PolySat
Building on Success

CubeSat Developers’ Workshop
Logan, Utah
25 August 2008
PolySat

- Objective: Engineering Education

- Objective: Provide a reliable bus system to allow for flight qualification of a wide variety of small sensors and attitude control devices.
Earth Station

- Yeasu FT-847 and Icom IC-910
- Yaesu G-5500
- MixW Software TNC
- Mac Doppler Pro for tracking
Earth Station

Marconi

dual phased 70 cm yagis

Hertz

2 m yagi
70 cm yagi
CP1

- Magnetorquer developed by Cal Poly
- Third party Sun Sensor

- Valuable lessons learned
  - CubeSat development: challenges & logistics
  - Multiple Flight Units
• CP2.1 manifested as CP4
  – Energy Storage and Dissipation Experiments
  – Test and Characterize CPBus

• CP3
  – Attitude Determination using a suite of sensors
  – Attitude Control using Magnetorquers in each side panel
  – Observation Imagers: lots of data to download!
Early CP3 External Temps

External Temperatures
CP3 CDH June 18, 2007

Temperature (°C)

Time

Front (-Y)
Right (-X)
Back (+Y)
Left (+X)
Top (-Z)
Recent CP3 Bus Voltages
Early CP3 Solar Panel Currents

Solar Panel Currents
CP3 CDH June 18, 2007

Time

Front (-Y)
Right (-X)
Back (+Y)
Left (+X)
Top (-Z)
Recent CP3 Solar Panel Currents

Solar Panel Currents
CP3 CDH April 9, 2008

Current (mA)

Time

Front (-Y)
Right (-X)
Back (+Y)
Left (+X)
Top (-Z)
Early CP4 External Temps

External Side Temps
CP4 CDH May 24, 2007

Time

Front (-Y)
Right (-X)
Back (+Y)
Left (+X)
Top (-Z)
Recent CP4 External Temps

External Temperatures
CP4 ADCS July 31, 2008

Temperature (°C)

Time

Front (-Y)
Right (-X)
Back (+Y)
Left (+X)
Top (-Z)
Early CP4 Solar Panel Currents

Solar Panel Currents
CP4 CDH May 24,
Recent CP4 Solar Panel Currents

Solar Panel Currents
CP4 ADCS July 31, 2008

- Front (-Y)
- Right (-X)
- Back (+Y)
- Left (+X)
- Top (-Z)
Lessons Learned

• Beacons
  – Object identification
  – Immediate data
  – Fun for world wide satellite trackers
• Uplink difficulties
• Solar panel efficiency
CP6

• Bus Improvements:
  – Low Noise Amplifier
  – Software stability

• Naval Research Laboratories Payload
  – Electron emitter and collection experiment
  – Two collectors, one emitter
  – Hopeful precursor to full electro-dynamic tether experiment
NRL Payload Fit Check
The Ground Station Network
GENSO Background

• A system to link ground stations using the internet
• Only 1200/9600 baud data for now
• Three parts:
  – Central server
    • Authentication and registration
  – Mission Control Client
    • Scheduling of Ground Station Servers
    • 1 MCC per satellite developer
  – Ground Station Servers
    • Actual interface between rotors/radio and internet
GENSO Background

• Global Educational Network for Satellite Operators
• Originally started with the Japanese to combat interference (GROWS)
• Started under the International Space Education Board, a collaboration between CSA, ESA, JAXA, and NASA
• Approved on 5 October 2006 for 2 years
• Project to link low-cost earth stations
“Standard” Earth Station

- Icom IC-910 radio with computer interface
- M² OR2800P-DC for Azimuth and MT-1000 for elevation
- Symek TNC 31S
  - Possibly software in future
- Antennas:
  - 2MCP22 for 145 MHz
  - 436CP42UG for 437 MHz
  - 1 meter dish for S-band (downlink only)
GENSO Update

• Finishing alpha testing
• Had a workshop at AMSAT UK Colloquium recently where the technology was demonstrated
• Central server currently active at Cal Poly
• Genso-us@atl.calpoly.edu for mailing list
Thanks!

polysat.calpoly.edu

cubesat.org

Justin Foley
jfoley@calpoly.edu

Austin Williams
atwillia@calpoly.edu