

Note: We will be recording all Bootcamp Sessions. Anyone not wishing to be recorded should mute their video or disconnect.



# GETTING STARTED WITH AMATEUR RADIO SATELLITES

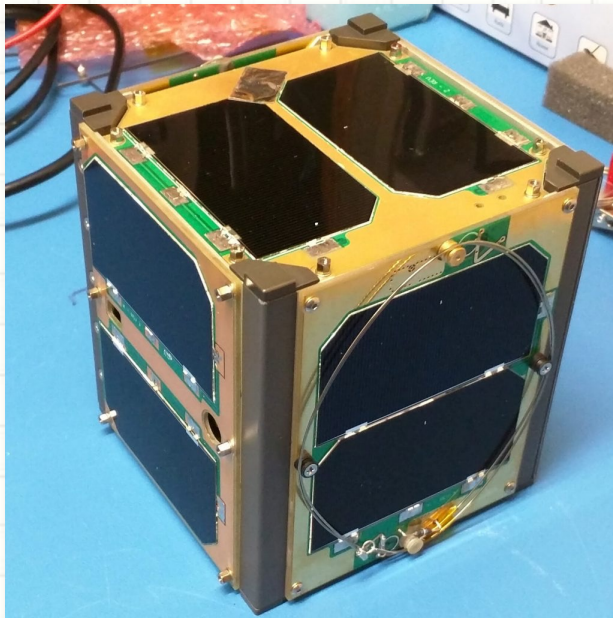
Ham Bootcamp

Fall 2023

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# Amateur Satellites

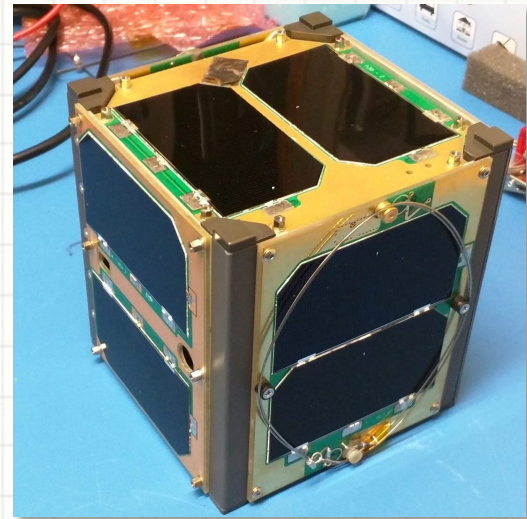
- Orbiting Satellites Carrying Amateur Radio (OSCAR)
- They are small!
- They ride share with big payloads



# Types of Satellites

FM EasySats, Linear Sats, Digital Sats...

- FM Repeaters
  - “EasySats” but they are very busy!
  - That’s mostly what we will talk about
- Linear Transponders
  - Harder to work but more users possible
  - Usually use sideband (USB/LSB)
  - Best done with computer control
- APRS (digital packet)
  - Use AX.25 modulated audio over an FM channel
- Other kinds of digital



# What Can I Do With Amateur Satellites?



- Learn New Skills/Ideas
- Communication
  - With other other hams (+ astronauts in space)
  - Contesting ← What we will mainly talk about
    - Extra points on field day
    - Satellite-specific awards
  - Improve weak signal skills
- Collect Data/Messages/Pictures (think Short Wave Listener)

# Getting Started Summary

## What Equipment Do I Need?

- Two Handheld Radios
- Handheld Yagi
- Smartphone
  - Satellite tracking app
  - Compass
- Adjust UHF frequency to correct for Doppler (use memories)
- A Voice Recorder is helpful to capture QSOs details as you make them
- Consider tent stakes to mark rise/set locations
- Consider helpers to call out directions, frequencies, write log



# Radios for Satellites

## Two Inexpensive HTs

- For example Baofeng BF-F8HP (many others)
- \$70<sup>ish</sup> on Amazon - many others are cheaper
- Good choice with an Arrow antenna which has two feedlines - one for each radio
- A Headset with a PTT button will make operating much easier
  - Required so you can hear your own signal in the downlink
- Don't forget cables and adapters!
- Good for FM Only

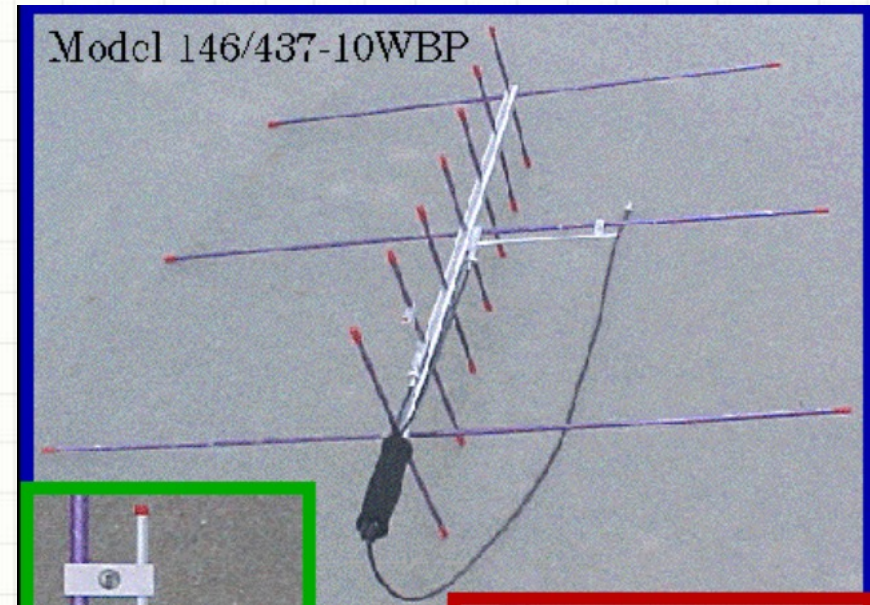
Full Duplex Radio Antenna Options  
Exist but are more \$



# Getting Started

## Antennas (handheld)

- Handheld yagis are the most common
- Arrow Yagi Antenna
  - Notice separate 2 m elements and 70 cm elements
    - Two Yagi antennas on one boom
  - Two feedlines, one for each band
  - Must rotate to align with satellite polarity for Rx and Tx
- Tripod or some sort of support can be helpful

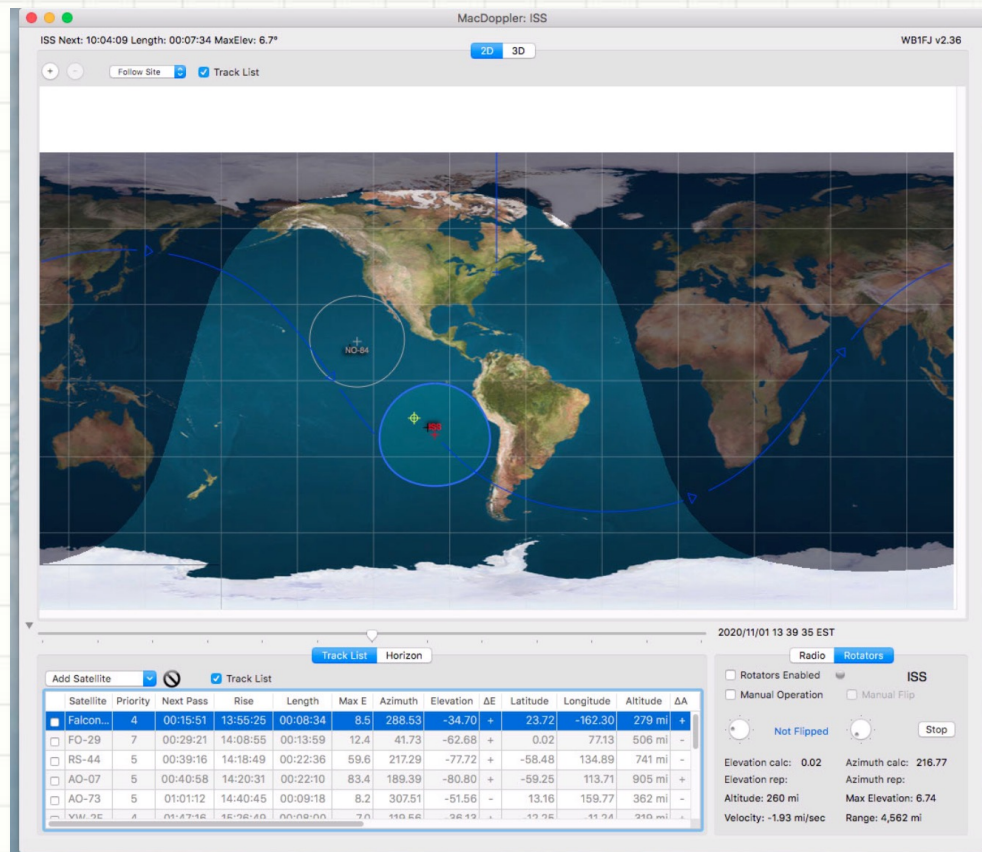


This Arrow can have an optional diplexer in handle for single feedline



# Satellite Tracking Apps

- **Android:** AmsatDroid
- **Mac:** MacDoppler (\$)
- **Windows:** SatPC32 (\$)
- **Linux:** Gpredict (Free)



How do the apps know where satellites are?

- Keplerian Elements downloaded from internet

This set of numbers is all you need to track each bird:

SO-50 1 27607U 02058C 20303.41730594 .00000041 00000-0 26214-4 0 9992 2 27607 064.5555  
324.7826 0032786 129.0565 231.3463 14.75671885960481

# Getting Started

## Programming Your HT(s) For Satellites

| AO-91 (U/V Mode)      | Downlink (V) | Uplink (U)                 |
|-----------------------|--------------|----------------------------|
| Acquisition of Signal | 145.960 MHz  | 435.240 MHz + 67.0 Hz Tone |
| Early in Pass         |              | 435.245 MHz + 67.0 Hz Tone |
| Mid Pass (TCA)        |              | 435.250 MHz + 67.0 Hz Tone |
| Late Pass             |              | 435.255 MHz + 67.0 Hz Tone |
| Loss of Signal        |              | 435.260 MHz + 67.0 Hz Tone |

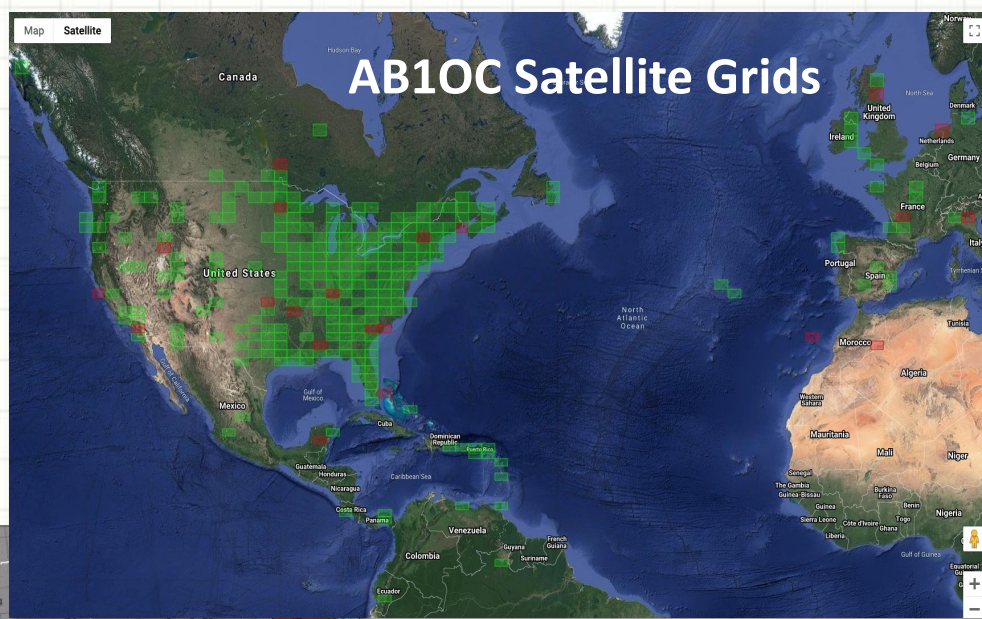
| SO-50 (V/U Mode)      | Downlink (U) | Uplink (V)                 |
|-----------------------|--------------|----------------------------|
| Activate SO-50        | ---          | 145.850 MHz + 74.4 Hz Tone |
| Acquisition of Signal | 436.805 MHz  | 145.850 MHz + 67.0 Hz Tone |
| Early in Pass         | 436.800 MHz  |                            |
| Mid Pass (TCA)        | 436.795 MHz  |                            |
| Late Pass             | 436.790 MHz  |                            |
| Loss of Signal        | 436.785 MHz  |                            |

***Program HT(s) memories with frequencies for each FM satellite***

# Where Am I Located?

## Maidenhead Grid Squares

- Maidenhead Grid Squares divide up the world into a combination of 2 letters + 2 digits
- Each grid is approx. 70 miles X 100 miles



- Hams try to work a station in every grid square
- Earn a VUCC Award for confirming 100+ grids

# Making EasySat Contacts

Here is what it looks like!



[Video on YouTube](#)

# Progressing With Satellites

## A Variety of Stations are Possible

- Permanent or semi-portable
- With and without rotators
- Ground mount in the yard, portable in a parking lot, or a dedicated tower
- Circular-polarized antennas for permanent installations
- Computer control for linear satellites
- View our Tech Night for more ideas and info



# Questions?

**Have Fun!**

**To Learn More:**

Check out the Nashua Area Radio Society's Tech Night Program at:

[n1fd.org/tech-night](http://n1fd.org/tech-night)

Become an Internet Subscriber (or members of NARS):

[n1fd.org/join-us](http://n1fd.org/join-us)

Much more information, pictures and video are available on our Blog at:

[stationproject.blog](http://stationproject.blog)



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# AMATEUR RADIO SATELLITE DEMO

Nashua Area Radio Society

Fall 2023

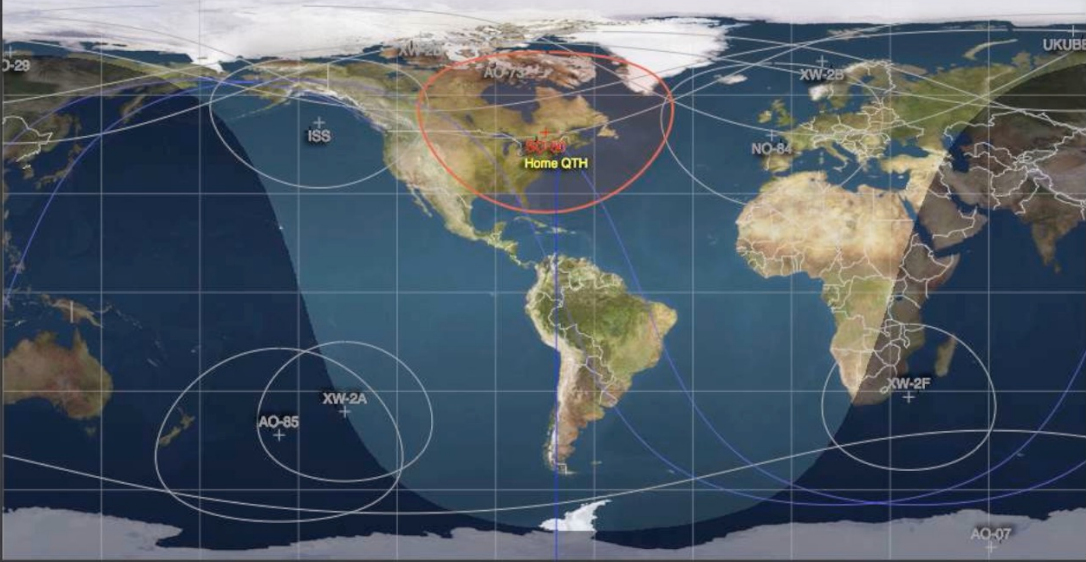
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# FM "EasySat" Demo QSOs (SO-50)

Next: 00:00:00 Length: 00:08:31 Elev: 36.5 Path Loss: 50.0dB AB10C v2.24

2D 3D

☐ Follow Sat ☒ Track List



2017/05/09 11 50 13 America/New\_York

Track List Horizon

| Satellite                                   | Pr... | Next Pass | Rise     | Length   | Azimuth | Elevation | ΔE | Max E | Altitude | ΔA | Range    |
|---------------------------------------------|-------|-----------|----------|----------|---------|-----------|----|-------|----------|----|----------|
| <input checked="" type="checkbox"/> SO-50   | 1     | 00:00:00  | 11:50:14 | 00:08:32 | 340.95  | 36.28     | +  | 69.7  | 387 mi   | +  | 618 mi   |
| <input checked="" type="checkbox"/> AO-73   | 5     | 00:02:30  | 11:52:41 | 00:05:29 | 349.74  | -4.69     | +  | 2.3   | 381 mi   | +  | 2,160 mi |
| <input checked="" type="checkbox"/> ISS     | 2     | 00:09:01  | 11:59:14 | 00:06:00 | 307.31  | -19.81    | +  | 3.6   | 250 mi   | -  | 3,326 mi |
| <input checked="" type="checkbox"/> UKUB... | 5     | 00:13:58  | 12:04:11 | 00:01:26 | 4.82    | -23.57    | +  | 0.1   | 384 mi   | -  | 3,998 mi |
| <input checked="" type="checkbox"/> AO-85   | 2     | 00:26:45  | 12:16:57 | 00:07:27 | 232.29  | -55.16    | +  | 11.6  | 469 mi   | -  | 7,042 mi |
| <input checked="" type="checkbox"/> AO-07   | 2     | 00:39:24  | 12:29:35 | 00:14:58 | 165.29  | -68.13    | +  | 10.4  | 904 mi   | -  | 8,302 mi |
| <input checked="" type="checkbox"/> EO-88   | 3     | 00:42:05  | 12:32:17 | 00:06:22 | 93.90   | -84.06    | +  | 4.0   | 307 mi   | -  | 8,187 mi |
| <input checked="" type="checkbox"/> EO-79   | 4     | 00:51:15  | 12:41:27 | 00:11:36 | 349.79  | -72.36    | -  | 20.6  | 377 mi   | +  | 7,951 mi |

Radio Rotators

☒ Radio Enabled SO-50

Downlink: 436.795.00 Uplink: 145.850.00

**436.802.54** **145.847.48**

0.000.00 0.000.00

☒ VFO's Locked ☐ Non-Inverting Transponder

☒ Full Doppler ☐ Beacon JFM

JFM-3 

Call Sign:  Grid:

First Name:  Time:  UTC

Last Name:  Up:  MHz

Street:  Down:  MHz

City:  Mode:

State:  Satellite:

Country: **United States** Azimuth:  Degrees

zip:  Elevation:  Degrees

email:

Comments:

My Grid: FN42er RSTS **59** RSTR **R**

Lookup Clear Log it Done

Extra

Presentations

Mobile HF

Satellite Predictions

AMSAT OSCAR Satellite Status

GH Tr...

File Setup Source Help

● EL: **036.1**

● AZ: **338.4**

SO-50

Tracking

# Linear Satellite Demo QSOs (FO-29)

Next: 00:00:00 Length: 00:10:01 Elev: 12.7 Path Loss: 152.6dB AB10C v2.24

2D 3D

☒ Follow Sat ☒ Track List



Call Sign:  Grid:   
First Name:  Time:  UTC  
Last Name:  Up:  MHz  
Street:  Down:  MHz  
City:  Mode:   
State:  Satellite:   
Country:  Azimuth:  Degrees  
zip:  Elevation:  Degrees  
email:   
Comments:   
My Grid: FN42er RSTS  RSTR

2017/05/09 11:29:18 America/New\_York

Track List Horizon

Add Satellite ☒ Track List

| Satellite                                 | Pr... | Next Pass | Rise     | Length   | Azimuth | Elevation | ΔE | Max E | Altitude | ΔA | Range    |
|-------------------------------------------|-------|-----------|----------|----------|---------|-----------|----|-------|----------|----|----------|
| <input checked="" type="checkbox"/> FO-29 | 1     | 00:00:00  | 11:29:19 | 00:10:01 | 227.08  | 12.74     | +  | 19.9  | 547 mi   | -  | 1,456 mi |
| <input checked="" type="checkbox"/> SO-50 | 1     | 00:16:51  | 11:45:08 | 00:13:37 | 318.96  | -37.32    | +  | 69.7  | 396 mi   | -  | 5,430 mi |
| <input checked="" type="checkbox"/> AO-73 | 5     | 00:23:23  | 11:52:42 | 00:05:29 | 33.08   | -47.89    | +  | 2.3   | 362 mi   | -  | 6,366 mi |
| <input checked="" type="checkbox"/> ISS   | 2     | 00:29:57  | 11:59:14 | 00:06:00 | 326.27  | -60.91    | +  | 3.8   | 253 mi   | -  | 7,220 mi |
| <input checked="" type="checkbox"/> UKUB  | 5     | 00:34:54  | 12:04:11 | 00:01:26 | 319.45  | -59.00    | +  | 0.1   | 396 mi   | -  | 7,297 mi |
| <input checked="" type="checkbox"/> AO-85 | 2     | 00:49:41  | 12:18:57 | 00:07:27 | 118.66  | -81.91    | -  | 4.6   | 460 mi   | +  | 8,304 mi |
| <input checked="" type="checkbox"/> AO-07 | 2     | 01:00:16  | 12:29:35 | 00:14:58 | 263.22  | -60.89    | -  | 10.4  | 907 mi   | +  | 7,929 mi |
| <input type="checkbox"/> FO-88            | 3     | 01:03:01  | 12:32:17 | 00:06:22 | 195.82  | -69.40    | -  | 4.0   | 311 mi   | -  | 6,401 mi |

Radio Rotators

☒ Radio Enabled ☒ FO-29  
Downlink: 435.851.70 UpLink: 145.950.00  
435.857.16 145.949.67  
-0.000.59 0.001.70  
☒ VFO's Locked ☒ Full Doppler ☐ Beacon JA\_SSB  
JA-3

Downlink Frequency Stepper

EL: 012.2  
AZ: 224.0  
FO-29  
Tracking

Extra  
Presentations  
Mobile HF  
Satellite Predictions  
AMSAT OSCAR  
Satellite Status