

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

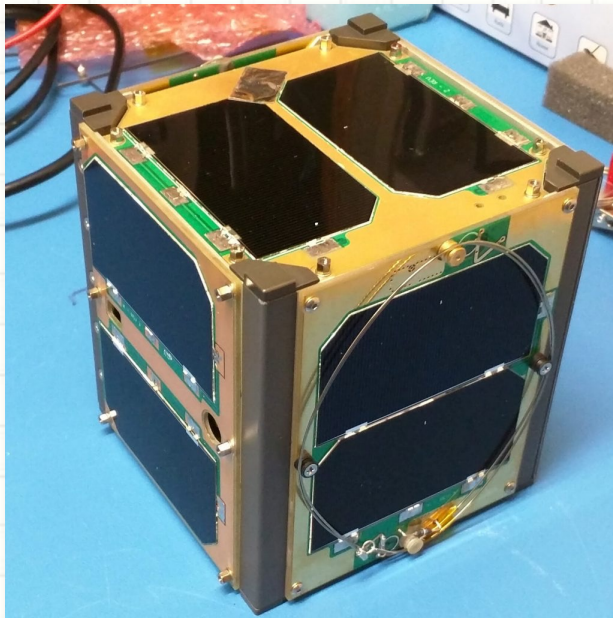
Nashua Area Radio Society

Fall 2021

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# Amateur Satellites

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

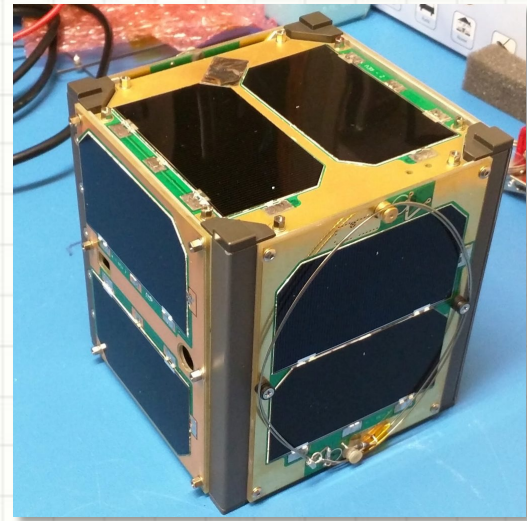




# Types of Satellites

FM EasySats, Linear Sats, Digital Sats...

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



# What Can I Do With Amateur Satellites?



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



# 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
- Maybe tent stakes to mark rise/set locations
- Maybe 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
  - Especially for hearing 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 \$

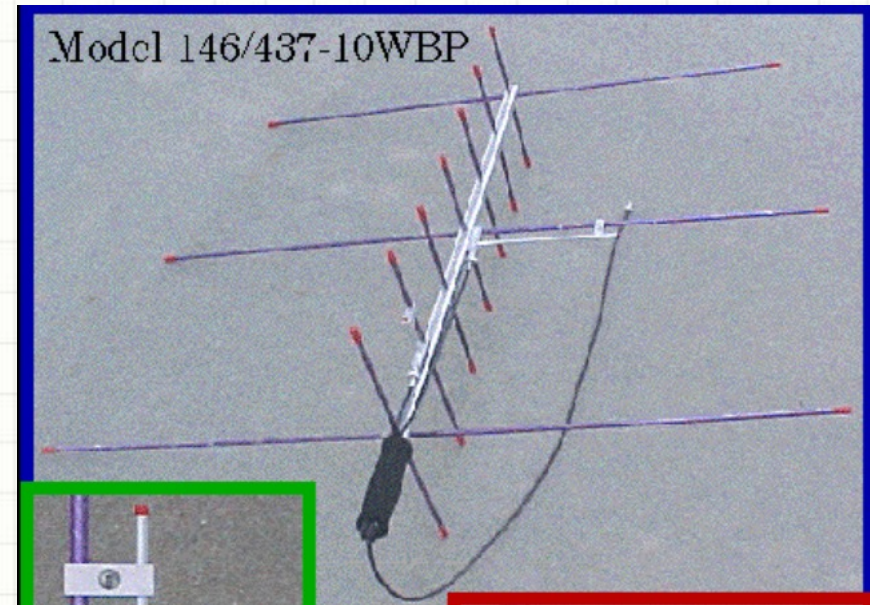




# Getting Started

## Antennas (handheld)

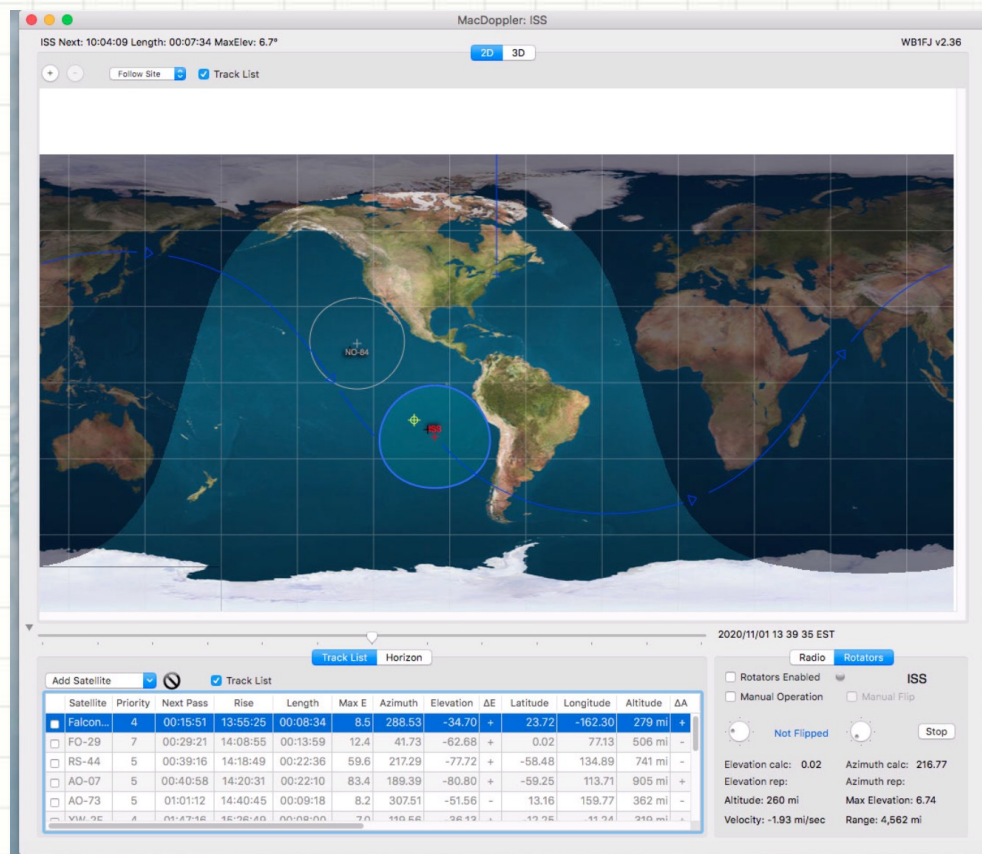
- Handheld yagis are the most common
- Arrow Yagi Antenna
  - Notice separate 2 m elements and 70 cm elements
    - Two Yagi antennas on one boom.
  - Two feedlines, one for each band
  - Must rotate to align with satellite polarity for Rx and Tx
- Tripod or some sort of support can be helpful



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

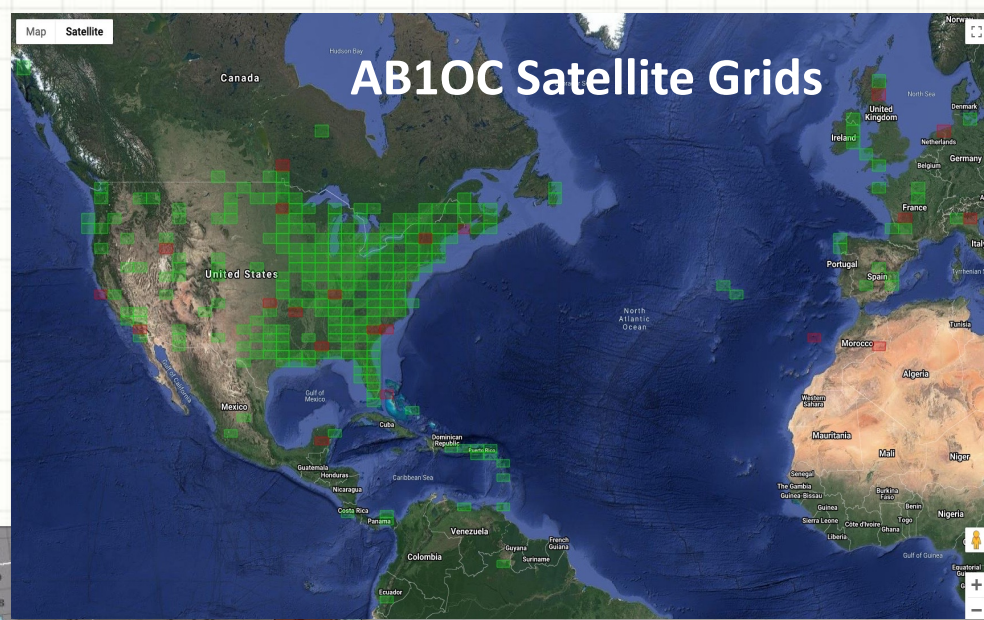
SO-50 (V/U Mode)	Downlink (U)	Uplink (V)
Activate SO-50	---	145.850 MHz + 74.4 Hz Tone
Acquisition of Signal	436.805 MHz	145.850 MHz + 67.0 Hz Tone
Early in Pass	436.800 MHz	
Mid Pass (TCA)	436.795 MHz	
Late Pass	436.790 MHz	
Loss of Signal	436.785 MHz	

***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

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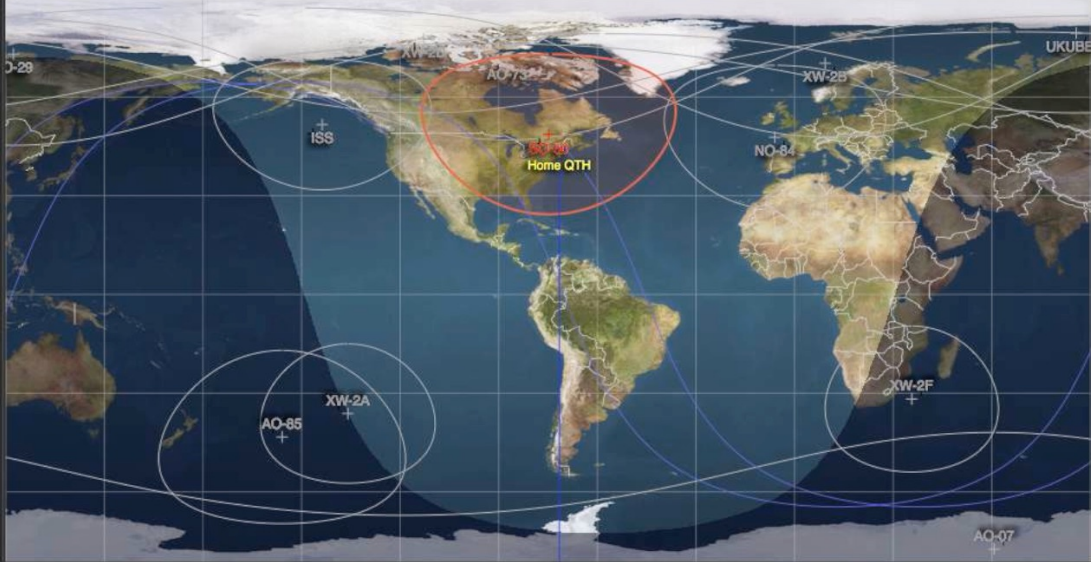


# FM "EasySat" Demo QSOs (SO-50)

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

Add Satellite ☒ Track List

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	+	3.8	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:  Azimuth:  Degrees

zip:  Elevation:  Degrees

email:

Comments:

My Grid: FN42er RSTS  RSTR

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

Track List Horizon

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

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

Radio Rotators

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

Download Frequency Stepper

EL: 012.2  
AZ: 224.0  
FO-29  
Tracking

Extra  
Presentations  
Mobile HF  
Satellite Predictions  
AMSAT OSCAR  
Satellite Status