

BUILDING A STATION FOR SATELLITE & EME CONTACTS

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- Get you hooked on Satellite & EME operation....
- So you join me building an EME mega-station. Misery loves company.



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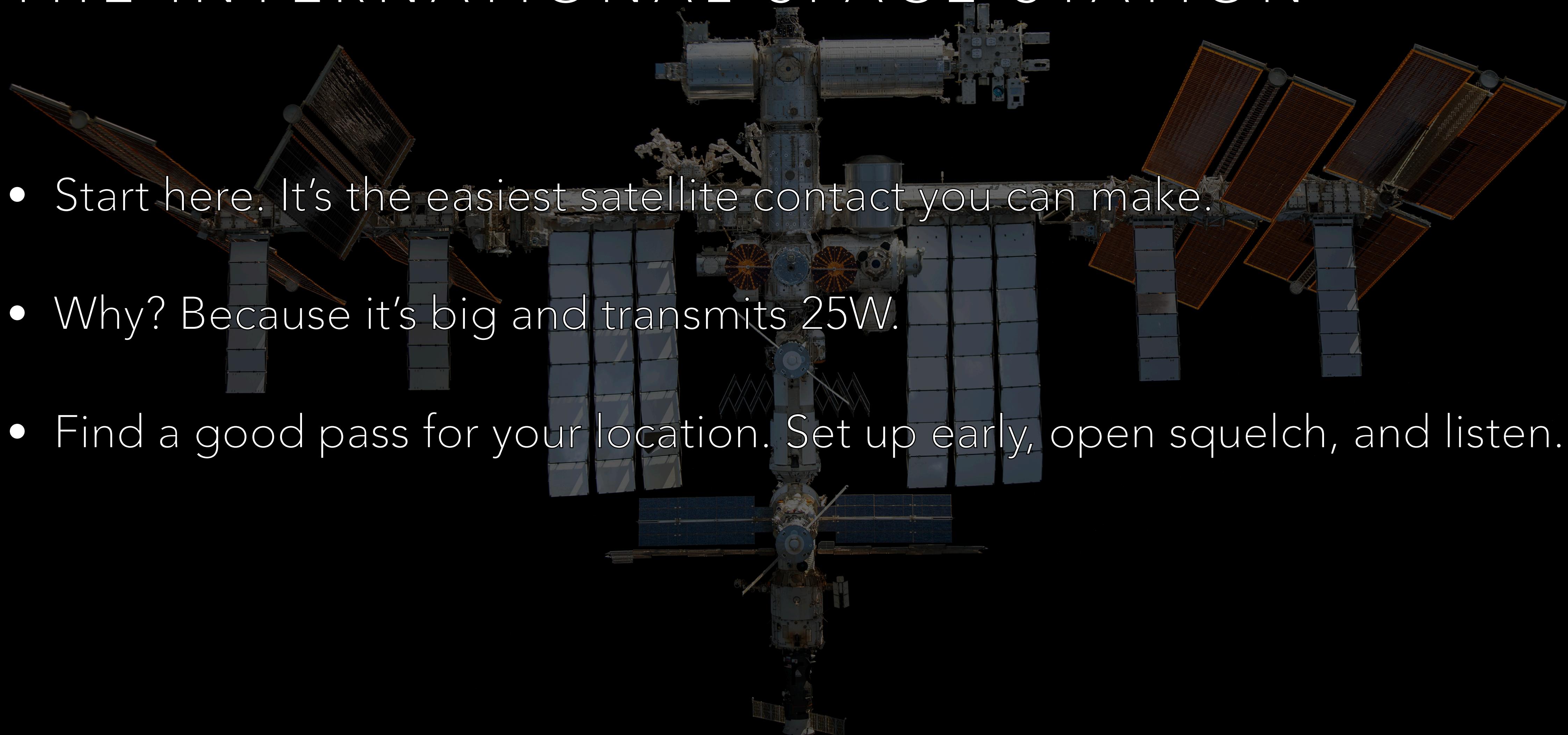
- Promote technician accessible activities - especially homebrew.
- Technical and operator skill development
- Because I can. What other reasons do we need?

YOUR FIRST CONTACT

- You will need
 - An HT or mobile rig. Dual-band, duplex helpful but not required.
 - Decent antenna. Vertical preferred, your mobile antenna, even a mag mount is fine.
 - Pass information - amsat.org, SatPathFinder (iOS), or Look4Sat (Android)

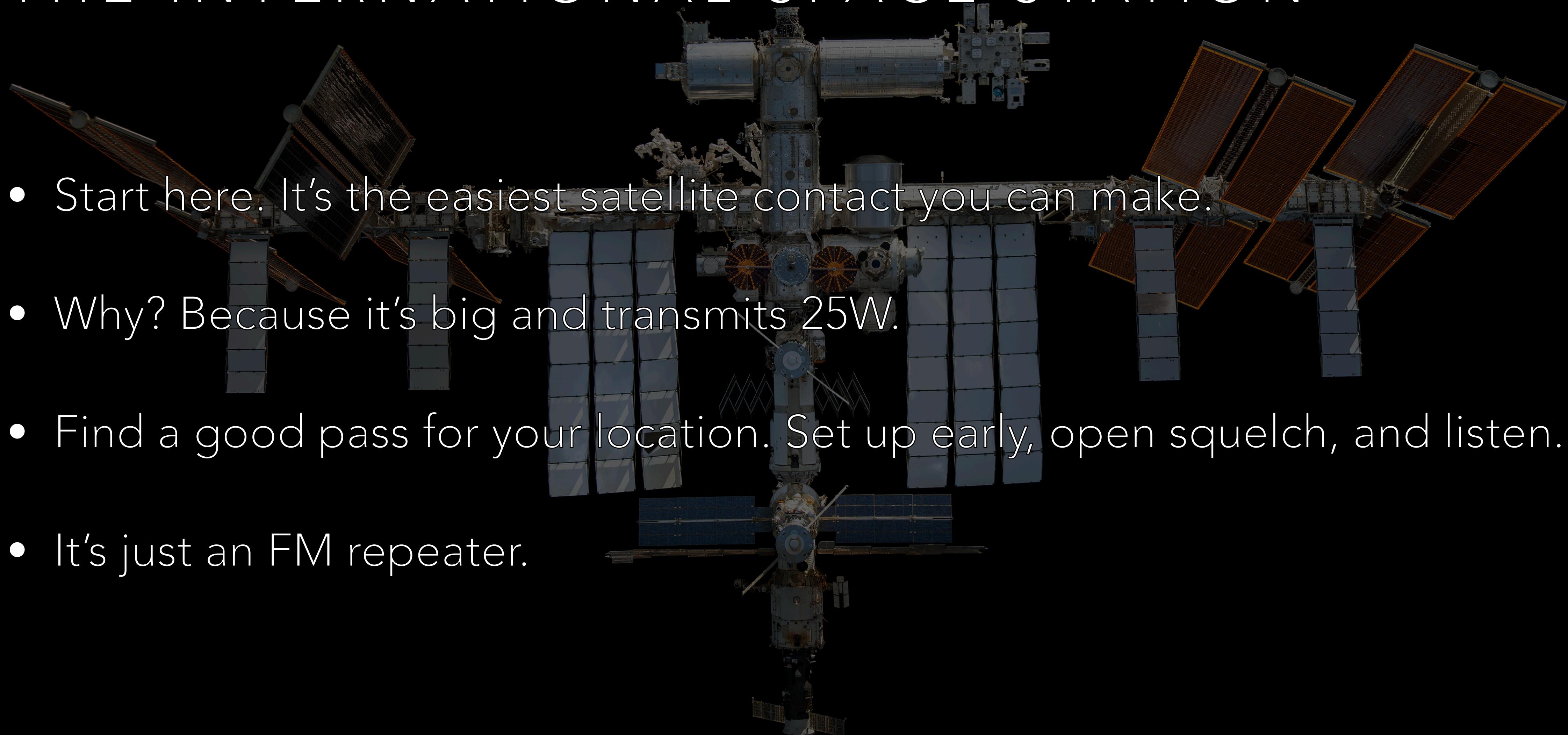
| AMSAT Online Satellite Pass Predictions - ISS | | | | | | | |
|--|-----------|----------|-------------|-------------------|----------------|-------------|-----------|
| View the current location of ISS | | | | | | | |
| Date (UTC) | AOS (UTC) | Duration | AOS Azimuth | Maximum Elevation | Max El Azimuth | LOS Azimuth | LOS (UTC) |
| 03 Oct 25 | 23:11:47 | 00:09:03 | 322 | 11 | 22 | 75 | 23:20:50 |
| 04 Oct 25 | 00:48:19 | 00:10:47 | 314 | 48 | 47 | 119 | 00:59:06 |
| 04 Oct 25 | 02:25:29 | 00:09:19 | 292 | 15 | 232 | 171 | 02:34:48 |
| 04 Oct 25 | 15:56:11 | 00:05:31 | 153 | 3 | 127 | 91 | 16:01:42 |
| 04 Oct 25 | 17:29:36 | 00:10:43 | 217 | 50 | 123 | 55 | 17:40:19 |
| 04 Oct 25 | 19:06:53 | 00:10:05 | 264 | 20 | 323 | 40 | 19:16:58 |
| 04 Oct 25 | 20:45:42 | 00:08:17 | 304 | 8 | 345 | 42 | 20:53:59 |
| 04 Oct 25 | 22:23:39 | 00:08:33 | 321 | 9 | 1 | 65 | 22:32:12 |
| 05 Oct 25 | 00:00:18 | 00:10:31 | 317 | 28 | 11 | 107 | 00:10:49 |
| 05 Oct 25 | 01:37:07 | 00:10:17 | 299 | 25 | 244 | 156 | 01:47:24 |

THE INTERNATIONAL SPACE STATION



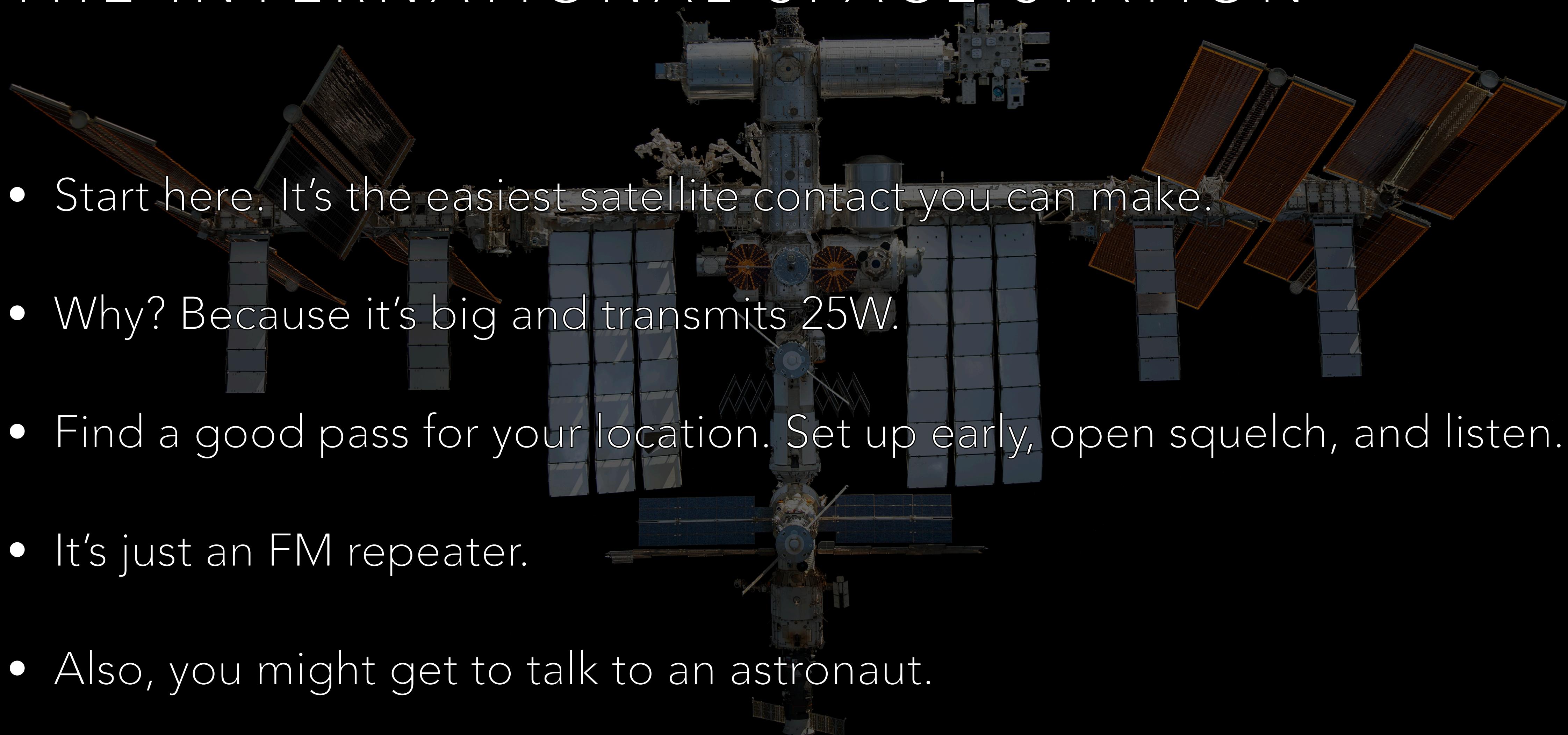
- Start here. It's the easiest satellite contact you can make.
- Why? Because it's big and transmits 25W.
- Find a good pass for your location. Set up early, open squelch, and listen.

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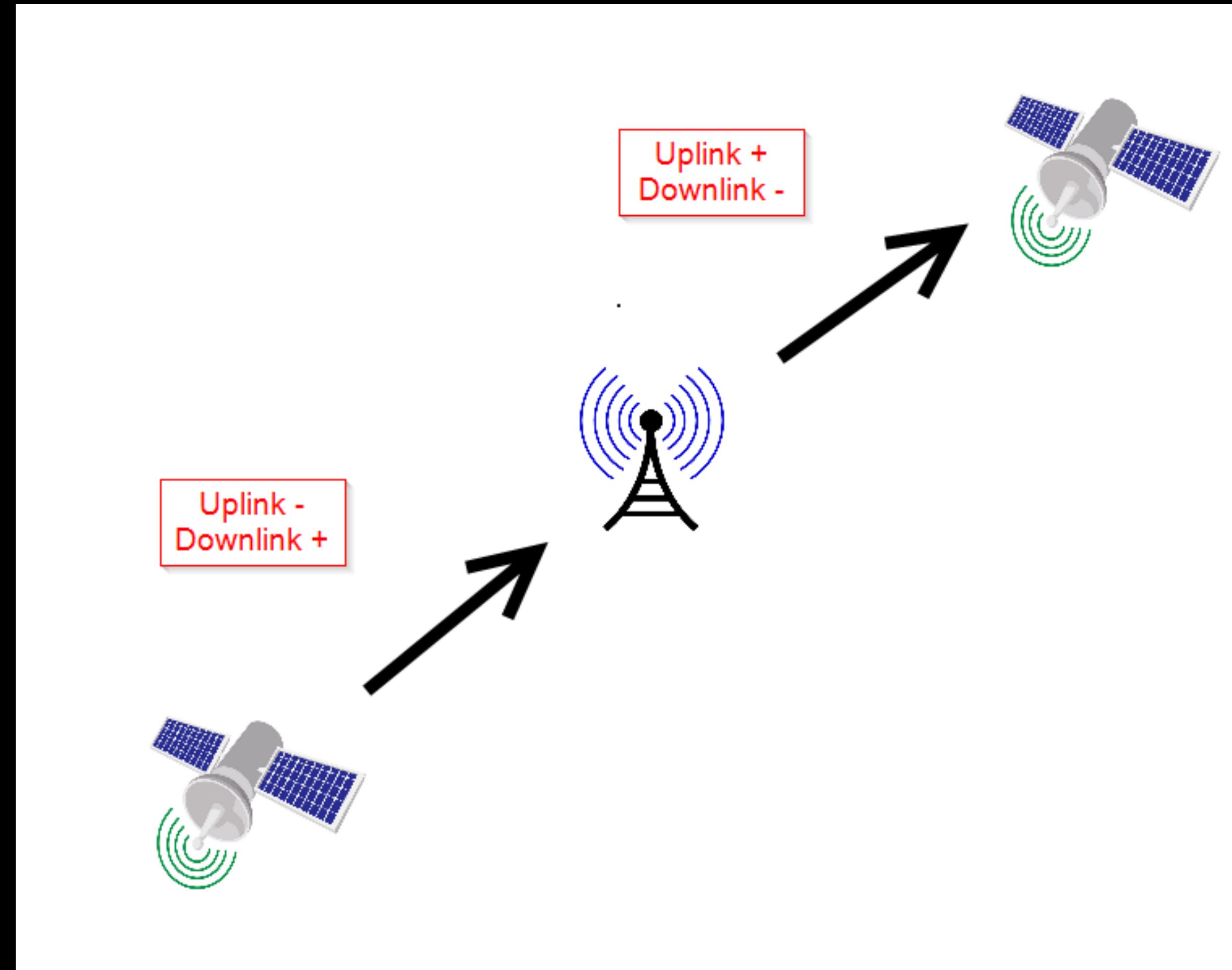
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 - Why? Because it's big and transmits 25W.
 - Find a good pass for your location. Set up early, open squelch, and listen.
 - It's just an FM repeater.
 - Also, you might get to talk to an astronaut.
- 

WHAT'S NEXT?

- More FM repeater satellites - AO-123, CAS-3H, FOX-1B, PO-101, SO-15, SO-124, SO-125.
- More range. ~1600 miles for the ISS, over 2100 miles for SO-50.
- Time to consider upgrades. Look at turnstile (egg beater) antennas.
- Remember that contacts low to the horizon are better for range.

DOPPLER SHIFT CORRECTION

- Relative velocity compresses and stretches frequency.
- Tune receive up during the first half of a pass then down.
- Opposite on transmit - the satellite isn't tuning for you.
- The effect is relative to frequency (3x on 70cm vs 2m).
- Large, rough corrections are fine for FM.



THERE'S MORE - LINEAR TRANSPONDERS

- AO-7, AO-73, FO-29, JO-97, MO-122, RS-44, & TO-108
- Don't try these satellites until you're comfortable with FM satellites.
- Transponders allow multiple QSOs in a band up to 100kHz.
- SSB & CW operation ONLY. Doppler correction is CRITICAL!
- More like operating SSB - pile ups instead of doubles.
- Longer range - up to 3,500 miles (AO-7).

UPGRADES

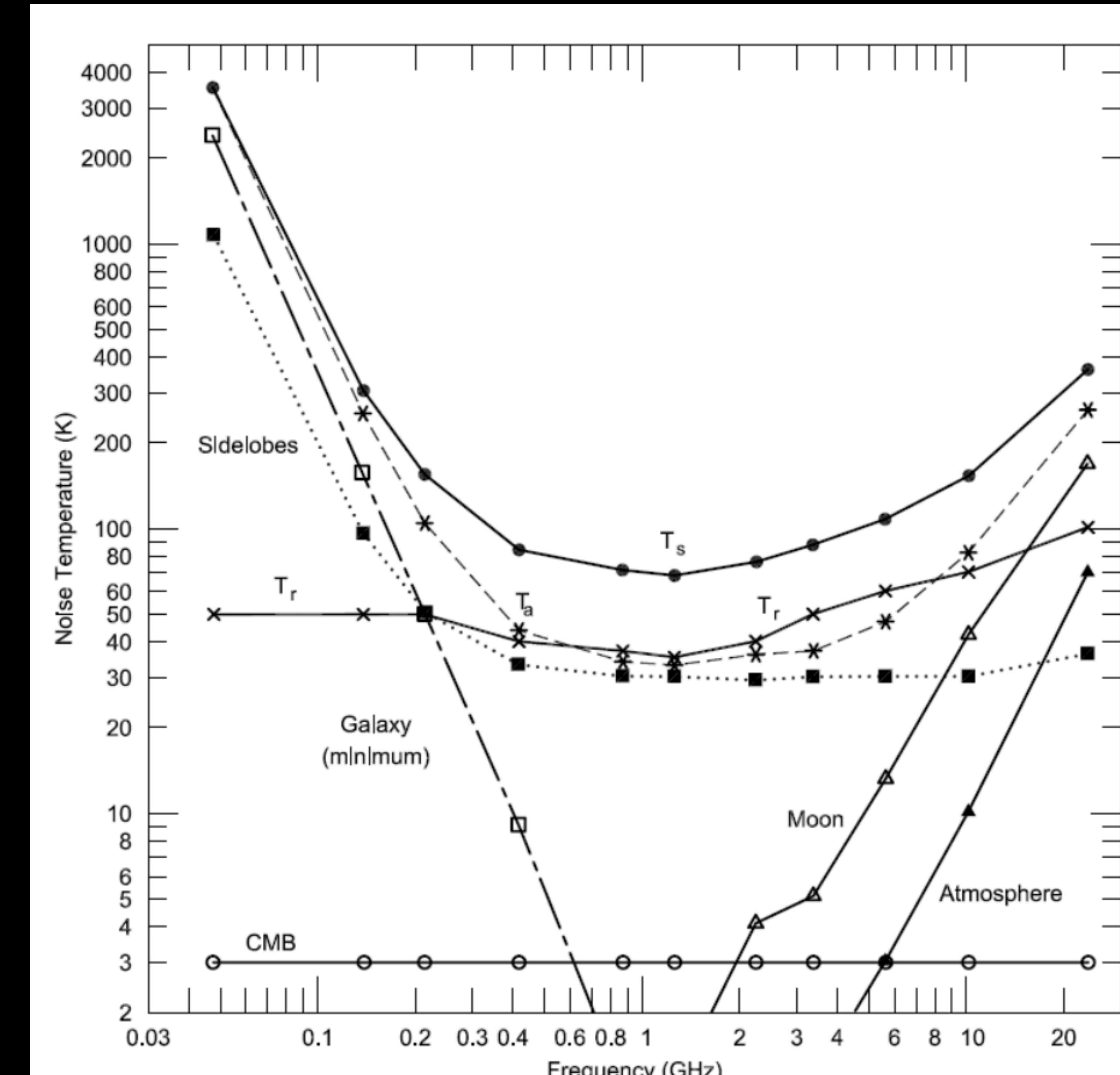
- Solid transceiver. Automatic doppler shift correction and zero-beat is very useful.
- LNA at the antenna - especially if there's more than a few feet of coax.
- Circularly polarized high gain antennas on an Az/El rotator.

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- Solid transceiver. Automatic doppler shift correction and zero-beat is very useful.
- LNA at the antenna - especially if there's more than a few feet of coax.
- Circularly polarized high gain antennas on an Az/El rotator.
- A GREAT satellite station is a bad, but workable, EME station. Just add power.

EARTH-MOON-EARTH BASICS

- 100% globe coverage every year.
- Solar & Ground noise matters, but is very predictable.
- 2m band is very popular - but higher noise.
- 70cm is a sweet spot for noise.
- Dishes feasible at 1.2GHz and up.



ADDRESSING THE CIRCULAR ELEPHANT

- Circular is great for beginners - always the same match to linear.
- Geometric mismatch - angle of path rotates polarization.
- Faraday rotation - the ionosphere rotates polarization.
- Rotation of a circle is irrelevant - but handedness reverses on reflection.

FIELD DAY STATION DESIGN

- Dual Circularly Polarized High-Gain Yagi-Udas
- Homebrew Az/EI Rotator
- IC-9700 Transceiver
- Shielded CANBus Rotator Control
- gPredict - Predicting Passes, Controlling Rotator, & Tuning Radio
- Satellite Map on 40" TV



WHAT WENT WRONG

- HDMI to TV and USB to radio formed a ground loop - TV inoperable.
- gPredict used outdated TLE data - bad pass predictions.
- 70cm antenna Y match shorted.
- Antennas coupled and prevented full-duplex operation.
- Az/El rotator produced massive noise and common mode currents.



WHAT WENT WELL

- One contact over the ISS FM repeater - 100 bonus points.
- CANBus command and control worked flawlessly.
- Community came together to debug and improve.
- We found and corrected or worked around all of the issues.
- Next year will be better because of what we learned.



Thank you!