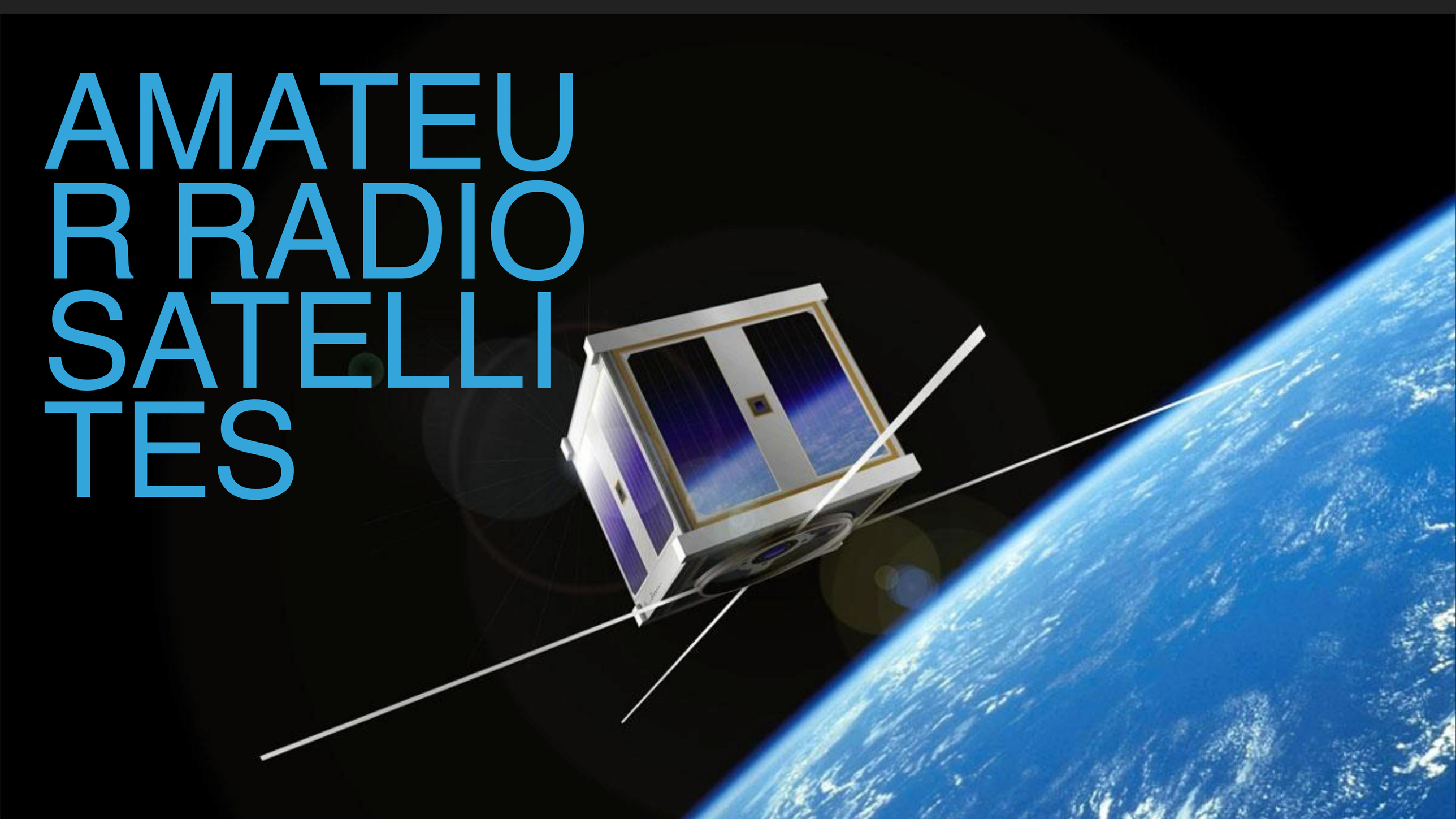
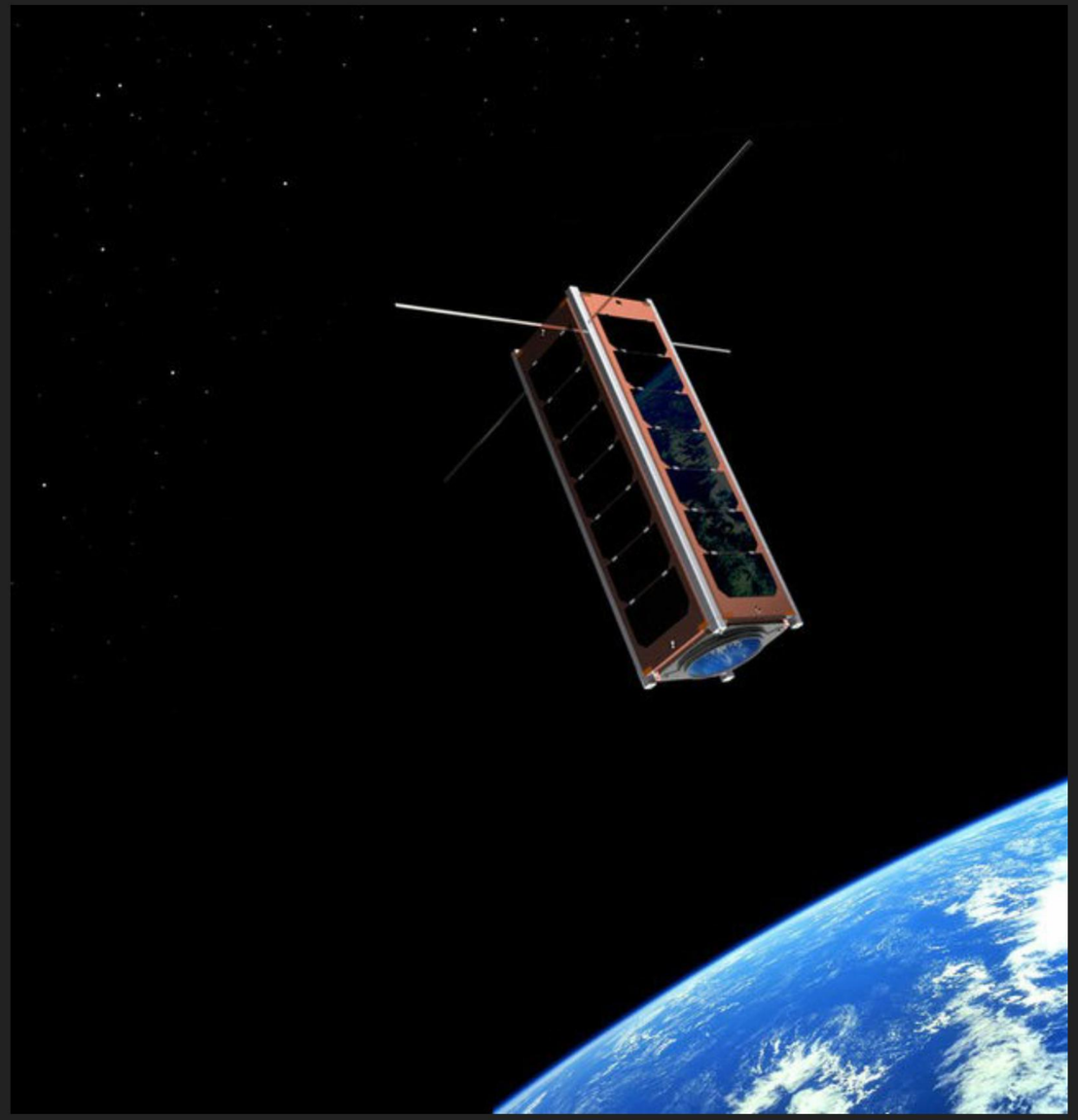
AMATEUR RADIO SATELLITES



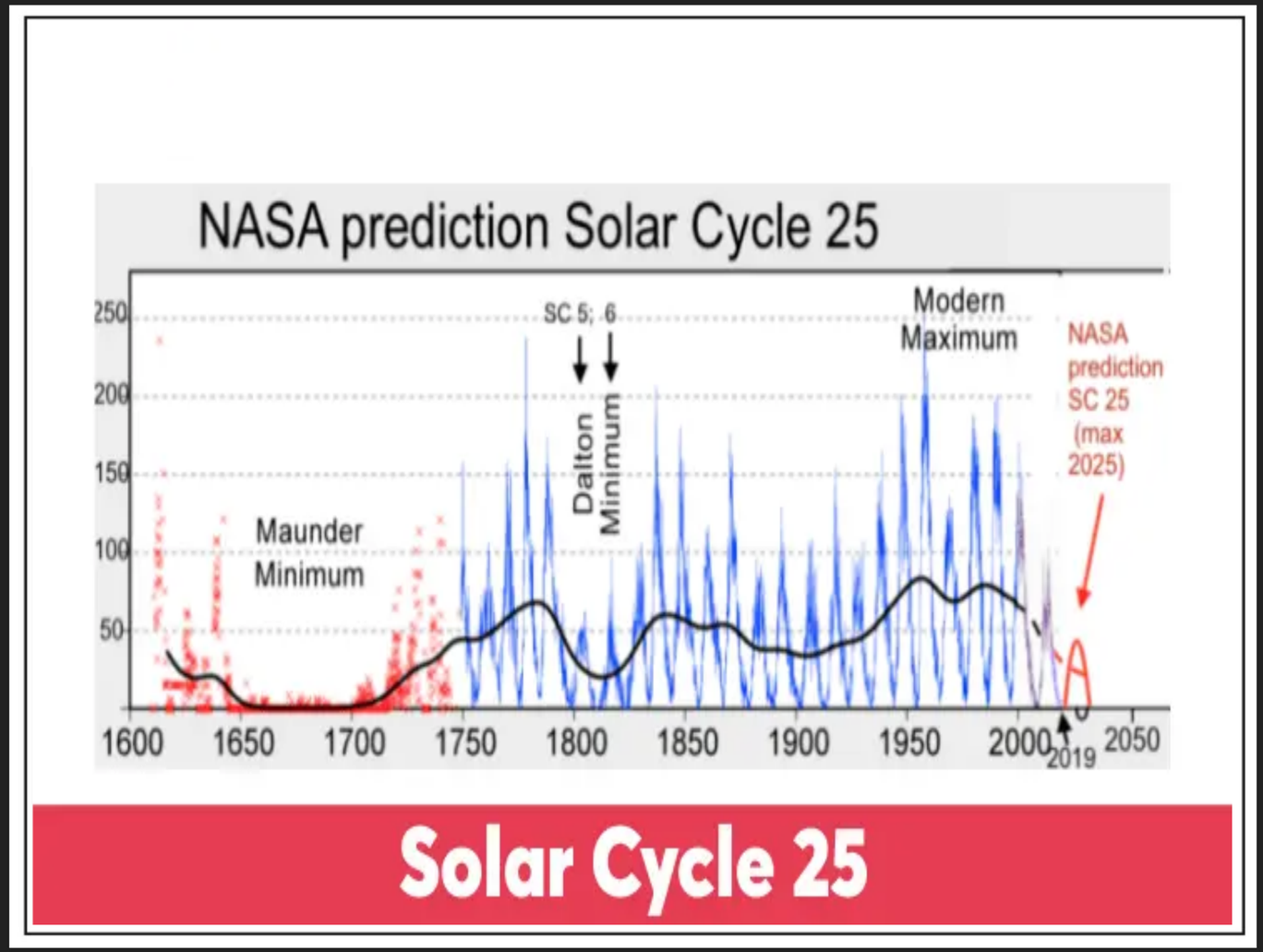
WHAT WE'RE GOING TO TALK ABOUT

- What are Ham Radio Satellites?
- Orbits and More — Active Satellites
- How Can I Work Them?
- What Radio and Antenna Do I Need?
- What Software Do I Need?



FUN WITH SUNSPOTS

- Solar Cycle 25
- Minimum Expected 2023/4
- Limited F Layer Openings
- Lower Bands - 160/80
- VHF-UHF Modes

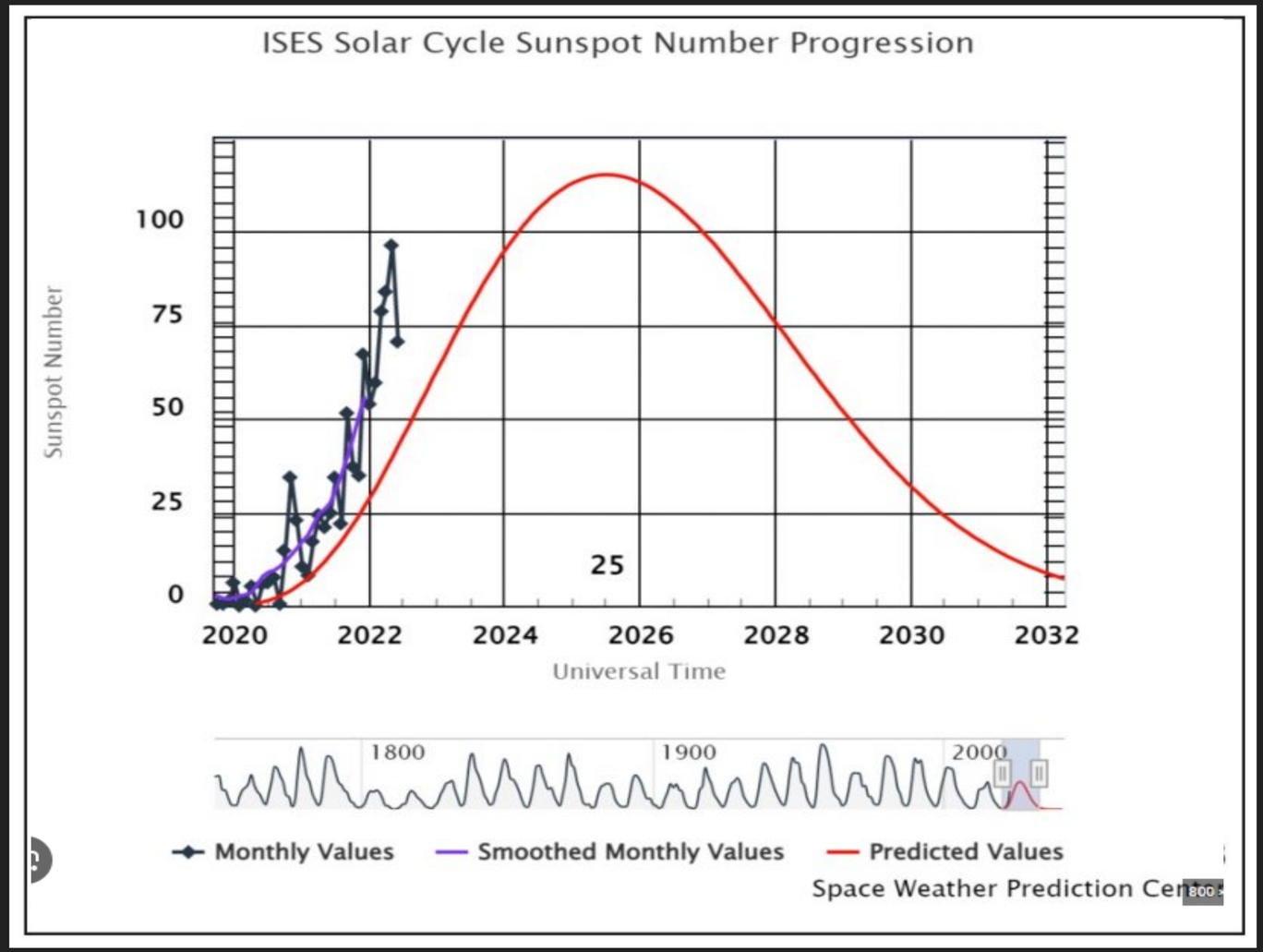


FUN WITH SUNSPOTS

Solar Cycle 25

May have already peaked – 2 years earlier then predicted

Unexplained dip in Index mid/late 2023

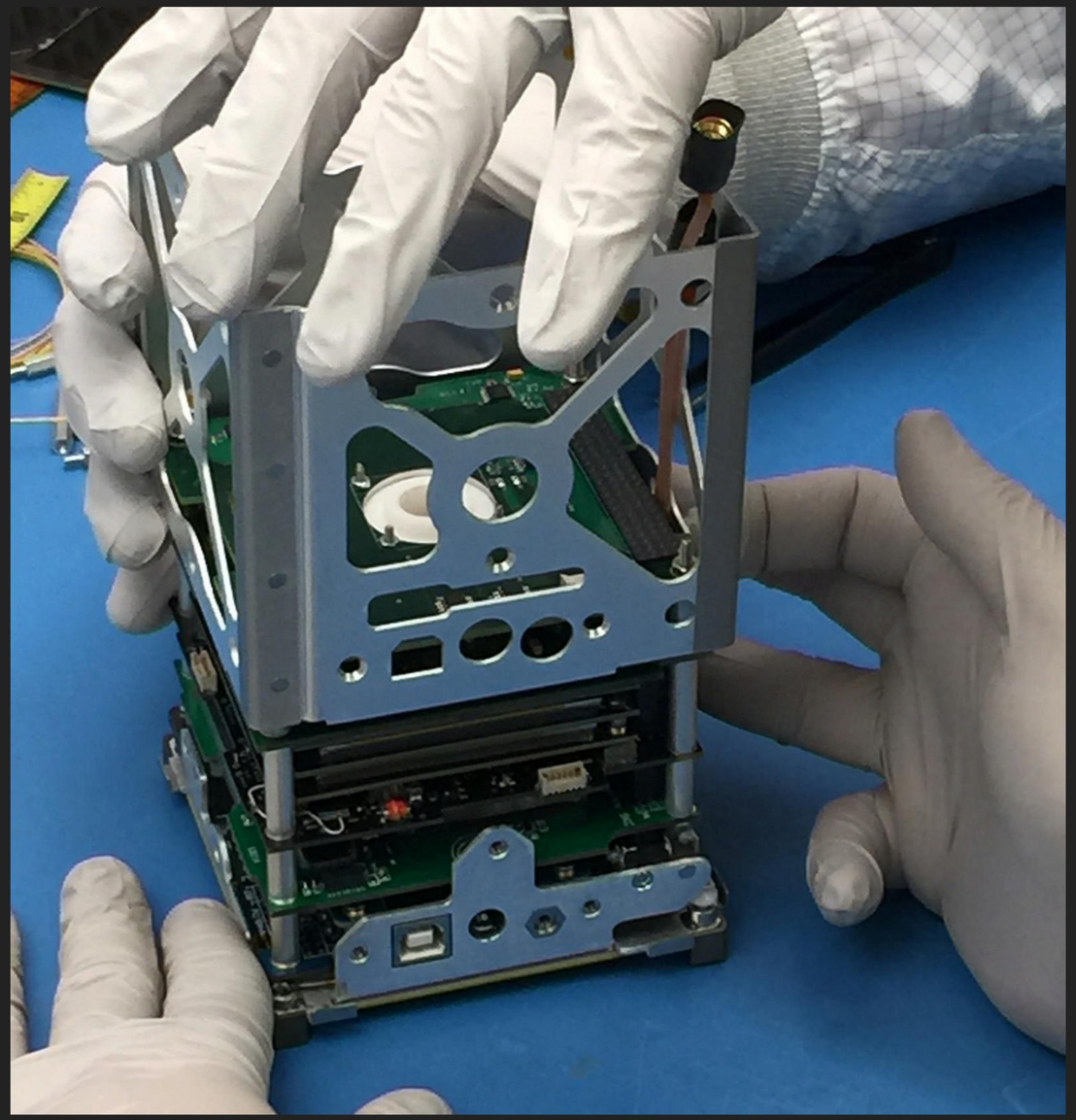


AMATEUR RADIO SATELLITES

- Technical Achievement
- Working extreme DX
- Activating DX
- ARRL Awards
- AMSAT Awards
- Low Power, Small Antennas, Short QSOs

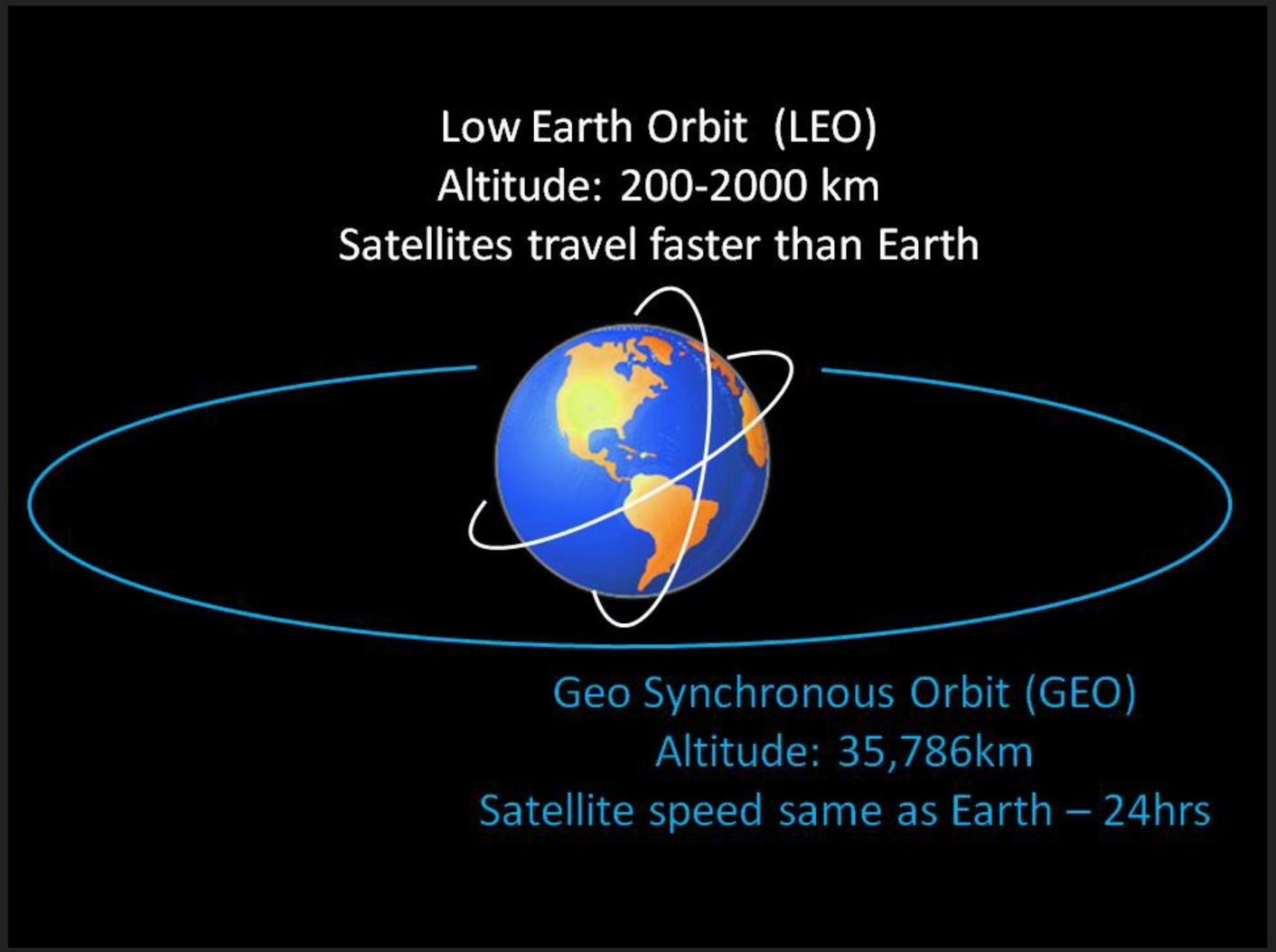
WHAT ARE HAM RADIO SATELLITES?

- Orbiting Repeaters and Transponders
  - Crossband VHF to UHF
  - Crossband UHF to VHF
- FM Repeaters
- SSB/CW/PSK Transponders



ORBITS AND MORE

- Low Earth Orbit (LEO)
- Altitude
- Azimuth
- 10 to 15 minutes AOS to LOS
- 1 hour 25-minute Orbit
- Doppler Shift



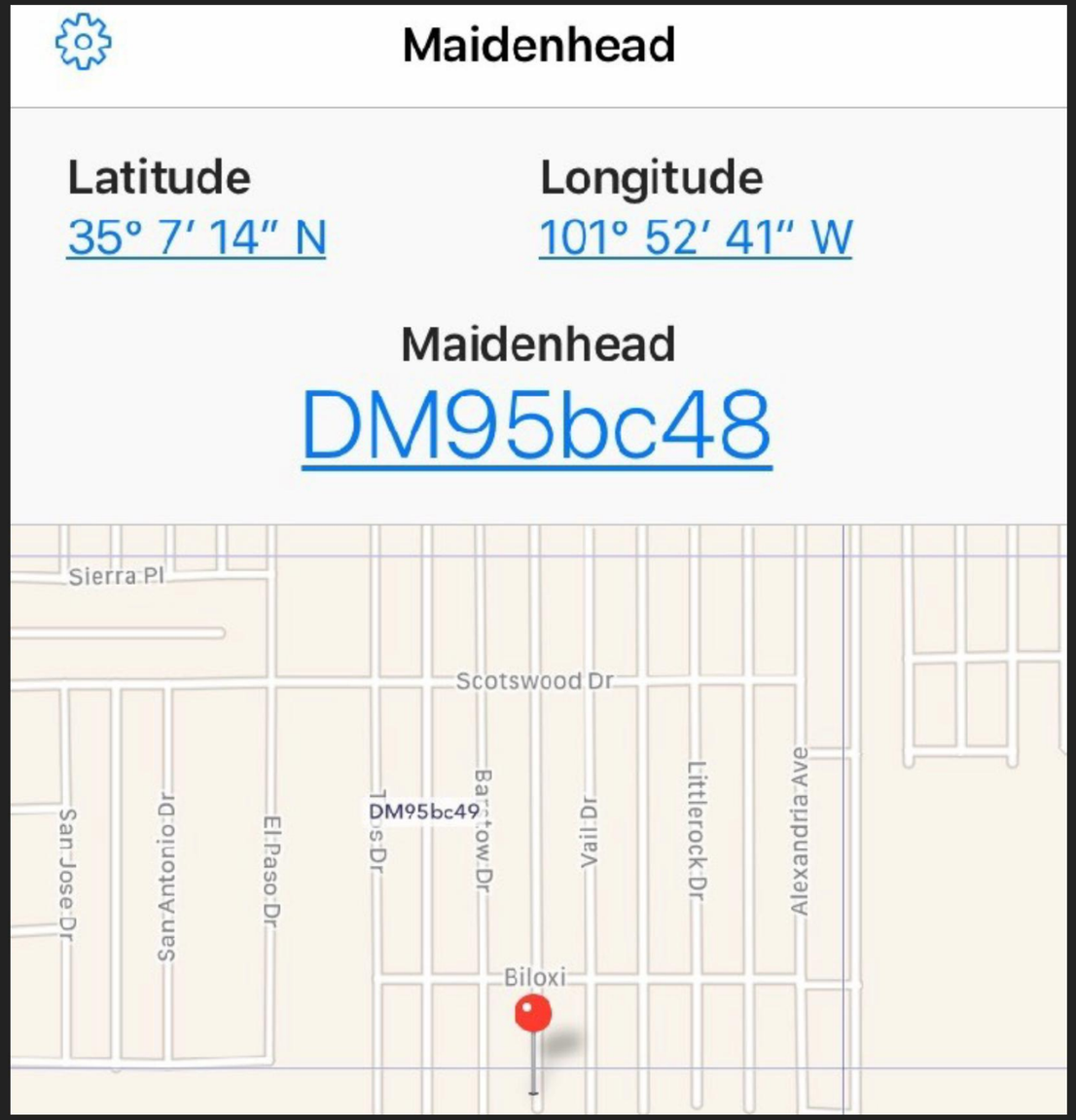
ACTIVE SATELLITES

- IS
  S
- AO-7, FO-29, XW-2A/B/C/D/F, CAS-4B
- SO-50, AO-85
- AO-91 in orbit since November 2017
- Fox 1-D launched January 2018
- Many, many more plus ongoing launches

SATELLITE OPERATING

HOW CAN I WORK THEM?

- Know Your Location
- Know the Satellite
  - Frequencies
  - Keplerian Elements
- Determine Satellite Timing and Path
- Radio(s) and Antenna



HOW CAN I WORK THEM?

- Know Your Location
- Know the Satellite
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Radio Programming Chart

AO-91 Doppler Shift Correction		
Memory	**Your Transmit Frequency(With 67 Hz Tone)**	**Your Receive Frequency**
Acquisition of Signal (AOS)	435.240 MHz	145.960 MHz
Approaching	435.245 MHz	145.960 MHz
Time of Closest Approach (TCA)	435.250 MHz	145.960 MHz
Departing	435.255 MHz	145.960 MHz
Loss of Signal (LOS)	435.260 MHz	145.960 MHz

HOW CAN I WORK THEM?

- Know Your Location
- Know the Satellite
  - Frequencies
  - Keplerian Elements
- Determine Satellite Path/Timing
- Radio(s) and Antenna

AMSAT Online Satellite Pass Predictions - AO-91

View the current location of AO-91

Date (UTC)	AOS (UTC)	Duration	AOS Azimuth	Maximum Elevation	Max El Azimuth	LOS Azimuth	LOS (UTC)
12 Jan 18	20:09:01	00:09:39	203	15	267	326	20:18:40
13 Jan 18	06:25:44	00:08:44	52	6	95	135	06:34:28
13 Jan 18	08:00:19	00:13:03	10	79	286	196	08:13:22
13 Jan 18	09:38:54	00:07:08	329	4	302	260	09:46:02
13 Jan 18	18:54:11	00:10:43	153	37	99	358	19:04:54
13 Jan 18	20:32:24	00:07:31	222	7	265	311	20:39:55
14 Jan 18	06:46:56	00:11:07	38	14	101	152	06:58:03
14 Jan 18	08:22:37	00:12:56	2	40	265	208	08:35:33
14 Jan 18	17:43:41	00:04:34	90	2	77	39	17:48:15
14 Jan 18	19:16:14	00:10:58	167	87	331	349	19:27:12

WHAT RADIO DO I NEED?

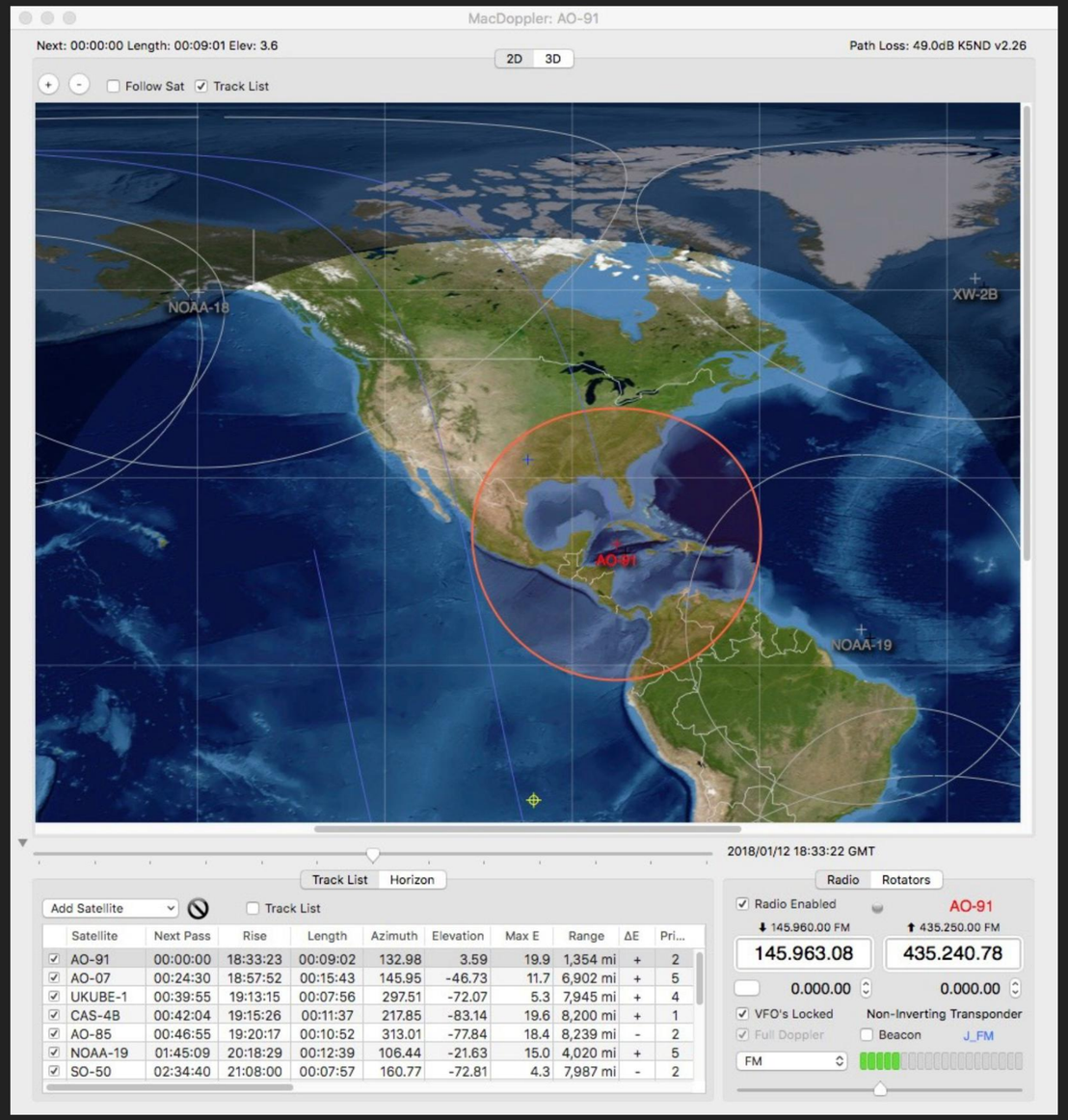
- Full Duplex versus Half Duplex
- FM HTs — Kenwood TH-D72A
- FM Mobile — Icom IC-2728H/2800
- Portable Rigs — FT 817/847
- Base Station — Icom IC-9700, Kenwood TS2000
- SDRs on the receive side

WHAT ANTENNA DO I NEED?

- HT Long Whips can work
- Cheap Yagis
- Hand-Held
- Fixed Elevation
- AZ-EL Rotators
- Listen First!

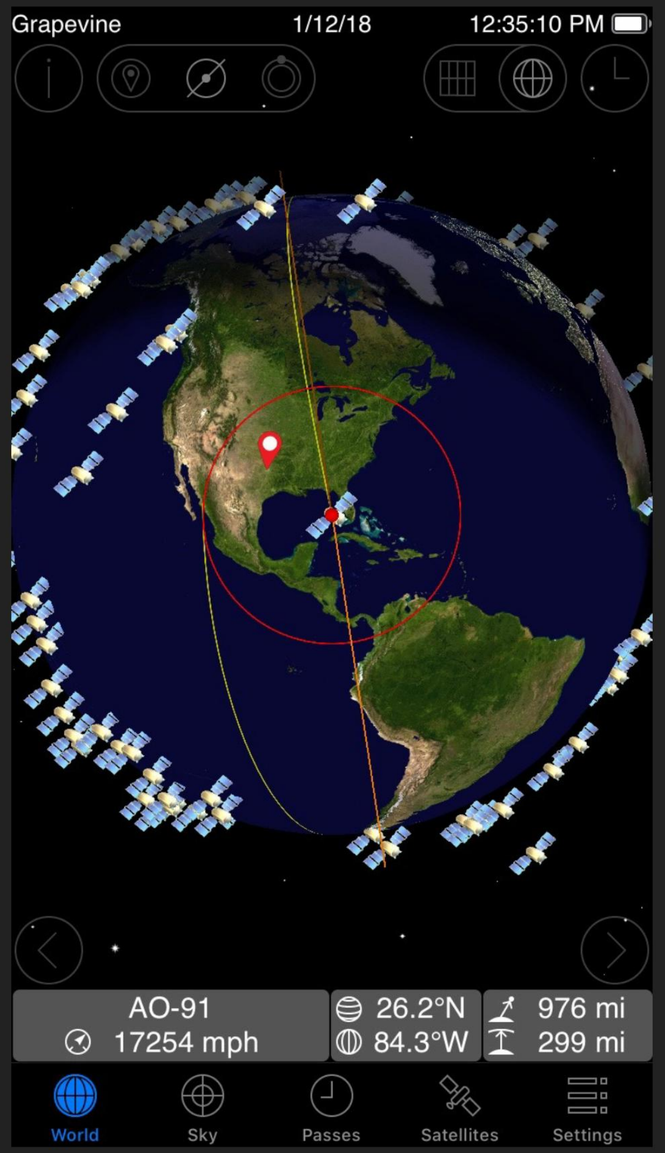
WHAT SOFTWARE DO I NEED?

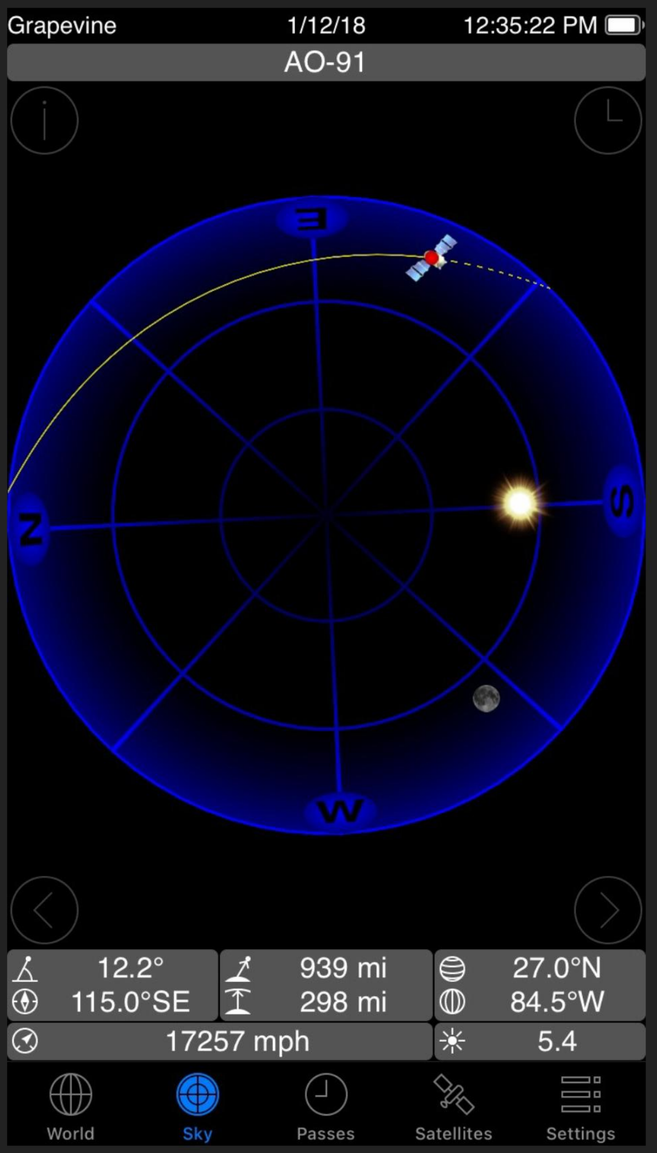
- Phone Apps for predictions and paths
- Online prediction software
- SatPC32 tracking software
- MacDoppler tracking software
- Manual or automatic doppler correction



PHONE APP

- GoSatWatch App on iPhone
- World Map of AO-91
- Overhead Chart of Satellite Path





FOR MORE INFORMATION

- Amsats and Hamsats: Amateur Radio and other Small Satellites: A comprehensive guide to communicating through amateur radio satellites. Written by Andrew Barron ZL3DW and published in 2018.
- The ARRL Satellite Handbook: Includes descriptions and illustrations to help you participate in satellite communications.
- The Radio Amateur's Satellite Handbook: Includes information on operating antennas and software.
- OSCAR: The Ham Radio Satellites: By Dave Ingram.

Other books about ham satellites include:

- Getting Started with Amateur Satellites
- 2006-2012 AMSAT Symposium Proceedings
- 2018 AMSAT Symposium Proceedings
- 1996-2000 AMSAT Symposium Proceedings
- 1990-1995 AMSAT Symposium Proceedings

THANK YOU!

QUESTIONS?