

Working Amateur Satellites

- History
- Satellite law
- International efforts
- AMSAT webpage, and current satellite status

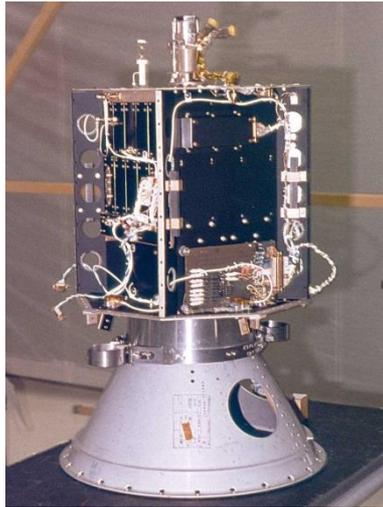
- Satellite operation: what to expect
- Setting up a satellite station

History

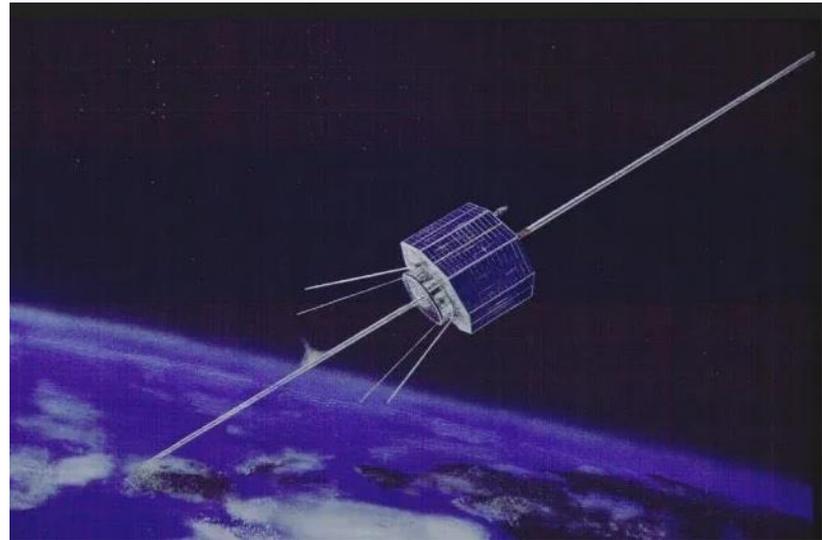
- Amateur Satellites began in the '70's
- Operation was on 2 meters, and 10 meters
- Then: moved to 2 meters and 440: an almost 'experimental' band at the time

- Sizes ranged from 5-gallon-bucket-size, to garbage-can size
- Some had rocket motors

- All are mostly covered with solar cells, and 'spin stabilized', primarily for even heating



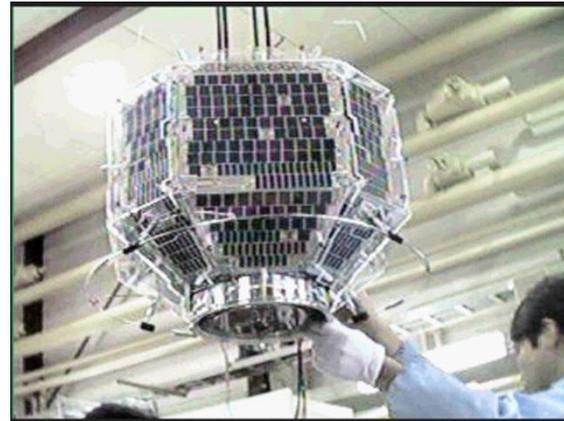
AO-07 innards



Artist image AO-07 flying



FO-29



FO-29 testing

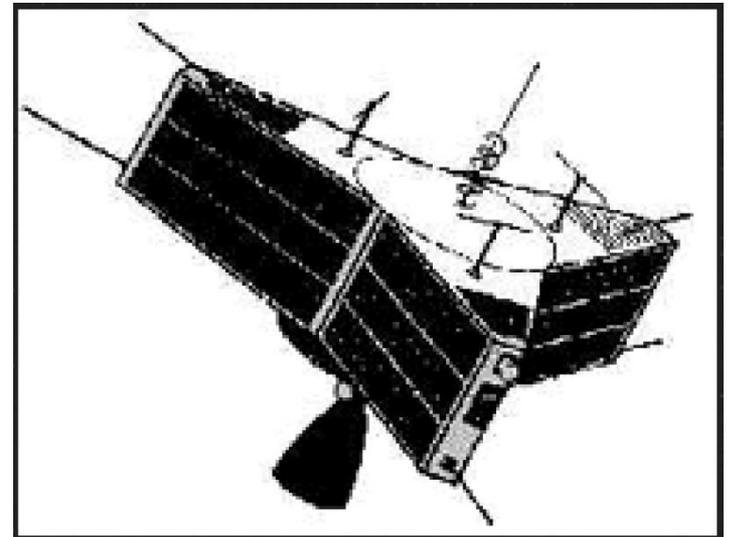


AO-13

Elliptical Orbit

In view for multiple hours at a time

AO-13 Included a rocket motor, necessary to achieve the large elliptical orbit



Satellite law

- '25 year rule' for space debris: Need to 'remove' your satellite from the sky in 25 years.

Maybe too long? Maybe not all companies are compliant?

- LEO's:
- "Putting non-maneuverable cubesats into LEO in densely populated orbits ... is like putting go-carts on the freeway. Nobody would do that," John Janka, Viasat

Graveyard Orbits and the Satellite Afterlife

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Monday, October 31, 2016

As Halloween approaches, the ghouls, ghosts and zombies are preparing to rise from their graves and once again roam the planet. But, perhaps, this year, our earthly graveyards are not the only ones to keep an eye on...

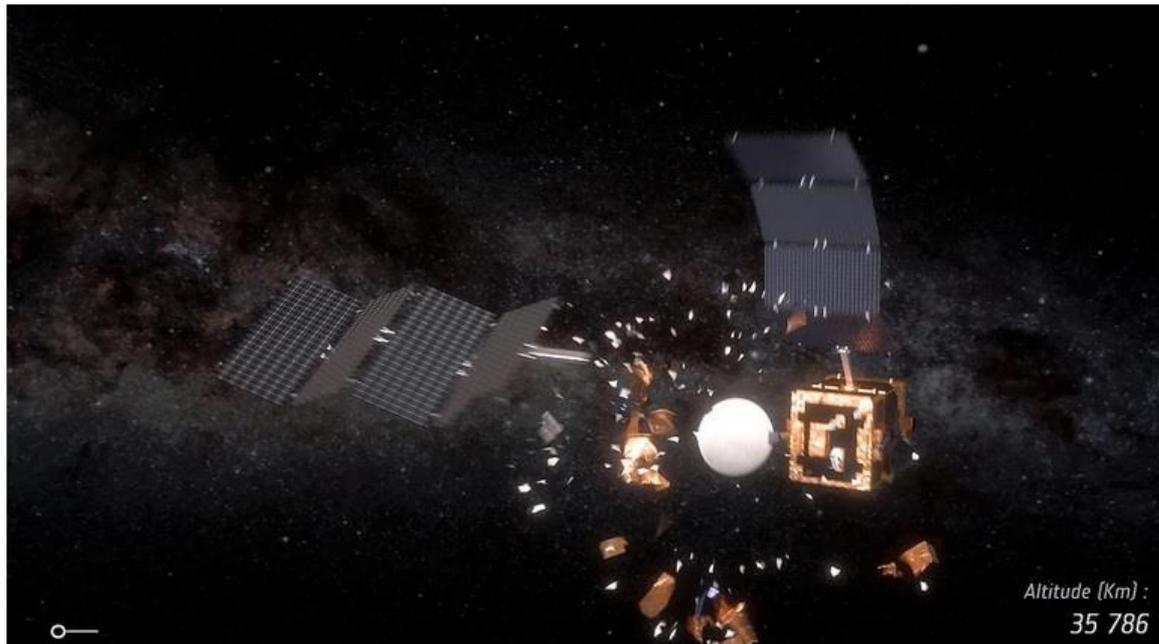


Lack of Space Law Complicates Growing Debris Problem

MOLLY QUELL August 28, 2020



Existing international treaties cover only narrow aspects of space and have been signed by fewer than half of the world's countries.

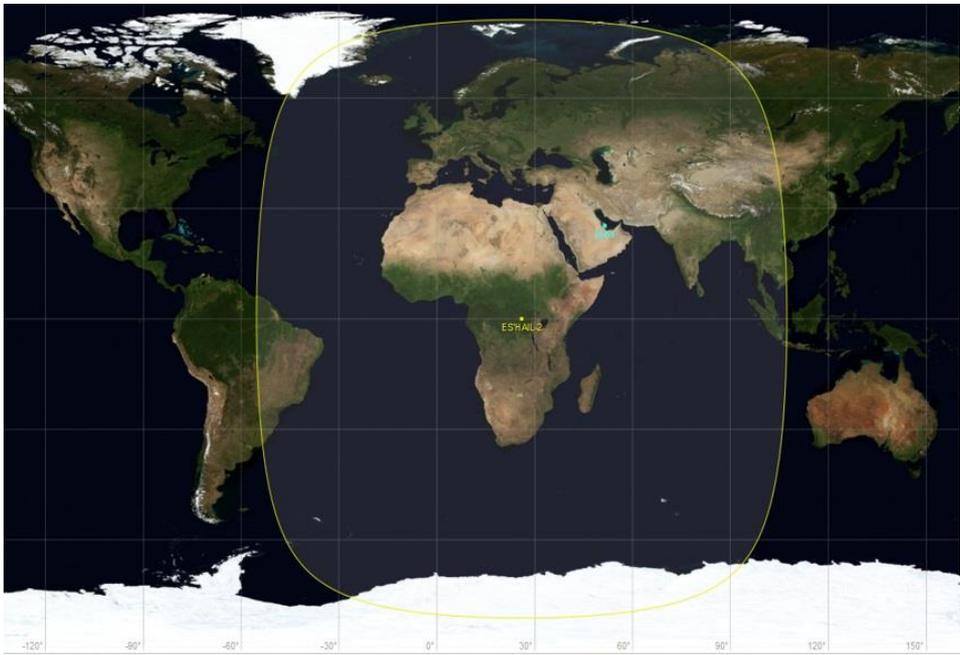


Satellite collisions give rise to space debris. (Image via European Space Agency)



International efforts

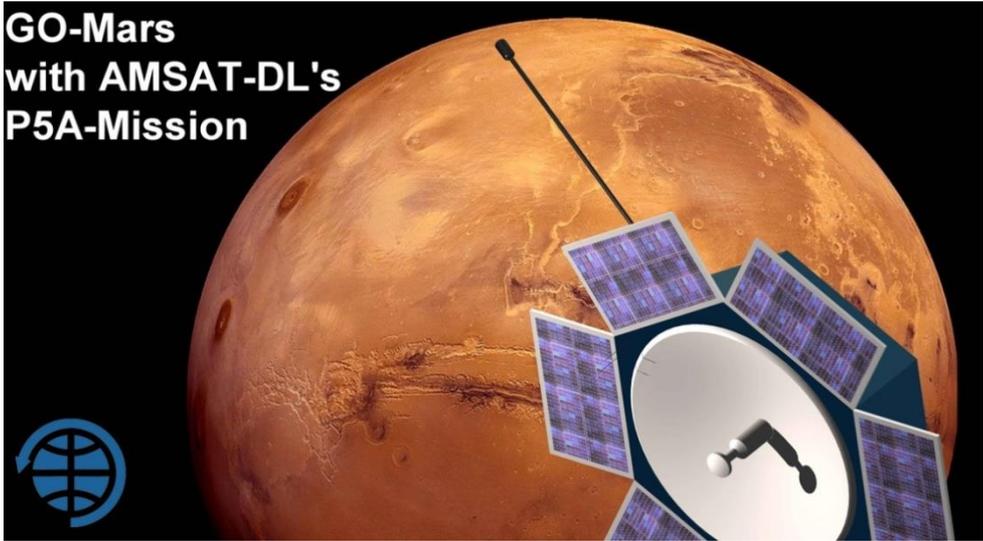
- AMSAT-DL: geosynchronous amateur sat, 'Go-Mars' PA-5
- AMSAT-UK: FUNcube sat's, ground station support
- Philippines: PO-101 FM satellite
- Saudi-Sat: SO-50 FM satellite
- Argentina: LO-87 Transponder sat (South America and EU)
- Jordan: JY1Sat (JO-97)
- China: CAMSAT (Chinese Amateur Satellite Group):
XW sats , CAS sats, student sat's, orbiting the moon!



AMSAT-DL

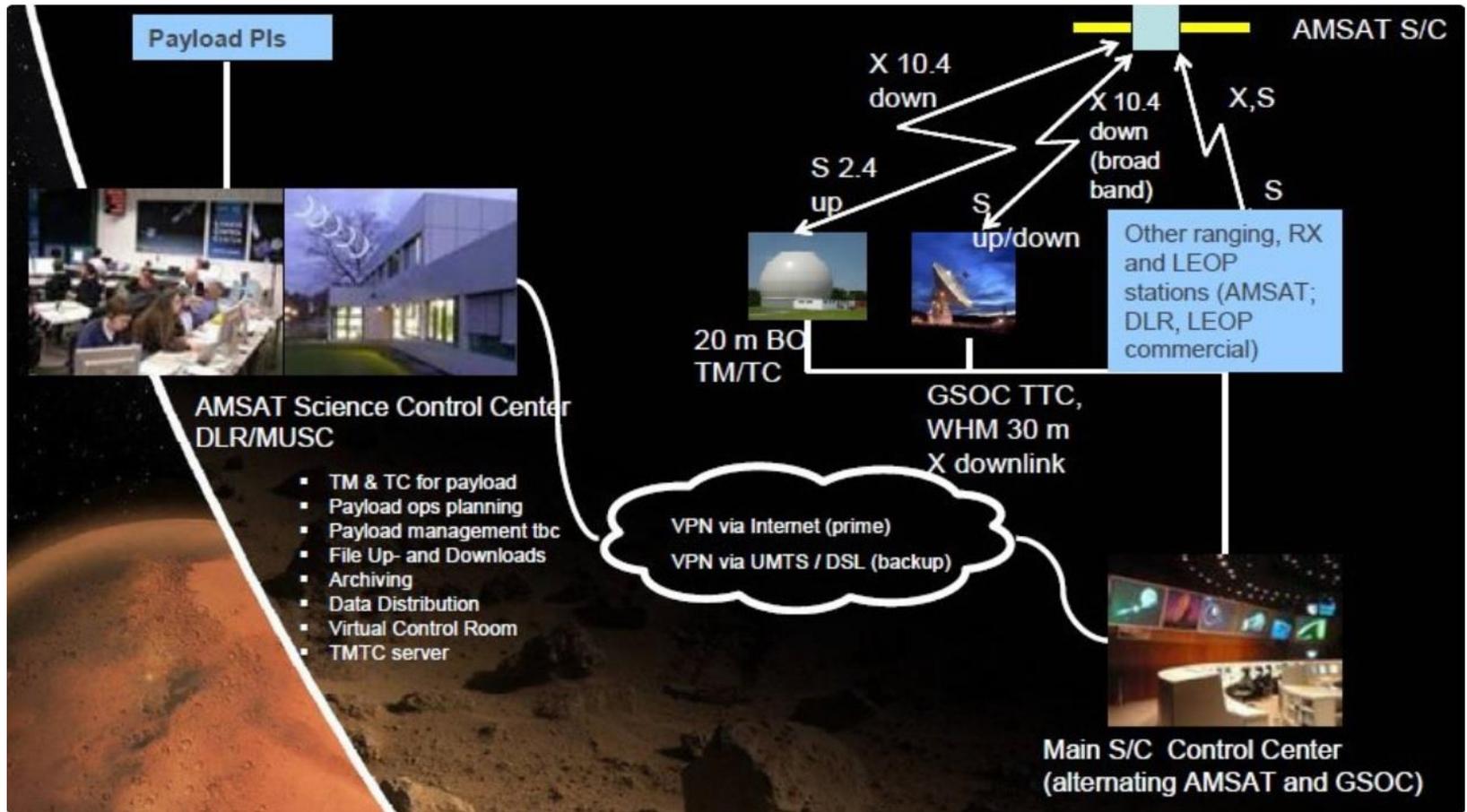
Geosynchronous

2.4Ghz/10Ghz



GO-Mars P5A

Initial plan: 2002
Redo: 2012-2013
Next try: 2018



AMSAT-UK ground support



AMSAT-NA Webpages

Satellite Operation: what to expect

- Almost all are Cube Sats (small...)
- All are 'low' earth orbits
- In view: less than 20 minutes
- Effects of sat antennas
- Effects of multiple users at the same time
- Doppler: an ever-present issue. Solution: software!

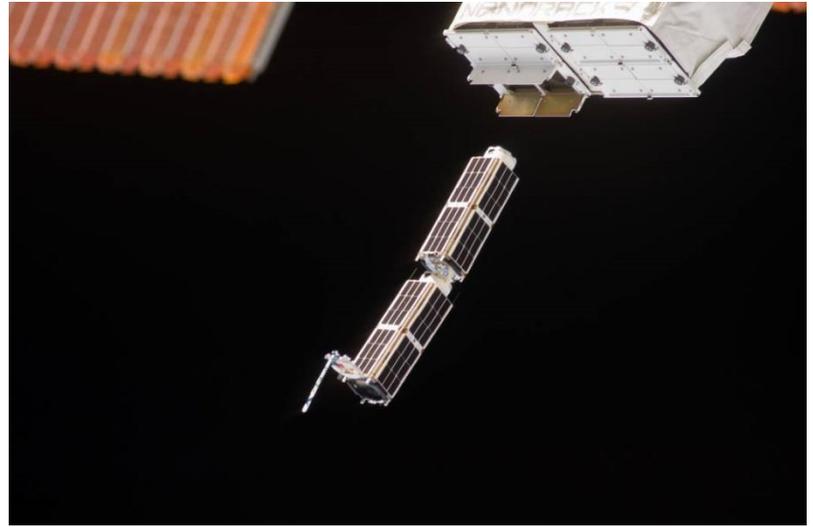
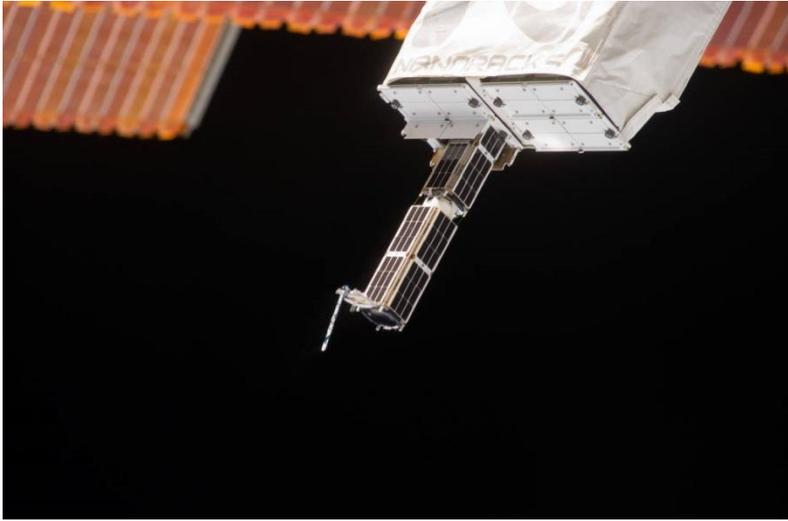


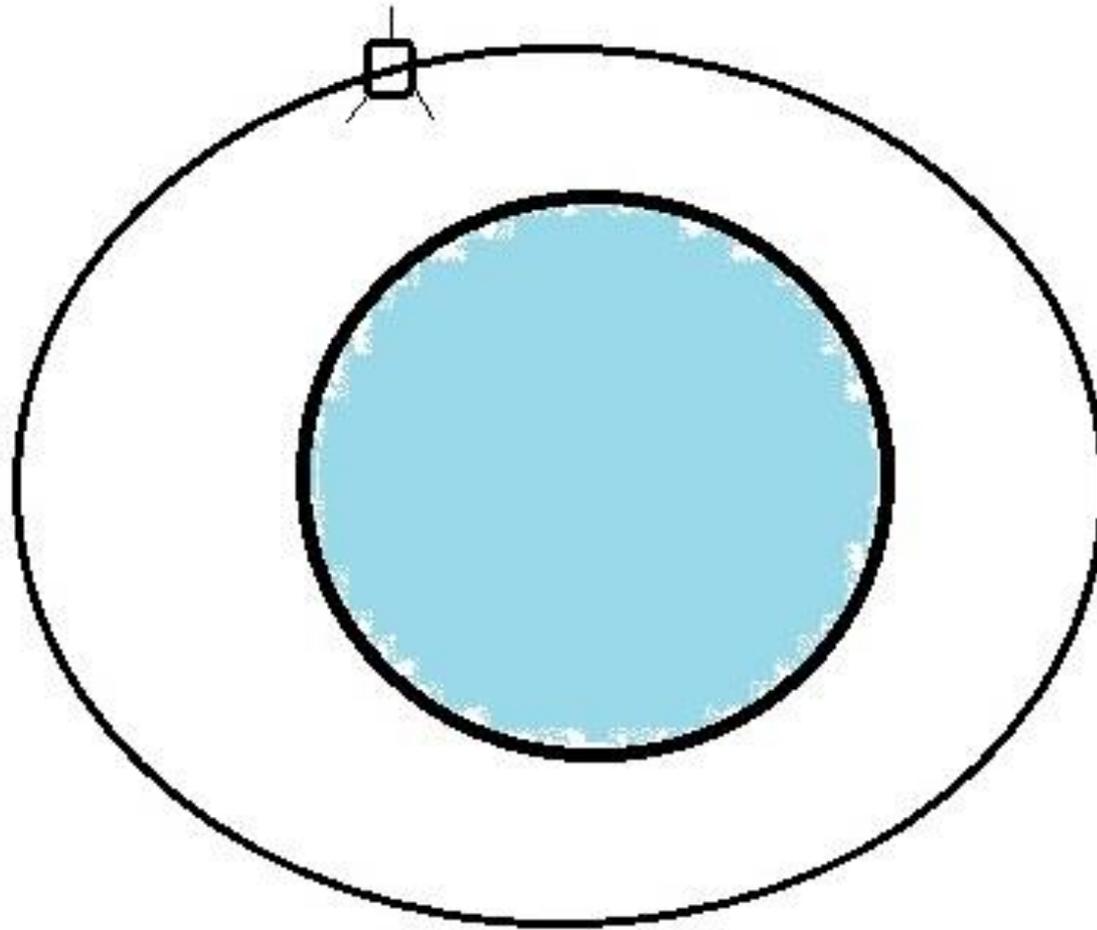
FUNcube-I



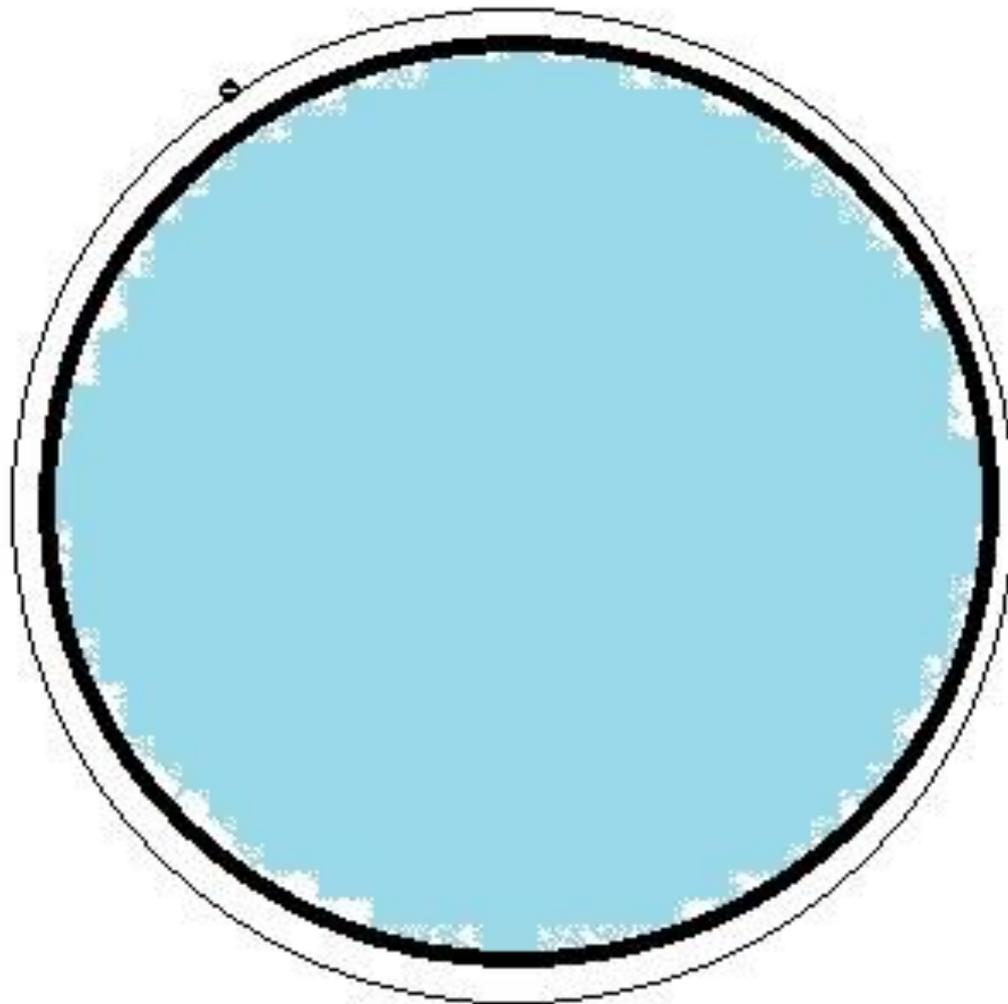


FUNcube-3

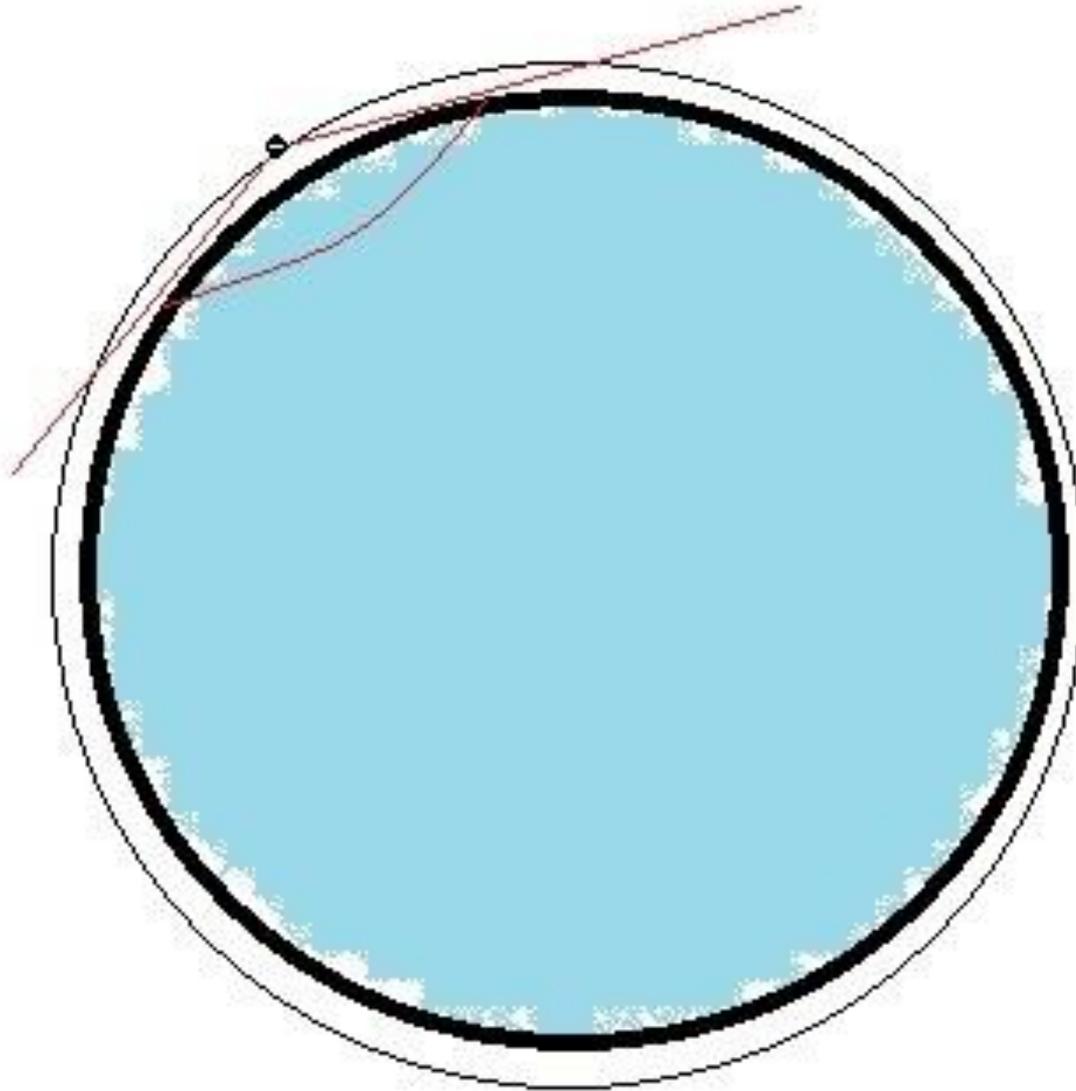




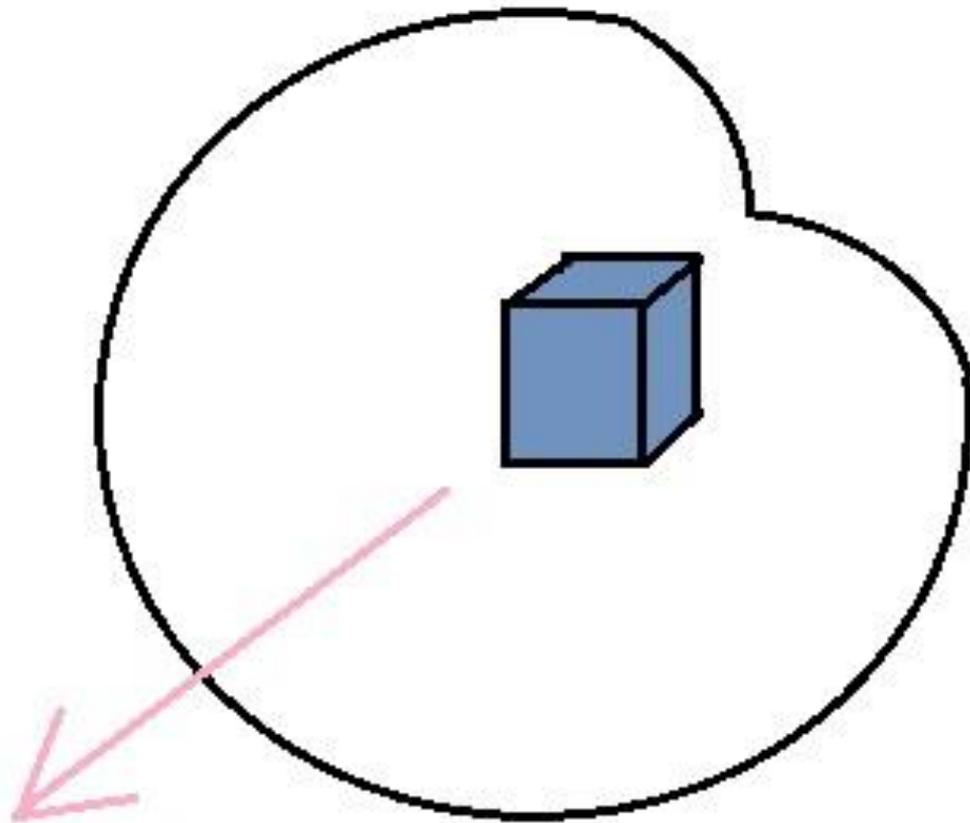
All are in low earth orbit



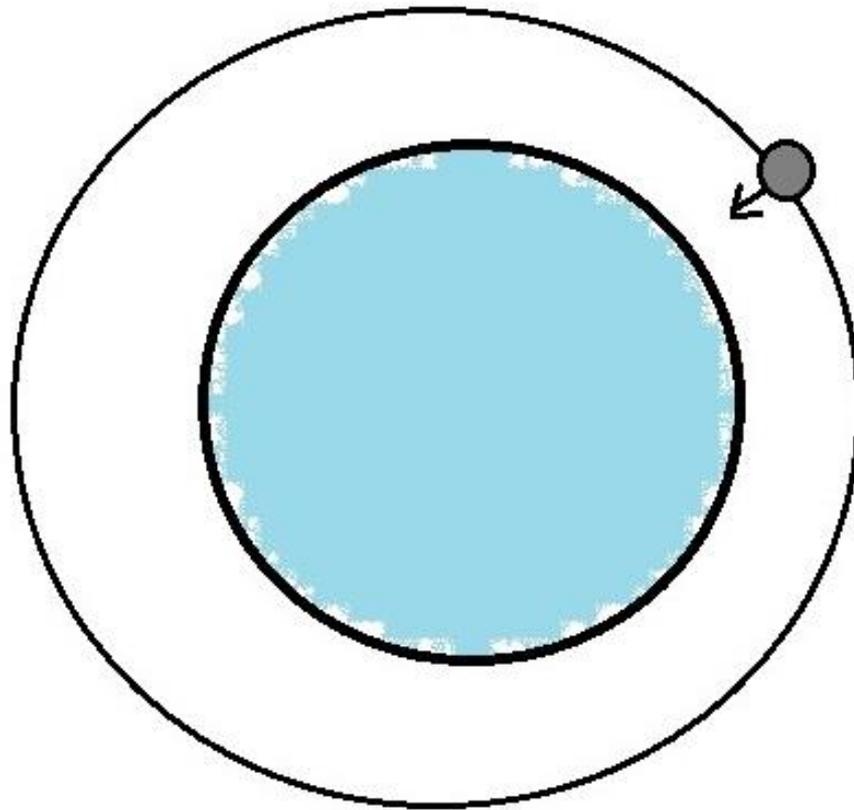
Low orbit 'real view'



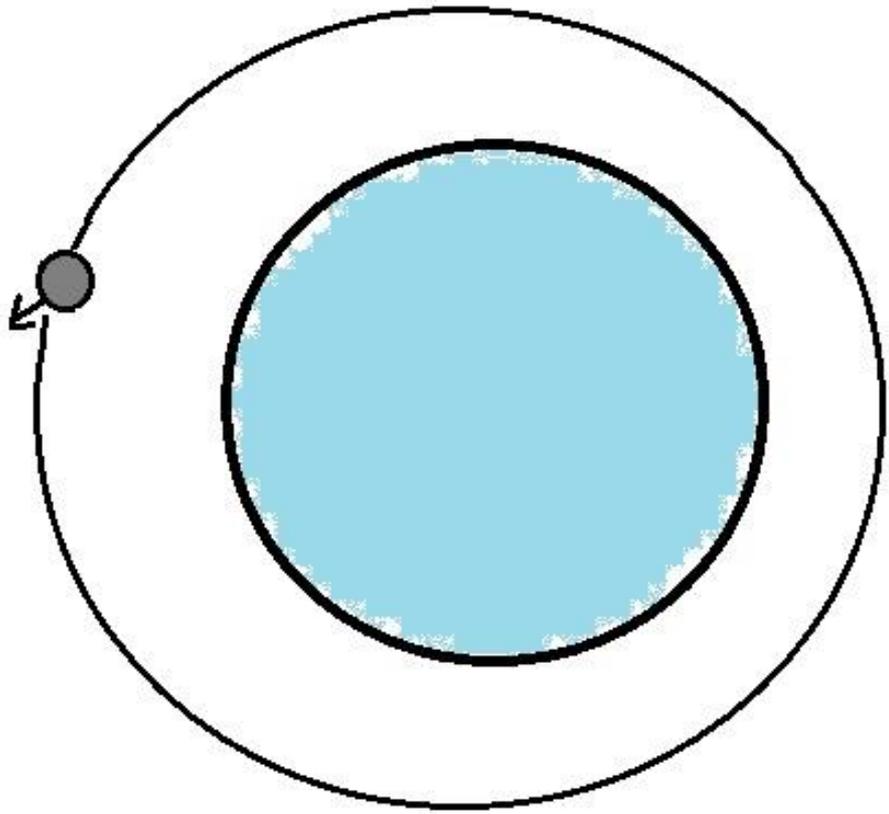
Satellite's 'horizon view'



Antenna radiation pattern



Ideal antenna pointing direction



Effects of other users

- There are three operational modes: **FM, Transponder, Digital**
- **FM**: like a repeater: has a 'FM detector', and FM transmitter on different frequency
- **Transponder**: receives a SWATH of frequencies, amplifies that received swath, and retransmits on a different frequency
- **Digital**: like FM, uses variety of digital modes, usually offer more than one channel

Effects of other users

- Users on FM: Loudest signal wins
- Users on Digital: same as FM. Overly strong transmissions may cause distortion, creating less throughput
- Users on Transponder: The full received swath is being amplified as best as possible to recreate what was received.

**That means a very loud signal somewhere in the bandwidth
Will take most of the satellite's power.**

If you are using another portion of the frequency swath, the satellite's power output will drop for you when the strong station (somewhere else in the swath) begins to talk.

Result is: variable signal strength from the satellite, at random times.



SatPC32

Setting up a satellite station

- FM and digital modes only? OK, start by listening
- Good headphones
- Next step: software
- How much gain? More is better of course
- But with gain comes pointing requirements, right? Well...
- All mode: Getting an allmode radio may be the main issue



Handheld





Gain, and rotators

Accuracy is not that critical

Sufficient gain can overcome
Inaccurate pointing

Pointing within 20 degrees is
OK (with gain antennas)

The issue at all times will be
receive.

Don't 'blame' your pointing if
the signal drops off. Just wait
through the fades.



Radios, Tx and Rx: What you need

- 2 meters and 440 (435). Little use of 1.2G or others bands
- FM: most common radios available, plenty of satellites to try, both voice and digital
- All mode receive: many ways, even USB dongles
- All mode for Tx and Rx ? Well... time to websurf...?



Allmode Receive

Conclusion

- Satellite operation is very alive and active.
- International efforts, university involvement, far-reaching ideas
- Putting together a station can be as simple as handheld antennas and good headphones. Not easy, but not impossible!
- Or you can 'go for it', and use gain antennas, with ability to point, and.... aim for the stars!

Thank you