Automated Ground Station & the GENSO Project

Justin Foley - Jason Anderson
PolySat - Cal Poly
Background

- Cal Poly’s first two satellites: CP3 & CP4
- Launched 4/17/07 - 2 years old!
- Still working
- 2 to 4 passes per day per satellite
- Satellites operate on 70 cm band, LSB, AX.25 packet
The Problem

- Lots of student-hours to schedule
- Comm issue - takes persistence to get uplink
- Lacking motivation to run passes that don’t produce much data
The Solution

- Replace the human
- Software that automates the process of running passes and records the resulting data
Requirements

- Satellite Az/El
- Doppler Correction
- Radio/Rotor Serial Interface
- Audio analysis for automatic fine-tuning
- Operate multiple passes without human intervention
Programming Language

- LabVIEW has built-in capabilities
  - Serial Communications
  - Audio waveform analysis
  - DDE interface to satellite tracking programs like SatPC32 or Orbitron
- Just have to make features work together
Auto Pass Operator

Radio
Downlink (MHz) 0
Uplink (MHz) 0
Correction (Hz) 0
Manual Adj. 0

Rotor
Azimuth (°) 0
Elevation (°) 0
Flipped

Send
Signal
ACK Hold
Packet

CP4 Command List
CP3 Command List

Audio
Input Device 0
Packet Threshold 0.1
Signal Threshold 5

Minimum TX Elevation 25

Make sure Orbitron DDE is enabled before running
Results

- Before Auto Pass Operator
  - Average 5 KB/day downlinked
- With Auto Pass Operator
  - Average 10 KB/day downlinked
Automated Operations

- Without automated operations, we’d need people for 30 minutes each day
- What if we had contact for ~16 hours a day?
- Automated operations become essential
GENSO

- Global Educational Network for Satellite Operators
- Goal: Connect ground stations all over the world via the internet to create a global network for satellite communications
- An ESA managed project with students working from ESA, USA, JAXA, and CSA
Current GENSO Progress

- New development cycle to enable agile development
- Include real time audio streaming
- Closed loop frequency tracking
How can I get involved

- 1st Release in September
- US Mailing List
  - http://atl.calpoly.edu/mailman/listinfo/genso-us