Small Antenna Rotators for Amateur Satellite

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RMHAM-U Nerdfest

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So you wanna work AMSAT?

My intro to AMSAT

Doug, N6UA

RMHAM-U, November 2019

Need more hands!

My AMSAT QSOs to date:

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What's the problem?

Simultaneously trying to:

- Point the directional antenna at the fast-moving object in the sky
  - ~10 minutes per pass for LEOs
  - Twist for polarization, too!
- Adjust freq for Doppler effect
  - TX freq down, RX freq up during the first part of the pass
  - Vice versa during the last half of the pass
- Make QSOs, decode scratchy voice signals
- Logging

What can we automate?

- Record audio (at least RX, ideally TX) to reduce need for real-time logging
- Rig control/CAT for Doppler tuning adjustments
- …
- **Azimuth/Elevation antenna rotator to follow satellite motion**

Az/El Rotators from Major Brands

- **Yaesu G-5500 Az/El Rotator**
  - Yaesu GS-232A Computer Controller
  - or third party controllers like CSN SAT
  - "light-to-medium duty"
- RFinder PortAzEl
  - Looks like a light-duty rotor with a heavy-duty price tag
  - Integrates closely with RFinder Android radios
- Alfa or RF HamDesign RAS and BIG-RAS
  - High end, heavy duty. Think 3m+ dishes or EME arrays!
- WinRadio WR-ARP-ELAZ-100
  - Available by quote only

… All overkill for beginners

Robert Goodman K3RRR Projects

"El Cheapo"

- X-10 Ninja Pan 'N Tilt Camera System
- No computer control, manual tracking, but at least you're not holding it up
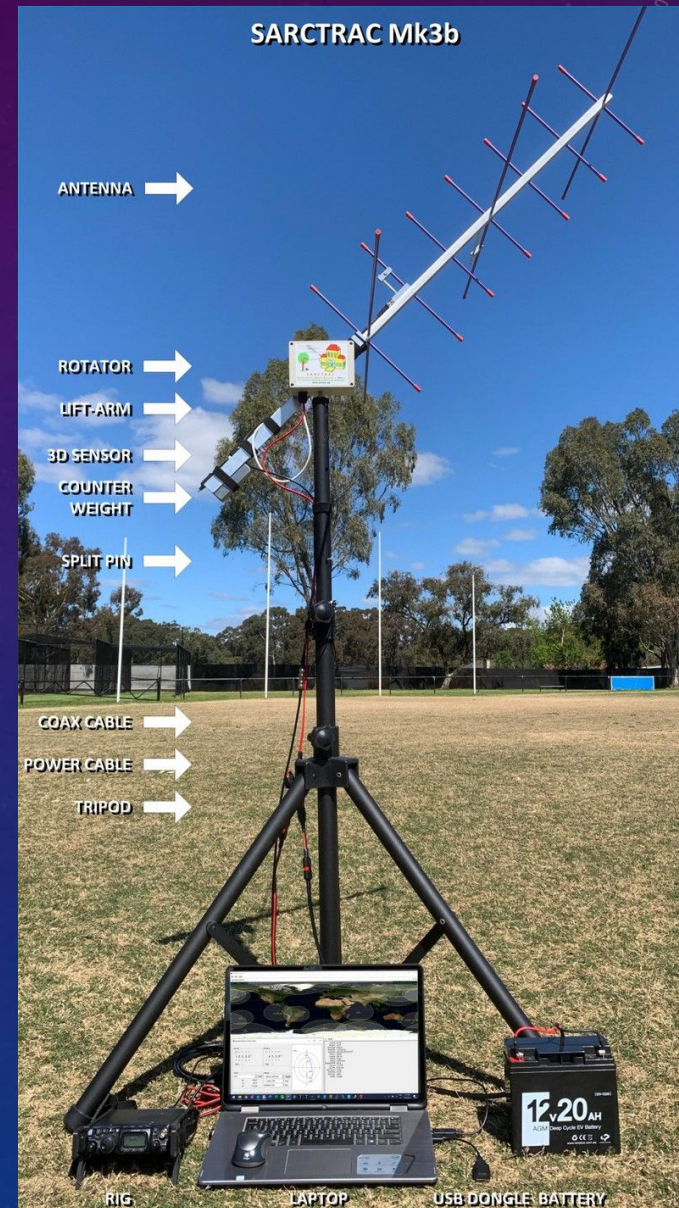
"Attic Contraption"

- Azimuth only, but the fixed elevation angle still works for many sat passes

SARCTRAC

- Designed and built by School Amateur Radio Clubs (SARC) of Australia
  - No longer sold
- Uses ESP-12S - WiFi control!
- Some RMHAM members used this during Field Day June 2023, with good results
- https://www.sarcnet.org/sarctrac.html

SatNOGS Rotator

- Open source plans! Very comprehensive
  - Includes mechanical analysis
- Pretty involved fabrication
- https://wiki.satnogs.org/SatNOGS_Rotator_v3

AntRunner

- Produced by small company (one ham?) in China
- Not weather shielded
- Slightly expensive, but looks solidly built
- ESP32 - WiFi capable! Or USB-C serial
- https://www.tindie.com/products/ johnnywu/the-antrunner-rotator/

SATRAN (Demo)

- Daniel Nikolajsen, SM7YSA
- Was sold as a kit, but only in Europe
  - No longer sold
- Open source plans!
  - STL files for 3D-printing parts
  - Gerber files for ordering PCBs
  - Templates for sheet metal parts
  - Open source firmware
- Uses NodeMCU ESP-8266 - WiFi control!
- Implements rotctld interface
- https://satran.io

Telescope GoTo Mounts (Demo)

Celestron & Meade, etc.

- Already made for more weight than an Arrow/Elk antenna
- Designed for more precision than we need for AMSAT
- Bonus: they come with a free telescope!

Healthy used market!

Altitude/Azimuth vs Equatorial

Software (Demo)

- hamlib rotctl
  - presents a network interface
  - controls many makes/models of rotators
  - https://hamlib.github.io/
- gpredict
  - Desktop software for satellite tracking
  - https://oz9aec.dk/gpredict/
- ISS Detector
  - iDevice and Android app
  - Need the Ham Radio Satellites Extension
  - https://issdetector.com/
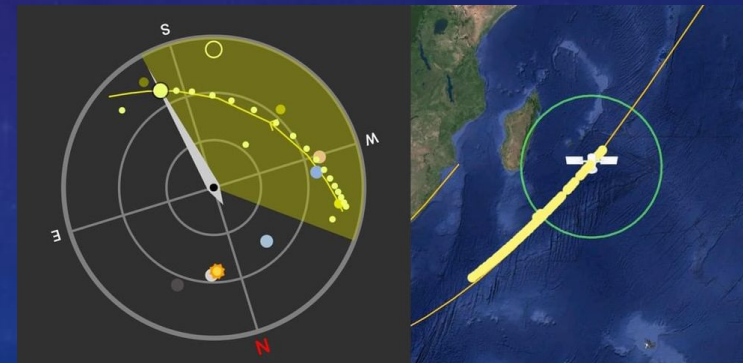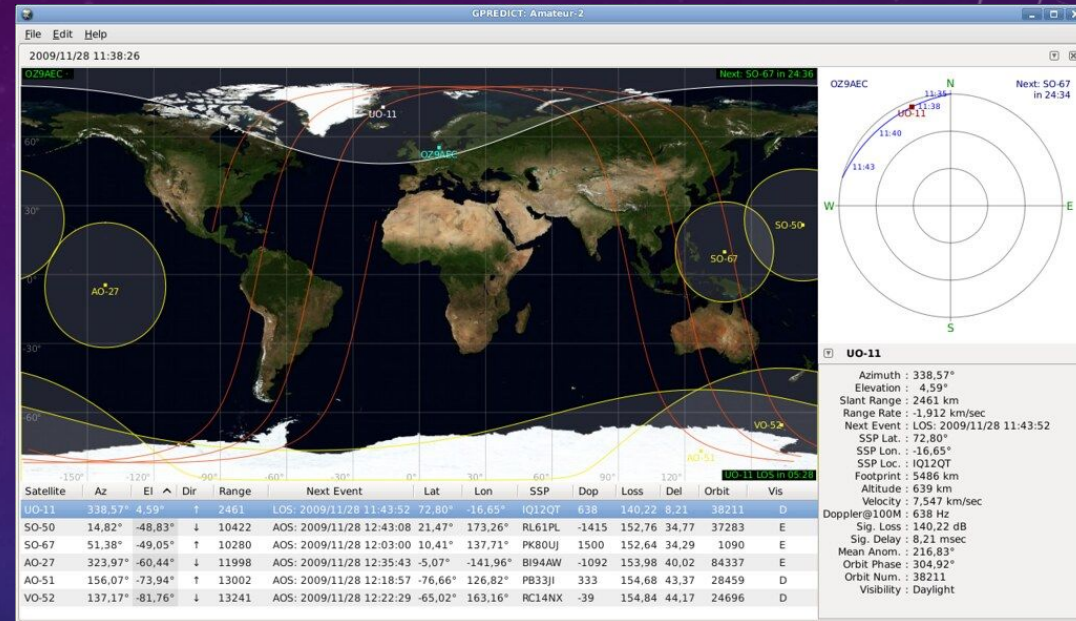
Demo Time

Questions?

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