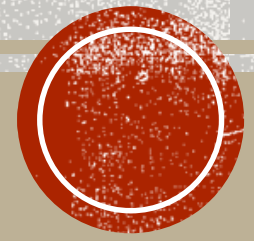
AMATEUR SATELLITE OPERATIONS

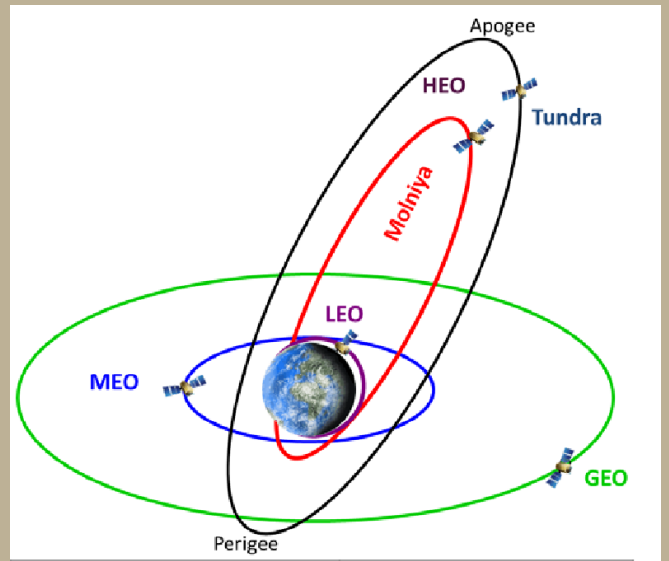


Adam – VK5GA & VK2YK

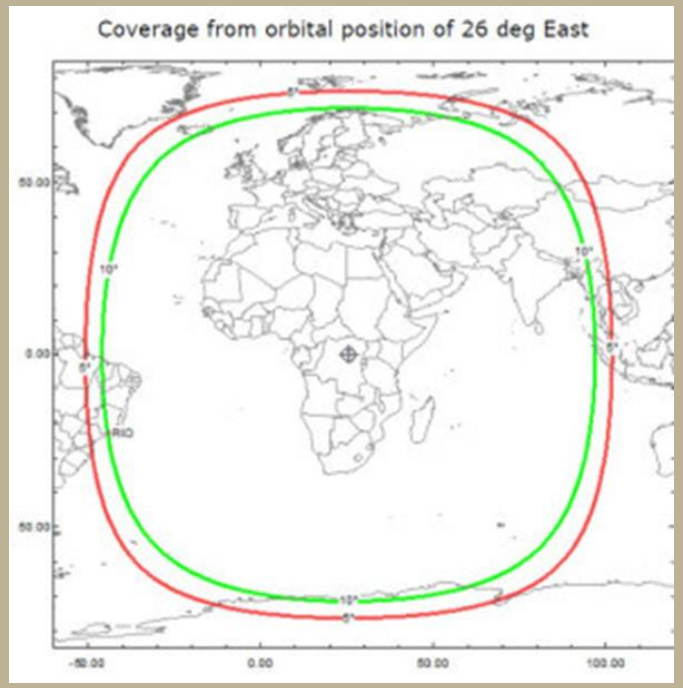
- Satellite Refresher Info
- Operational Satellites
- Setup options
- My experiences
- Issues encountered with setups
- References

ORBITS

- Low Earth Orbit
  - Between 800 km and 2000km
  - 10 to 15 minutes pass time
- Medium Earth Orbit
  - between 2,000 and 35,700 km
  - No functioning OSCAR sats
- High Earth Orbit
  - highly elliptical orbit out to 40,000km
- Geosynchronous Equatorial Orbit
  - Stays in the one spot in reference to Earth.
  - QO-100 (Es'hail-2) only OSCAR sat – covers only Africa & Europe



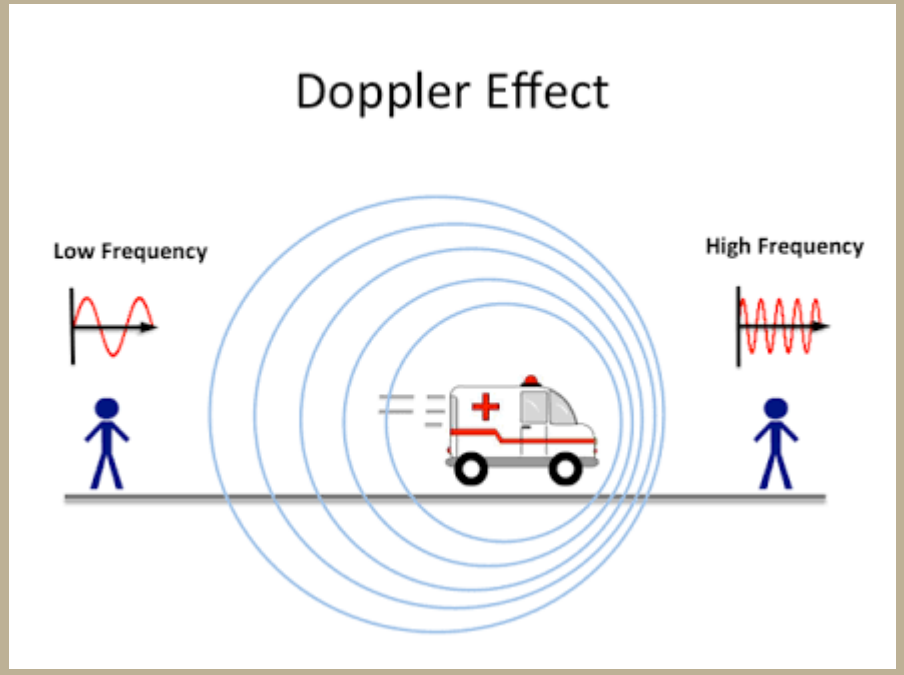
Orbit		Altitude [km]	
		Perigee	Apogee
LEO: low earth orbit		200–2 000; normally: 600–1 000	
MEO: medium earth orbit		2 000–GEO; normally: 10 000–20 000	
GEO: geostationary orbit		35.786	
HEO: high elliptical orbit	Molniya (12 h)	~500	~40 000
	Tundra (24 h)	~24 000	~48 000



DOPPLER SHIFT

A common example of Doppler shift is the change of pitch heard when a vehicle sounding a horn approaches and recedes from an observer.

When an ambulance passes with its siren blaring, you hear the pitch of the siren change: as it approaches, the siren's pitch sounds higher than when it is moving away from you.

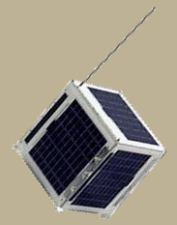


OPERATIONAL SATELLITES - FM

- International Space Station (ISS)
  - Voice – Crossband FM repeater (2m uplink – 70cm downlink)
    - Up - 145.990Mhz & 67.0hz tone - Down 437.800Mhz
  - APRS/Packet – 2m uplink & downlink - 145.825Mhz FM
  - Slow Scan TV – Special events only TX from ISS only (2m downlink)
    - 145.800Mhz FM
- SO-50 (Saudisat 1C)
  - FM Transponder – 2m uplink – 70cm downlink
- AO-123 (ASRTU-1) **New**
  - FM Transponder – 2m uplink – 70cm downlink
- SO-125 - (HADES-ICM) **New**
  - FM Transponder – 2m uplink – 70cm downlink

FM - SATELLITE TYPES

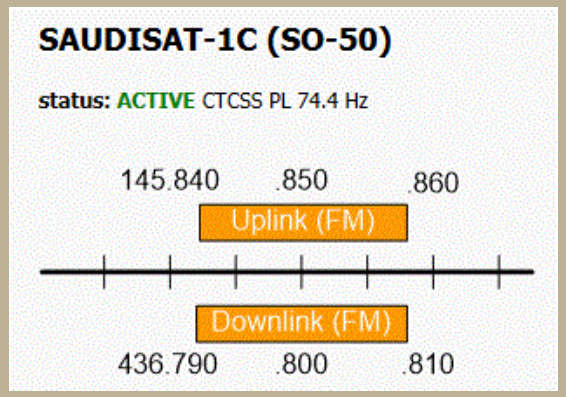
- FM transponders – (cross band repeaters)
  - Eg SO-50, AO-123, SO-125, ISS



Uplink 145.850Mhz FM
Downlink 436.800Mhz FM

Mode V/U

Uplink 145.850Mhz FM
Downlink 436.800Mhz FM



Frequencies +/- Doppler

OPERATIONAL SATELLITES – LINEAR/DIGITAL

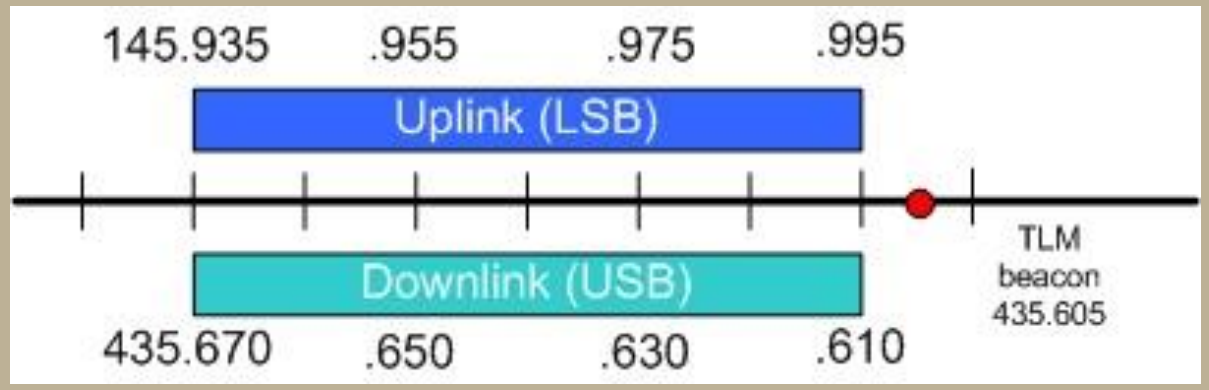
- AO-7 (Oscar 7)
  - Mode (A) – 2m uplink & 10m downlink (SSB/CW)
  - Mode (B) – 70cm uplink & 2m downlink (SSB/CW)
- RS-44 (DOSAAF-85)
  - 2m uplink & 70cm downlink (SSB/CW)
- JO-97 (JY1-Sat)
  - 70cm uplink & 2m downlink (SSB/CW)

SSB mode (Uplink is LSB and Downlink is USB)

LINEAR - SATELLITE TYPES

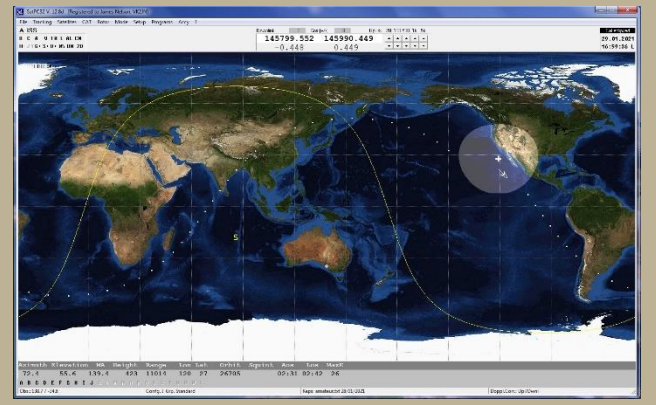
- Converts 20kHz - 100kHz of spectrum from one band to another
- Allows many QSOs at the same time
- Use narrow band modes CW SSB etc.
- Usually inverting. Convention is USB on downlink (LSB on uplink)

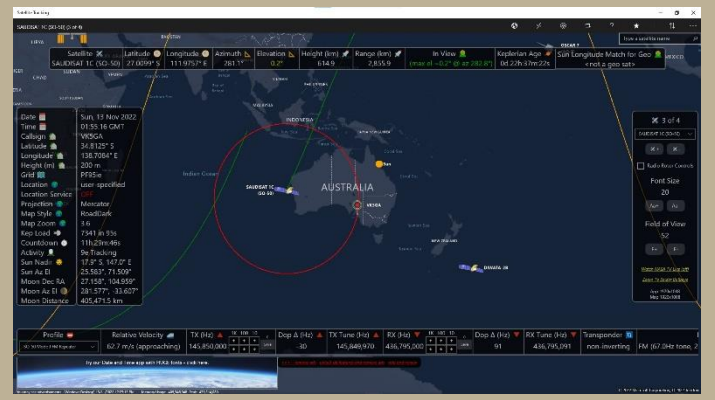
RS-44 (DOSAAF-85)

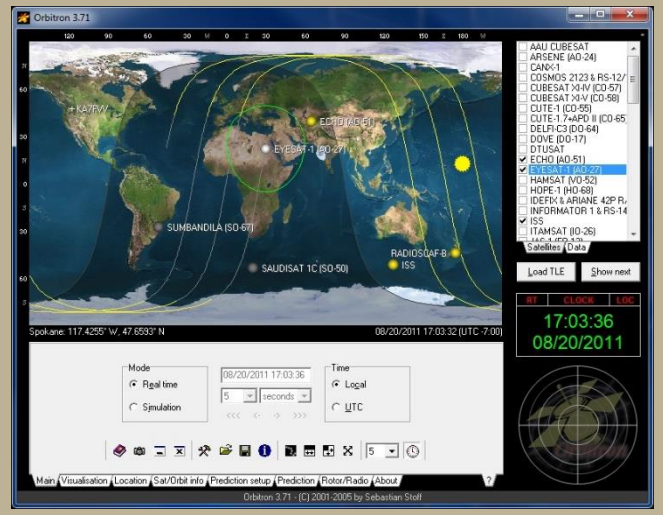


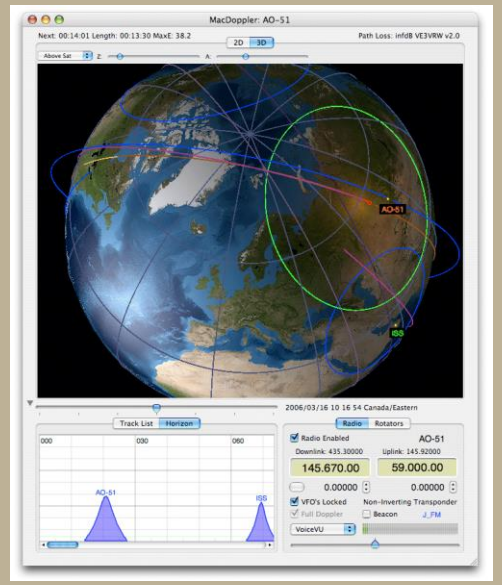
PREDICTION SOFTWARE

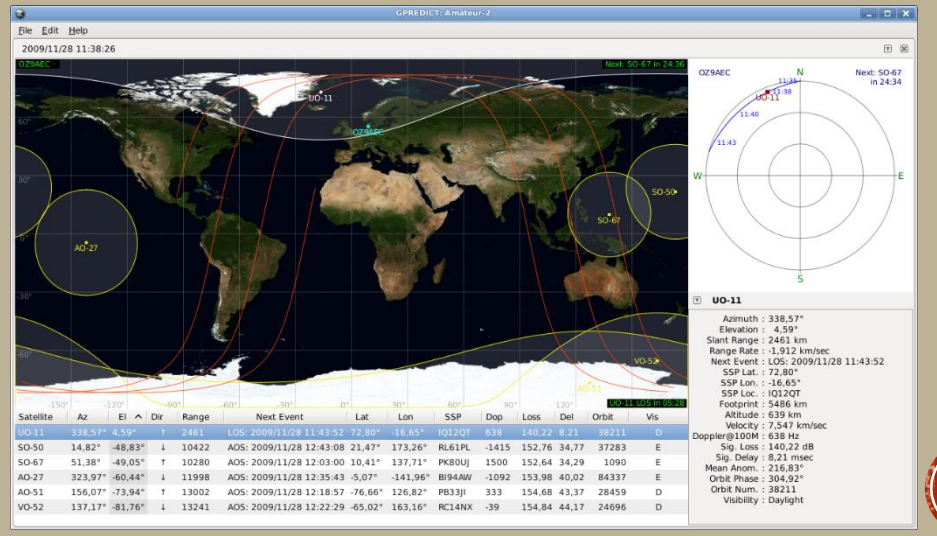
- Pass prediction data/software
  - Online – AMSAT NA - N2YO.COM - ISS Tracker
  - Software
    - Windows based - SATPC32 - ORBITRON - Satellite Tracking
    - Linux/Windows/MAC - GPredict
    - MAC/IOS - MacDoppler - GoSatWatch - Satellite Tracker
  - Site with list of more software Celestrak





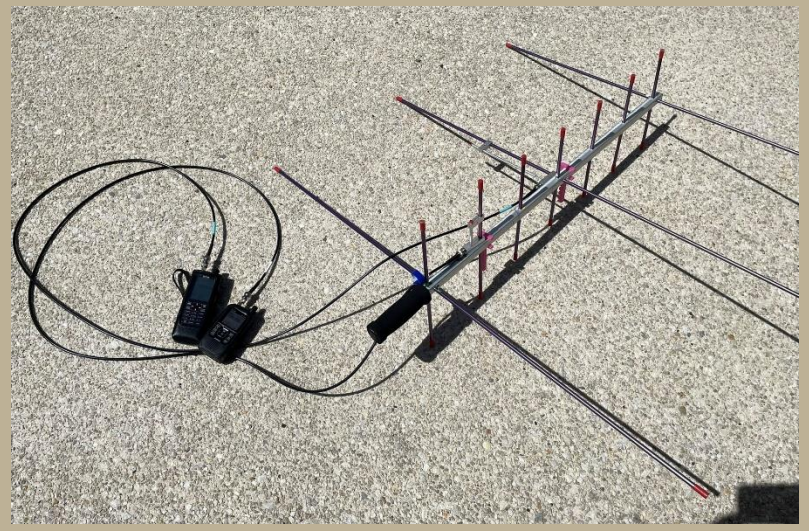






SETUP OPTIONS

- Pedestrian Portable
  - 2 x handheld radios (FM) or Dualband mobile (FM) or FT-817/818 (SSB/FM)
    - Carry bag to hold radios & battery
  - Arrow II style or Elk log periodic antenna – handheld



- Static Portable - Basic
  - Base radio eg; IC-910H, IC-9700, TS-2000 or above radios
  - Camera tripod with Arrow II style or Elk log periodic antenna

SETUP OPTIONS

- Static Portable - Advanced
  - Base radio eg; IC-910H, IC-9700, TS-2000
  - Laptop – Rig control and soundcard interface (DigiRig)
  - Azimuth & Elevation Rotator - Yaesu G5500, SARCTRAC or AntRunner
  - Masthead Pre-amp – 2m & 70cm (Minikits.com.au)

MY EXPERIENCES

- Pedestrian Portable
  - Best beginner option – Low cost entry.
  - Simple antennas can be homebrewed.
  - Good option if living in space limited home. Flexible setup location.
- Static Portable - Basic
  - Same as pedestrian portable.
  - Reduces equipment to be held.
  - Provides ability to experience linear sats easier.

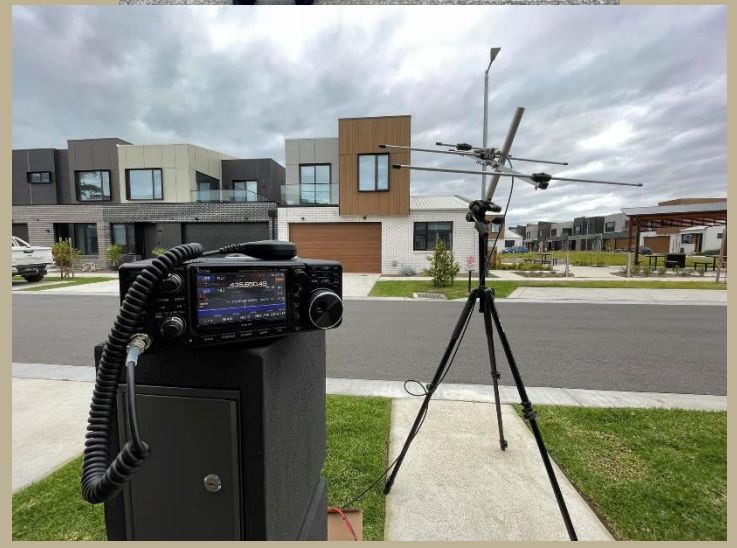
MY EXPERIENCES

- Static Portable – Advanced
  - Best option for DXpeditions.
  - Greater preparation required.
    - Try run of all items to be used before going portable.
    - Setup location of all equipment – Radio & antenna.
  - Greater amount of equipment to transport.
    - Consideration to equipment choice.
    - Coax type and length required for location.
    - Overall weight of all equipment & packing required.
  - Computer control – Radio & Rotator
    - Software required for control – various options for OS.
    - Software required for decoding digital signals.

ISSUES ENCOUNTERED

- Pedestrian Portable
  - Always <u>listen listen listen</u> before transmitting.
  - Can be daunting with having to hold radios and antennas.
  - Understanding satellite pass direction
  - Very weather dependent
- Static Portable – Basic
  - Similar to Pedestrian Portable.
  - Reduces need to hold all equipment on the person.
  - Slightly more equipment required.

VK3EHG - Hiro



ISSUES ENCOUNTERED

- Static Portable – Advanced
  - Selecting best equipment for satellites you are targeting to use.
  - Prior preparation prevents poor performance – mostly.
  - Ensure full understanding of all software required for satellite use.
  - Environmental conditions.

REFERENCES

- work-sat.com - Clint K6LCS
- KA7FVV – Scott
- SARCTRAC - SARCTRAC-Mk3b - Joe VK3YSP
- SATPC32 – Erich DK1TB
- www.satblog.info – Mike DK3WN

HOMEWORK - GIVE ISS SSTV A GO

SSTV Series 30: ISS at 25 & Scouts

Beginning Wednesday, help celebrate 25 years of the ISS, ARISS, and Scouting!

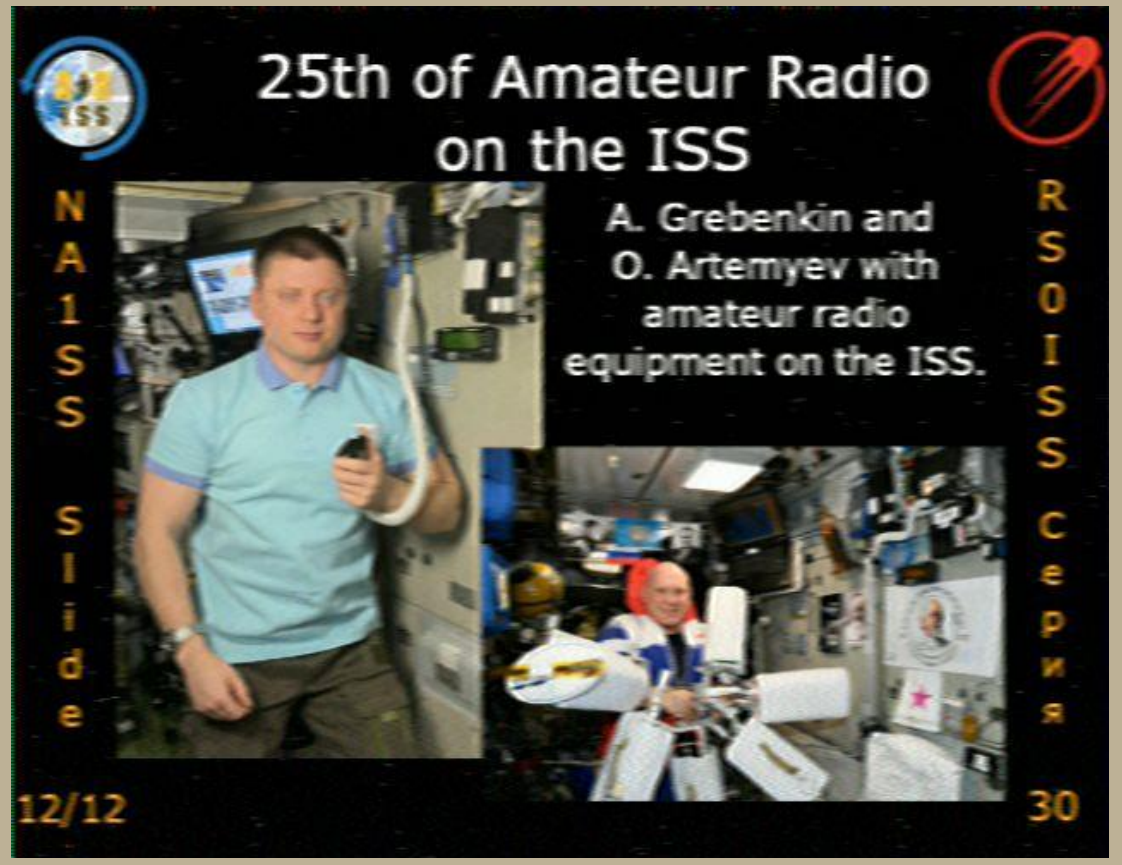
ARISS SSTV Series 30 - ISS at 25 / Scouting
Images: 12 images using PD120 encoding
Frequency: 145.800 MHz worldwide
Certificate Available: Yes for submission to gallery at: ariss-usa.org/ARISS_SSTV/
Image Timing: 2 minutes on / 2 minutes off

SSTV Series 30

Current event schedule:
Start: Wed. 12-Nov. 17:30 UTC (12:30 PM ET)
End: Wed. 19-Nov. 14:50 UTC (9:50 AM ET)

SSTV will pause for 2 educational contacts:
Azerbaijan: 16-November
14:30 UTC (9:50 ET) - 15:05 UTC (10:05 ET)

Russia TBD: 18-November
10:05 UTC (5:05 ET) - 10:30 UTC (5:30 ET)



HOMEWORK - GIVE ISS SSTV A GO

- Radio needed
  - VHF Handheld or mobile V/UHF
  - Antenna – Low gain will work
    - aftermarket handheld antenna or flowerpot style
    - Collinear vertical
  - SSTV decode program
    - MMSSTV or RX-SSTV (Windows), ROBOT36 (Android)
    - SSTV Slow Scan TV (iPhone) Black Cat SSTV (iOS)
    - Can use either microphone up to speaker or soundcard interface

HOMEWORK - GIVE ISS SSTV A GO

- Freq = 145.800Mhz, Mode – FM
  - No need to account for Doppler – At most 5Khz either side
- Online pass predictions – amsat.org/track/
  - Enter gridsquare & elevation of your location
  - Predication supplied in UTC format

WinAos QTH: 138.5/-34.9 T#: 17485 Sat.: 1 [Standard]

Tag	Obj	AOS	(L) LOS	Dur	maxEl	AZ
15.11.2025	ISS	05:08	05:16	08	10	003 - 112
15.11.2025	ISS	06:44	06:53	09	61	305 - 134
15.11.2025	ISS	08:22	08:29	07	10	254 - 148
15.11.2025	ISS	10:01	10:07	06	04	218 - 144
15.11.2025	ISS	11:39	11:45	06	07	205 - 113
15.11.2025	ISS	13:15	13:25	10	33	220 - 064
15.11.2025	ISS	14:52	15:01	09	19	245 - 017

WinAos QTH: 138.5/-34.9 T#: 17486 Sat.: 1 [Standard]

Tag	Obj	AOS	(L) LOS	Dur	maxEl	AZ
16.11.2025	ISS	04:22	04:27	05	04	030 - 095
16.11.2025	ISS	05:55	06:05	10	65	319 - 130
16.11.2025	ISS	07:33	07:41	08	15	269 - 146
16.11.2025	ISS	09:13	09:19	06	04	219 - 144
16.11.2025	ISS	10:51	10:57	06	06	203 - 118
16.11.2025	ISS	12:27	12:36	09	21	215 - 077
16.11.2025	ISS	14:04	14:13	09	35	238 - 029

THANK YOU FOR LISTENING

ANY QUESTIONS