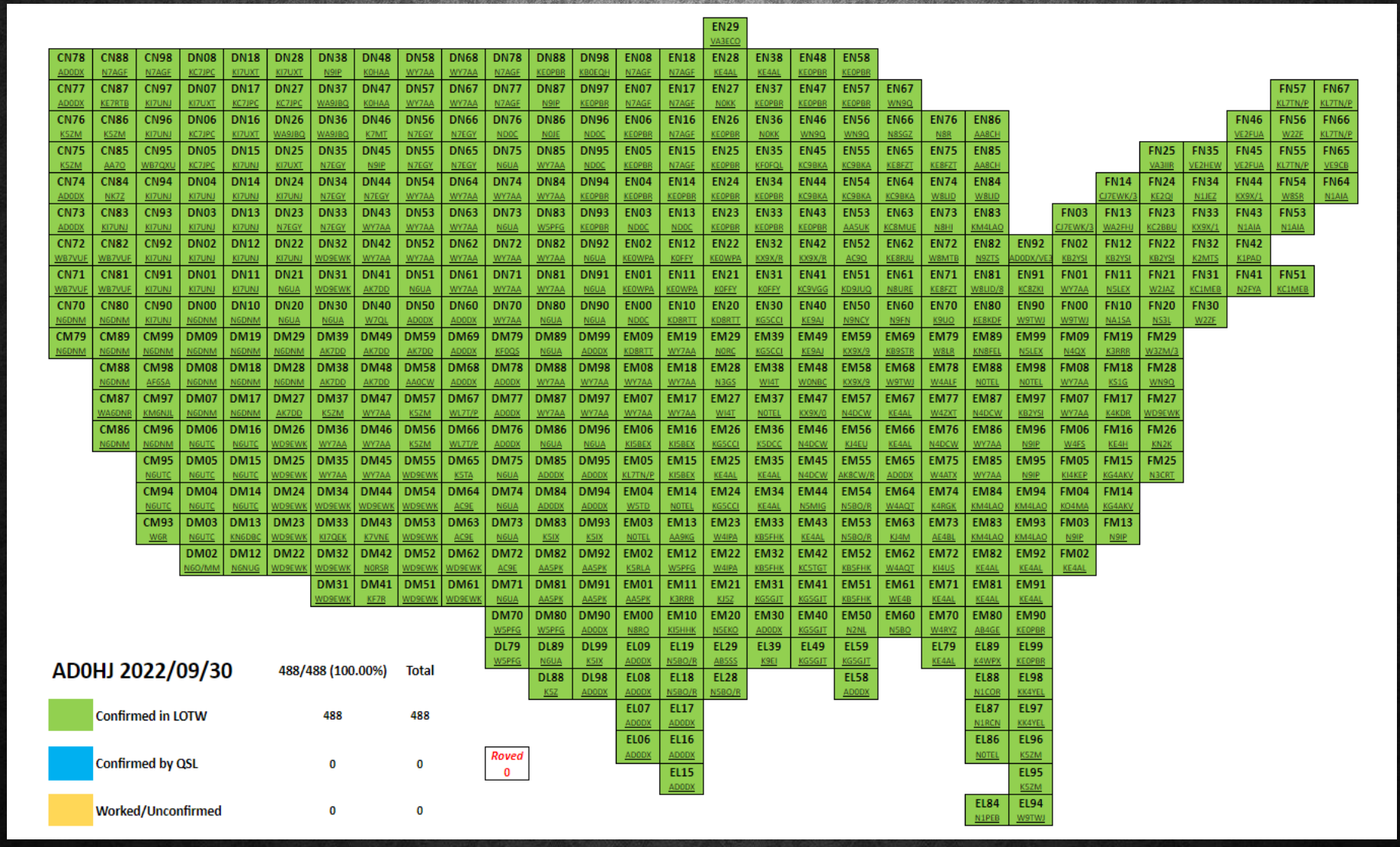
Source: Sean Kutzko KX9X @SeanKutzko

Recommended YouTube Videos from Sean KX9X

- How and Why to Get Started in Operating Amateur Radio
- Tips on Operating FM Amateur Radio Satellites
- Tips on Operating Linear Amateur Radio Satellites (Part 1)
- Tips on Operating Linear Amateur Radio Satellites (Part 2)
- Operating Amateur Radio Satellites from Your Home Station
- Tips on Operating a Satellite while Roving
- Satellites with Sean Kutzko, KX9X and K3LR

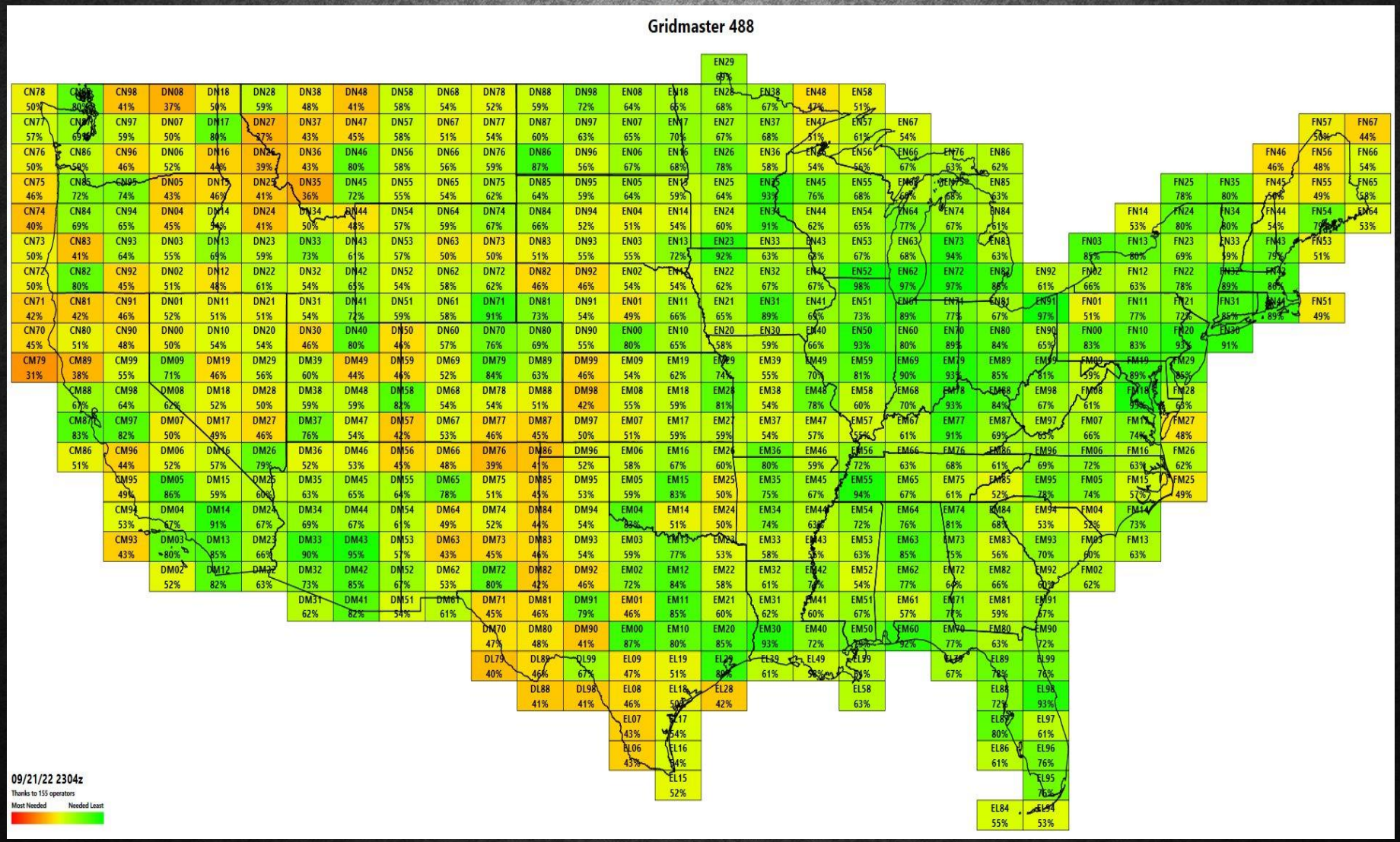
AMSAT GridMaster Award

Log Satellite QSOs With All 488 Grid Squares



AMSAT GridMaster Award

Log Satellite QSOs With All 488 Grid Squares



Source: GridMasterHeatMap @GridMasterHeat

AMSAT Reverse VUCC (VUCC/r)

Log Satellite QSOs From 100 Grid Squares

AD0HJ 2025/10/07 — 106/488 (21.72%) — Total

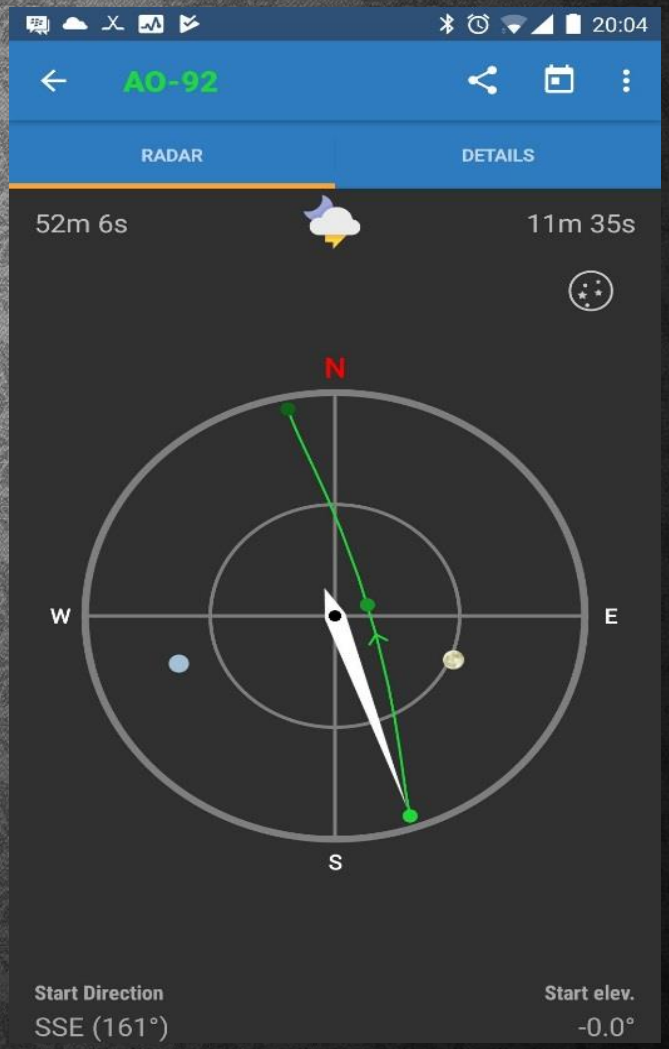
Confirmed in LOTW	106	106
Confirmed by QSL	0	0
Worked/Unconfirmed	0	0

Satellite Tracking Programs

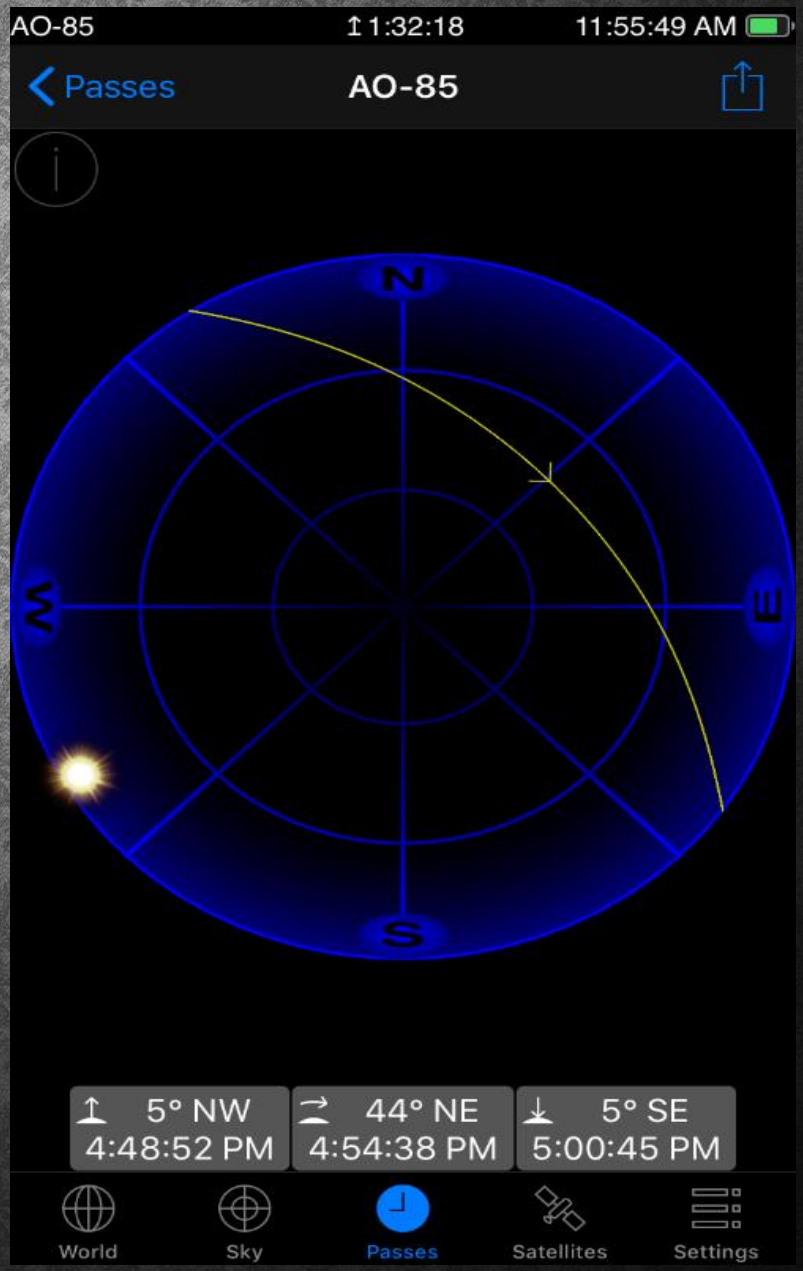
IOS
- GoSatWatch
- TrackSats
- Satellite Tracker

Android
- ~~Amsat Droid Free~~
- ISS Detector Pro
- Heavens Above
- Look4Sat

PC - Mac
- SatPC32 ($50.00) <- Available from AMSAT
- Mac Doppler <- More Features
- Orbitron
- GPredict
- AMSAT Web Page



Satellite Tracking on GoSatWatch (iOS)



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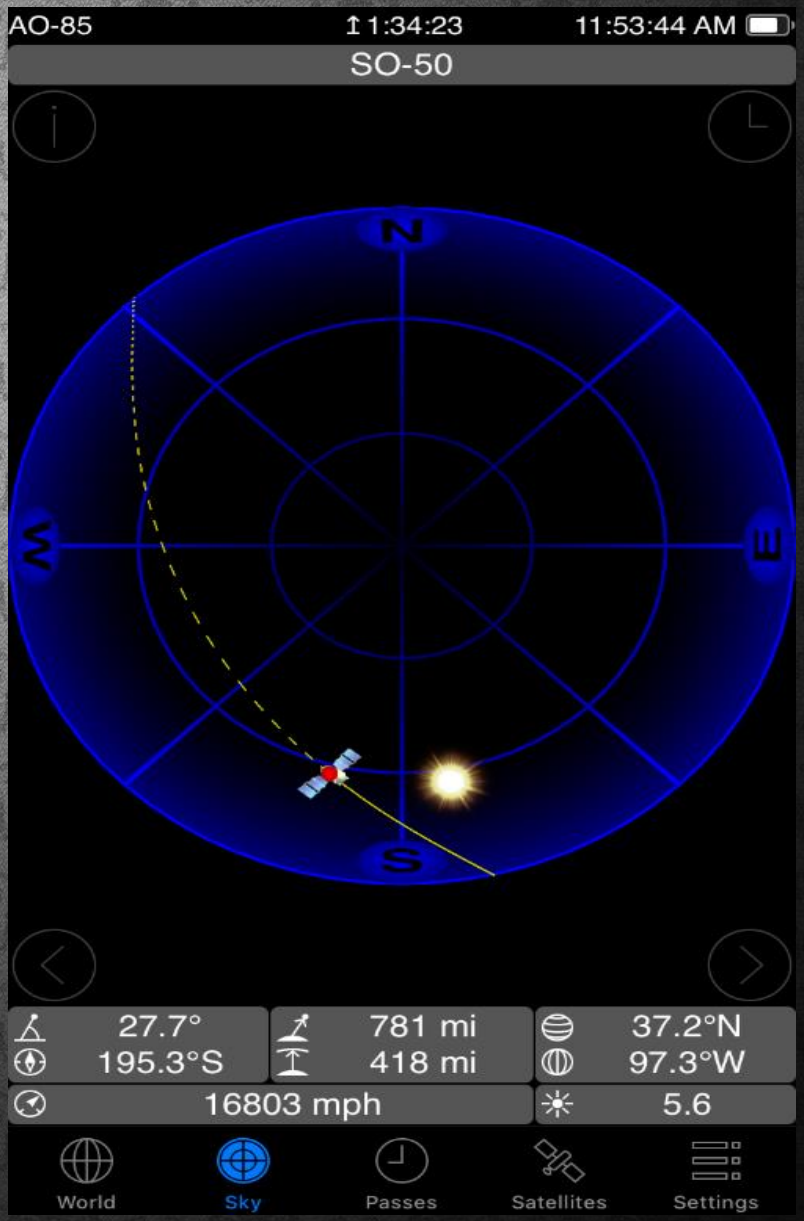
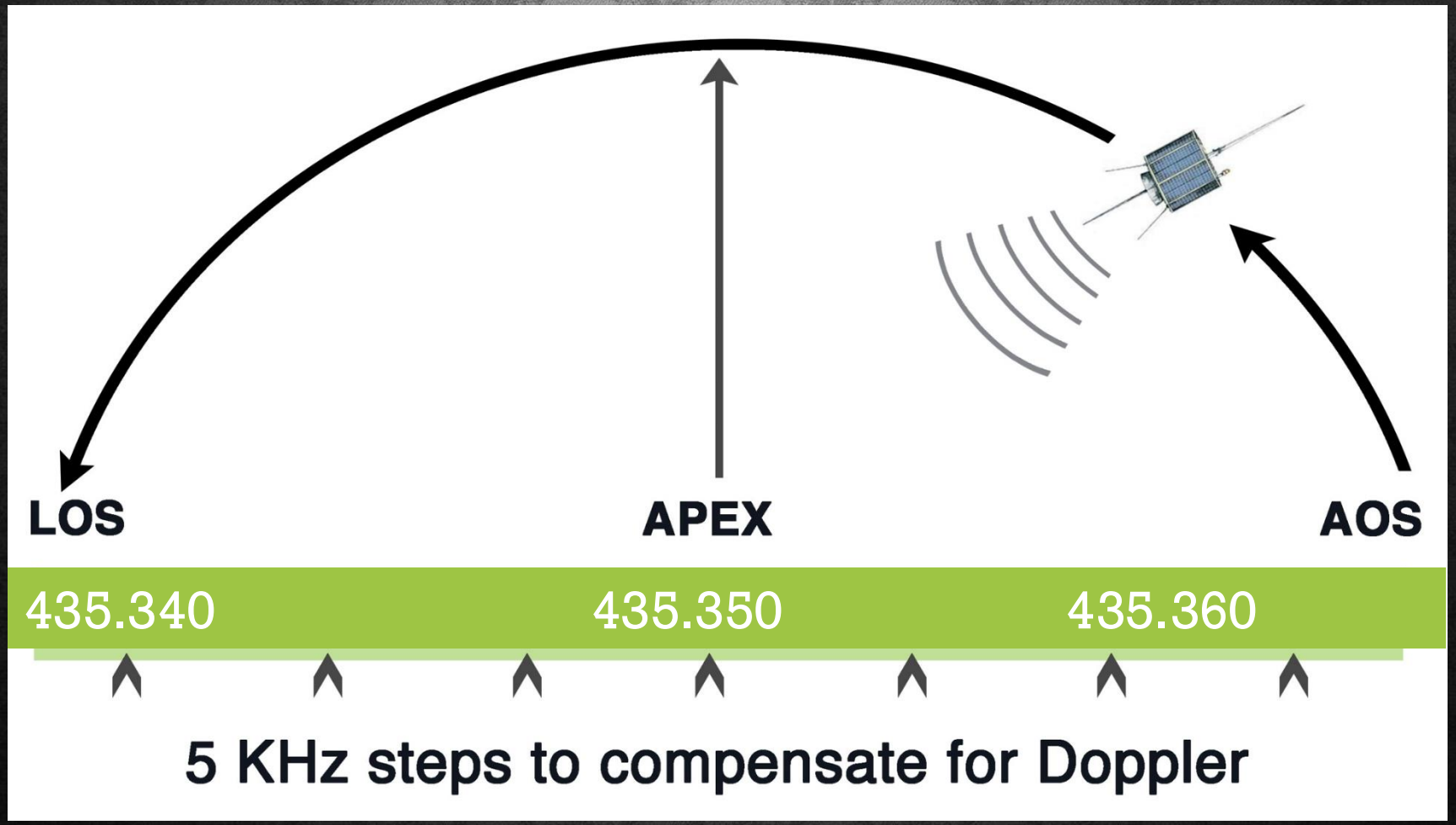


Doppler Effect (Satellite Travels ~17,500 mph)



KE0PBR Frequency Cheat Sheet

KE0PBR Wordpress Website

SO-50	67 Hz	
Preset #3	Up (FM)	Down (FM)
AOS		436.805
2		436.800
Mid	145.850	436.795
4		436.790
LOS		436.785

AO-91		67 Hz
Preset #2	Up (FM)	Down (FM)
AOS	435.240	
2	435.245	
Mid	435.250	145.960
4	435.255	
LOS	435.260	

LilacSat-2	No tone	
	Up (FM)	Down (FM)
AOS		437.210
2		437.205
Mid	144.350	437.200
4		437.195
LOS		437.190

AO-92		67 Hz
Preset #1	Up (FM)	Down (FM)
AOS	435.340	
2	435.345	
Mid	435.350	145.880
4	435.355	
LOS	435.360	

L-Band	AO-92
AOS	1267.320
	1267.325
	1267.330
	1267.335
	1267.340
	1267.345
TCA	1267.350
	1267.355
	1267.360
	1267.365
	1267.370
	1267.375
LOS	1267.380

<- Doppler is High to Low

Source: https://ke0pbr.wordpress.com/2018/12/31/my-frequency-cheat-sheet/

Portable Satellite Equipment

Dual Yaesu FT-818s
External Battery
Manual Doppler
Manual Antenna
Voice Recorder
Alaskan Arrow
Smartphone
Camera Bag
Headset

Great Portable Spot
Awesome Horizon
Perfect Weather
No RF Interference
No Power Lines
No Obstruction
No Distractions

Source: Philippe Chateau EA4NF @EA4NF_SAT

Portable Satellite Equipment

FM Satellite Gear

AD0HJ's FM Satellite Setup
- Kenwood TM-V71A Transceiver
- Arrow 146/437-10WBP Antenna
- Sony MDR-ZX110 Headphones
- Sony ICD-PX470 Voice Recorder
- DXE-58AURHC002 Coax Cable
- Zippy 13.2V 4200mAh Battery
- iSDT Q6 Lite Battery Charger
- 3.5mm Audio Patch Cable
- Tactical Shoulder Bag

- KE0PBR Wordpress / TM-V71 Setup
- Crossband Repeat Capable Radio
- Full Duplex / Listen to Downlink
- Kenwood TH-D72 Handheld
- Dual Handhelds / Solid Radio for RX
- AMSAT Getting Started with Amateur Satellites

Source: Ryan Zink KI7QEK @KI7QEK

Portable Satellite Equipment

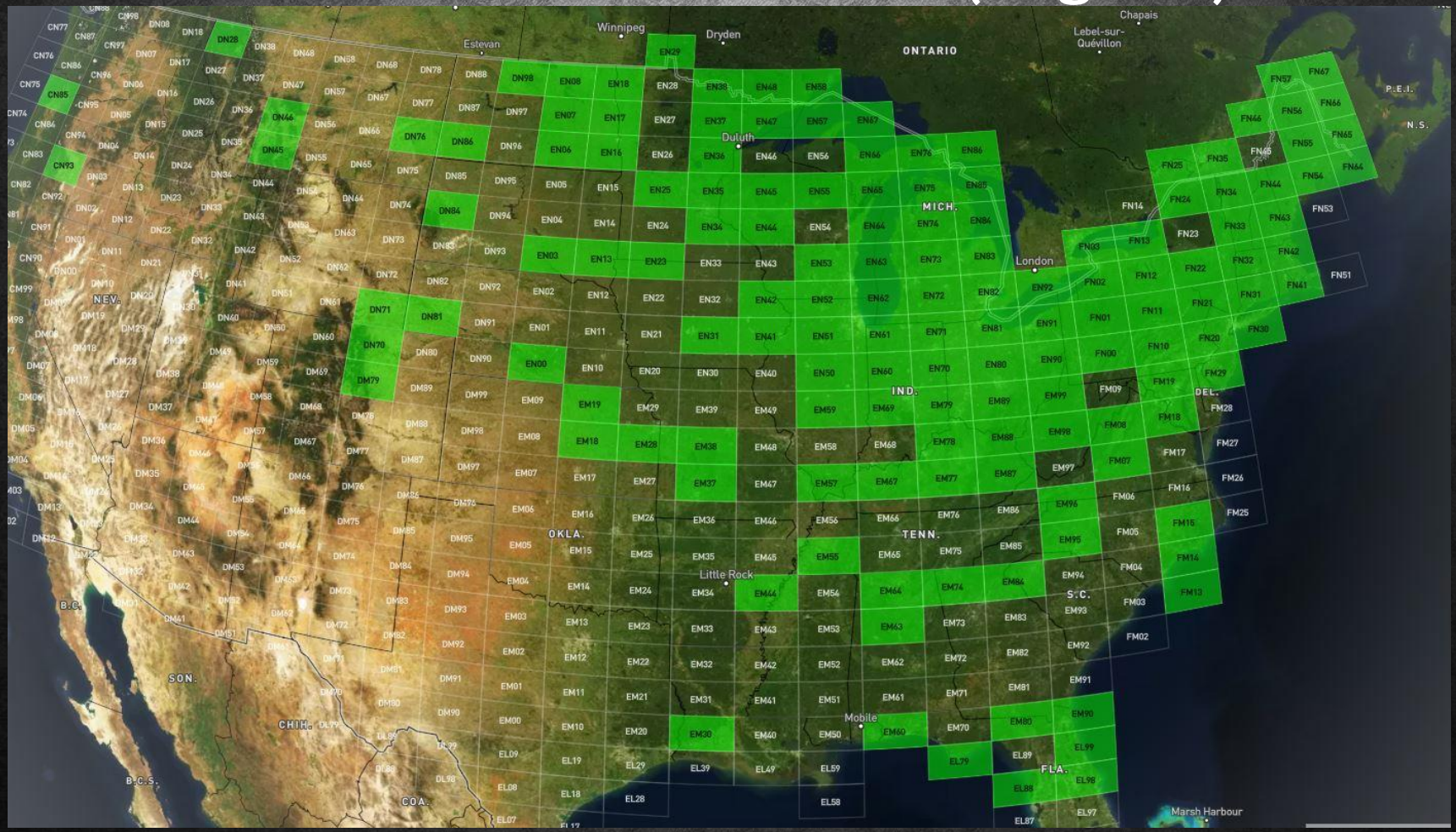
Linear / FM Satellite Gear

AD0HJ's Linear Satellite Setup
- Dual FT-818 Transceivers
- Portable Zero Dual Escort Rails
- Arrow 146/437-14BP Antenna
- Mini-Circuits BLP-200+ Filter
- 52 Inch / 60 Inch RG-58 Coax Cables
- UHF Male to BNC Female Adaptors
- MH-31 Microphone (Working FM Sats)
- Heil BM17DDYN Headset
- Heil AD1YM Headset Adapter
- Sony ICD-PX470 Voice Recorder
- 3.5mm Audio Patch Cable
- FT-818 Powerpole Power Adaptor
- Six Inch Power Pole Y Cable
- Five Foot Powerpole Cable
- Zippy 13.2V 4200mAh Battery
- iSDT Q6 Lite Battery Charger
- USB CAT Programming Cable
- CHIRP Programming / Memories

Source: Kylee Shirbroun KE0WPA @kylee_ke0wpa

DX Contacts via AO-7, FO-29, and RS-44

Maidenhead Grid IO93VN (England)



Source: David Pykett G0IIQ @G0IIQ

WELCOME TO THE AMSAT MEMBERSHIP AND EVENT PORTAL

This is the home of the AMSAT Membership and Event portal, including membership information, applications, renewals, and member account management, as well as AMSAT event information and registration. Current members should review these instructions for information on how to access your member account.

For more information about AMSAT and all the exciting things we do to keep amateur radio in space and the next generation reaching for the stars, please visit www.amsat.org

We Are AMSAT

The Radio Amateur Satellite Corporation (as AMSAT is officially known) is a scientific and educational non-profit corporation chartered in the District of Columbia in 1969. We design, construct, test, and operate space stations in the amateur satellite service. We also make available a variety of publications, computer programs, educational services, and internet services, promoting space science education among radio amateurs and students worldwide.

For over 50 years AMSAT has played a key role in significantly advancing the state of the art in space science, space education, and space technology. Undoubtedly, the work now being done by AMSAT volunteers throughout the world will continue to have far-reaching, positive effects on the future of Amateur Radio, as well as other governmental, scientific and commercial activities in the space, the final frontier.

NOT A MEMBER YET?

JOIN US NOW

MEMBER BENEFITS

- ✔ Subscription to *The AMSAT Journal* (digital only)
- ✔ Discounts at AMSAT Store

AMSAT / ARRL Satellite Awards

AMSAT Satellite Awards
- Satellite Communicators' Club (1 Contact)
- Oscar Achievement Award (20 Entities)
- Oscar Sexagesimal Award (60 Entities)
- Oscar Century Award (100 Entities)
- AMSAT Rover Award
- AMSAT GridMaster Award
- Reverse VUCC or VUCC/r Award
- W4AMI Satellite Operator Achievement Award

ARRL Satellite Awards
- VHF/UHF Century Club Satellite
- Worked All States Satellite

International Space Station QSL Card
- ARRL or RAC (Radio Amateurs of Canada)
- QSL Card for Voice, Packet or SSTV

Source: AMSAT @AMSAT

Amateur Radio Satellites
Mitch Ahrenstorff ADØHJ