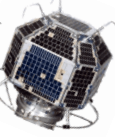


Working the Birds

Joe Noga KC9TQF

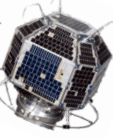




Topics Covered

- Space Communication
- Amateur Satellites
- Modes of Operation
- Equipment needed
- Technique
- Helpful Links

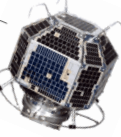




Space Communication

- Many forms of space communication.
 - EME (Earth Moon Earth)
 - Meteor Scatter
 - *NASA communication with the ISS and Shuttles*
 - *Satellite Communication*

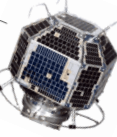




Amateur Satellites

- In 1961 the project OSCAR (Orbiting Satellite Carrying Amateur Radio) was formed to launch the first amateur radio satellite into space. On December 12, 1961 the satellite named OSCAR 1 operated on VHF 144.9830 and transmitted a CW beacon.
- IN 1969 AMSAT was founded to continue the research efforts of project OSCAR.

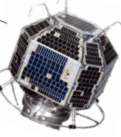




Amateur Satellites

- Quick Facts
 - 27 Amateur Radio Satellites in low earth orbit including the ISS
 - Orbits
 - LEO: Low Earth Orbit typically under 1,200 miles from the earth surface.
 - MEO: Medium Earth Orbit above 1,200 miles from the earth surface and below 22,000 miles. Your GPS satellites, and space observatory are located here as well, the Galileo spacecraft sent to monitor Jupiter is located here.
 - GEO: Geostationary Earth Orbit is a circular orbit located 22,236 miles above earth. Your communication, broadcast and weather satellites are located here.
 - HEO: Anything higher than GEO 22,236+

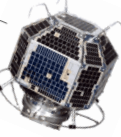




Modes of Operation

- Dependant on the Satellite
 - Many Satellites are capable of multi mode operation
 - V/U, U/V, SSB/CW
 - Digital mode (APRS)
 - AFSK, FSK, PSK, GMSK, APRS
 - Satellite control operators and schedules determine the mode and time of operation

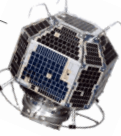




Equipment Needed (Basic)

- Compass (Azimuth)
- Inclinator (Elevation)
- Directional dual band antenna (2M/440Mhz)
 - Right hand polarization
 - Tripod
- Dual Band HT with Speaker/Mic
 - Headphones or recorder
- Satellite tracking website for Keplerian data

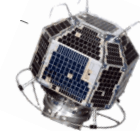




Equipment Needed (Advanced)

- Base station all mode transceiver with CAT control
 - Kenwood TS-2000
 - Yaesu FT-847, FT-897
 - ICOM 9100
- Computer
 - Satellite Tracking software (SatPC32, Orbitron)
 - CAT interface to control frequencies of the up and downlink
 - Rotator controller interface (EA4TX, AMSAT, Yaesu)

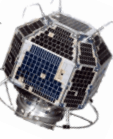




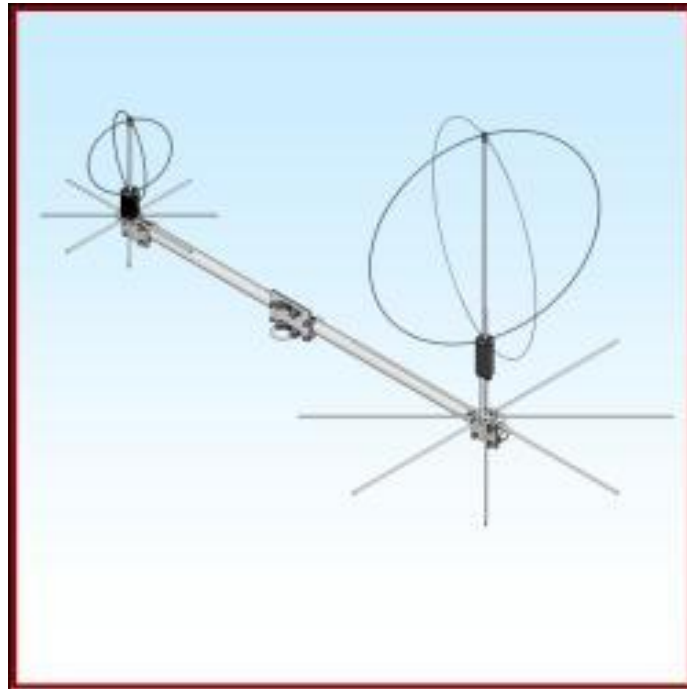
Equipment Needed (Advanced)

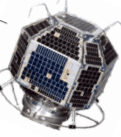
- Rotator(s) Azimuth / Elevation
 - Yaesu 5500, 5400
 - Kenpro KR-5400A (On Display)
 - M2 MT-1000 / MT-3000 (Used for EME)
- Antennas
 - 2M / 440 mhz Directional Yagi
 - Circular polarized
 - 8 – 14 elements per band(2M)
 - 18-22 elements per band(440mhz)
 - Circular polarized “egg beater” antenna





Antennas

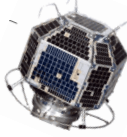




Technique

- Prep work
 - Select your satellite you will make contact on eg, SO-50 FM
 - Research your satellite www.AMSAT.org Sat Status
 - Some Sats might be offline or in a different mode or in a restricted state.
 - Know your location (Grid square, Lat and Longitude)
 - Input this data into your Sat tracking programming or site to determine when the sat will be making a pass.



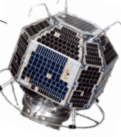


Technique

- Prep work
 - Program your HT for the Satellite frequencies taking into consideration the split operation and the Doppler shift.

Receive Frequency	Transmit Frequency	Offset	Dir	Name	Tx Power			
145.805	144.485	Split		ISS A	High (5 W)			
145.8	144.49	Split		ISS B	High (5 W)			
145.795	144.495	Split		ISS C	High (5 W)			
145.79	144.5	Split		ISS D	High (5 W)			

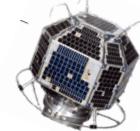




Technique

- Prep Work
 - Plot your pass based on tracking data.
 - Compass, Watch, Inclinator
 - Practice before the actual pass to familiarize yourself with the telemetry of the pass.
(ascending pass / descending pass)





Technique

- Prep Work Understanding Pass Data
- Low pass elevation 29* and distance is 1182 miles. Slim chance of making a contact.

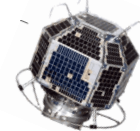
Satellite passes / Orbitron 3.71 / www.stoff.pl

Location : Home (87.8750° W, 43.8125° N)
 Time zone : UTC -6:00
 Search period : 2012-11-07 21:15:06 - 2 days
 2012-11-09 21:15:06
 Conditions : Maximum sun elevation = None
 Minimum sat elevation = 10 deg
 Illumination NOT required

Time	Satellite	Azm	Elv	Mag	Range	S.Azm	S.ElV
2012-11-07 22:10:40	SAUDISAT 1C (50-50)	305.5	10.0	ec1	2091	320.0	-57.5
2012-11-07 22:14:45	SAUDISAT 1C (50-50)	246.1	29.2	ec1	1182	321.6	-58.0
2012-11-07 22:18:42	SAUDISAT 1C (50-50)	186.1	10.1	ec1	2016	323.2	-58.4

Time of the Pass What Sat. Azimuth Elevation Magnitude Range





Technique

- Prep Work Understanding Pass Data.
- Elevation @68* and Range is 755 miles. Best chance at making a contact.

satellite passes / Orbitron 3.71 / www.stoff.pl

Location : Home (87.8750° W, 43.8125° N)
 Time zone : UTC -6:00
 Search period : 2012-11-07 21:15:06 - 2 days
 2012-11-09 21:15:06
 Conditions : Maximum sun elevation = None
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 Illumination NOT required

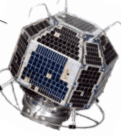
Time	satellite	Azm	Elv	Mag	Range	S.Azm	S.ElV
2012-11-08 12:26:16	SAUDISAT 1C (50-50)	203.6	10.0	13.6	2172	193.9	28.3
2012-11-08 12:31:12	SAUDISAT 1C (50-50)	122.0	68.7	10.6	755	195.2	28.0
2012-11-08 12:36:09	SAUDISAT 1C (50-50)	39.3	10.0	12.4	2174	196.5	27.8

Time of the Pass

What Sat.

Azimuth Elevation Magnitude Range

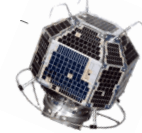




Technique

- If using a handheld, open your squelch wide open
- Unobstructed view of the horizon for your pass
- Listen to the in progress QSO's, the farther the satellite the greater the contact
- Rotate your antenna from horizontal to vertical to change polarization

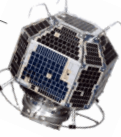




Technique

- Listen for a break and toss out your call with 'Handheld' or 'Portable' appended. Typically the big stations will back off and give you the channel.
- Exchange your call, grid square and signal report with the other station.
 - I typically work one or two stations and let the other stations work each other. A good pass is 10 minutes , average 6-8 usable minutes.
- Log your QSO many stations will send QSL cards.

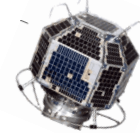




Other Terms and Vocabulary

- Telemetry = A technology that allows data measurements to be made at a distance.
- Spin Fading = Sounds like clipping due to the satellite spinning in orbit.
- Eclipse = When the satellite is not in the presence of the sun.
- Orbit Decay = The process of prolonged reduction in the altitude of a satellite's orbit.

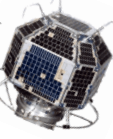




Helpful Links

- www.amsat.org
- www.stoff.pl (Orbitron)
- www.m2inc.com (M2 Antenna)
- www.yaesu.com
- www.nasa.gov
- www.ea4tx.com (Controller)





Thank You

