Software Factors for Satellite Communications

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Why Computer Control?

- Manual vs. Automatic operation

- Should a computer "replace" our radio?

  - Antennas: AZ, EL rotators; Polarization

  - Radio: what and how?

- What should we be controlling?

  - Everything?

- No, Only add specific missing features:

  - Should operate *with* my radio

  - Background TX & RX Doppler correction

  - Correct for systematic or experimental link offsets

  - Should remember published and recent operating parameters

Technical Requirements

- Computer

  - Real-time calculations using orbital elements

  - Range rate used to find Doppler shift

  - Satellite position: Azimuth and Elevation

  - Intuitive and consistent GUI

- Radio

  - Well-designed packet interface

  - High-speed connection to computer

  - Non-predatory controls

  - Satellite modes

Technical Requirements

- Yaesu FT-736R

  - Simplex packet interface

  - Predatory remote control only

  - Set modes and control VFO's

- Yaesu FT-847

  - Well-designed packet interface

  - High-speed connection to computer

  - Non-predatory controls

  - Satellite modes

- Icom IC-821H

  - Poorly designed full-duplex packet interface

  - Non-predatory remote control interface is difficult

  - Panel "modes"

Operational Requirements

- ## The One True Rule

  - re.: "The One True Rule for Doppler Tuning", by Paul Williamson, KB6MU; re: Amsat Archives, Jan 1994

  - Holds frequencies constant at the satellite

  - Replaces drift at the satellite for drift at the ground station

  - Operational interference issues

  - Link offset variations

  - How to use it correctly when others don't

- ## Background Doppler Correction

  - Tuning is done both by the computer *and* operator

  - Requires stringent interrupt-driven programming techniques

Operational Requirements

- Radio satellite tracking modes

  - Non-inverting transponder

  - Inverting transponder

- Add dynamic Doppler correction to the tracking modes

AC6P Ground Station Controller

- Why I wrote it

- Radios it works with now

- What it does and doesn't do

    - works *with* your radio; non-predatory interface

    - Won't make you a better operator

    - Can quickly be enabled or disabled using the mouse or hot-keys

    - Includes a satellite database to keep track of mundane operational satellite parameters

Conclusions

- Software tracking control is not a panacea

- Proper architecture and algorithm design must be thoughtfully done before coding (programming)

- Operational feedback is needed for improvements