PolySat

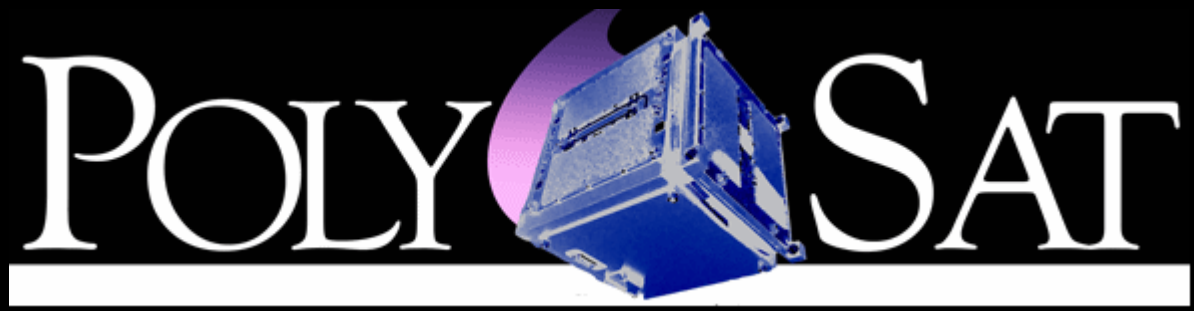
Launch and Operations

Cubesat Developers' Summer Workshop
Logan, Utah
12 August 2007

CAL POLY

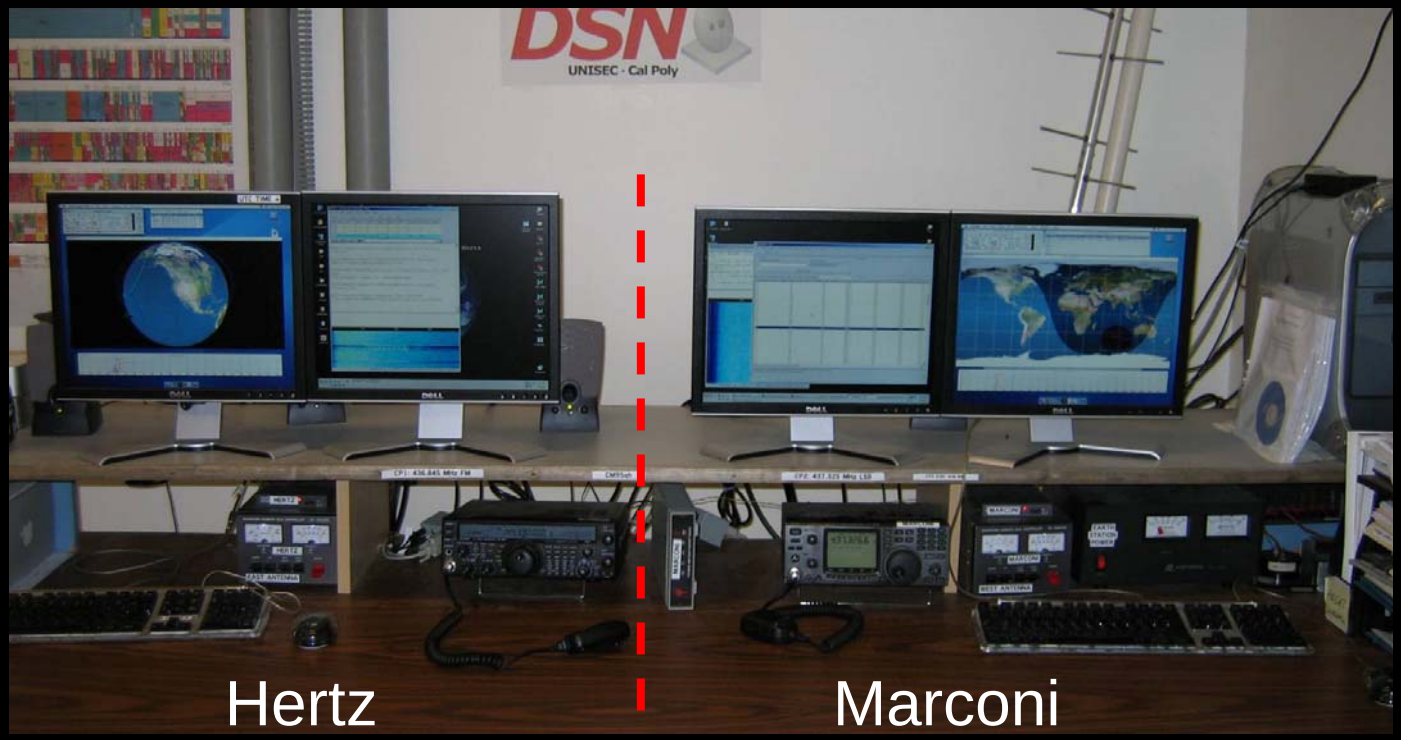
PolySat

- 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.



Multidisciplinary Space Technologies Laboratory

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

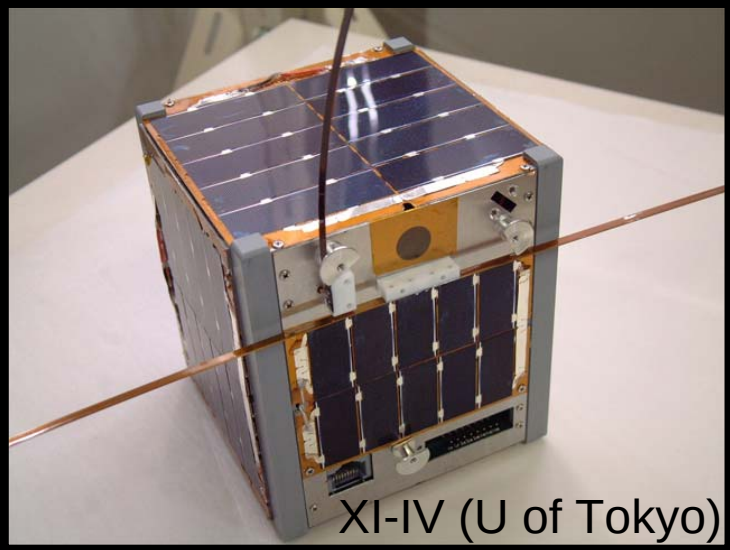
Hertz

2 m yagi

70 cm yagi

Operations Experience

- Training Objectives
  - Successfully make contact with a CubeSat
  - Download and decode AX.25 digital data.
- Collaboration with University of Tokyo
  - Experience gained with XI-IV


XI-IV (U of Tokyo)

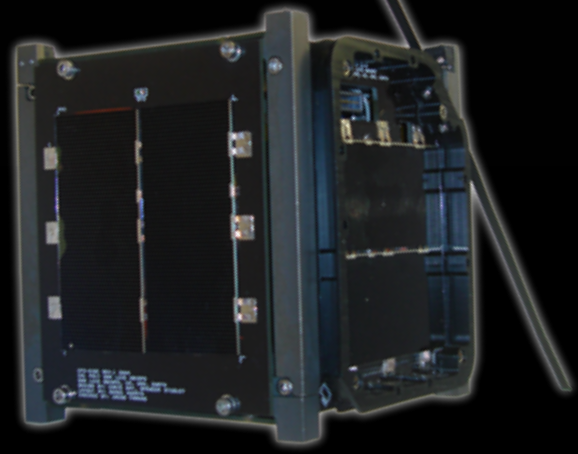
CP1

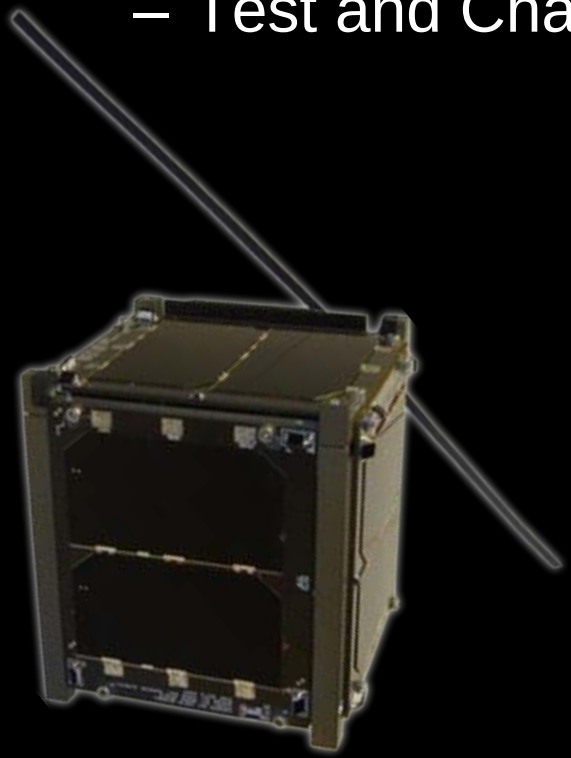
- Magnetorquer developed by Cal Poly
- Third party Sun Sensor

- Valuable lessons learned
  - CubeSat development: challenges & logistics
  - Multiple Flight Units

DNEPR 2 – April 17th 2007

- CP2.1 manifested as CP4
  - Energy Storage and Dissipation Experiments
  - Test and Characterize CPBus



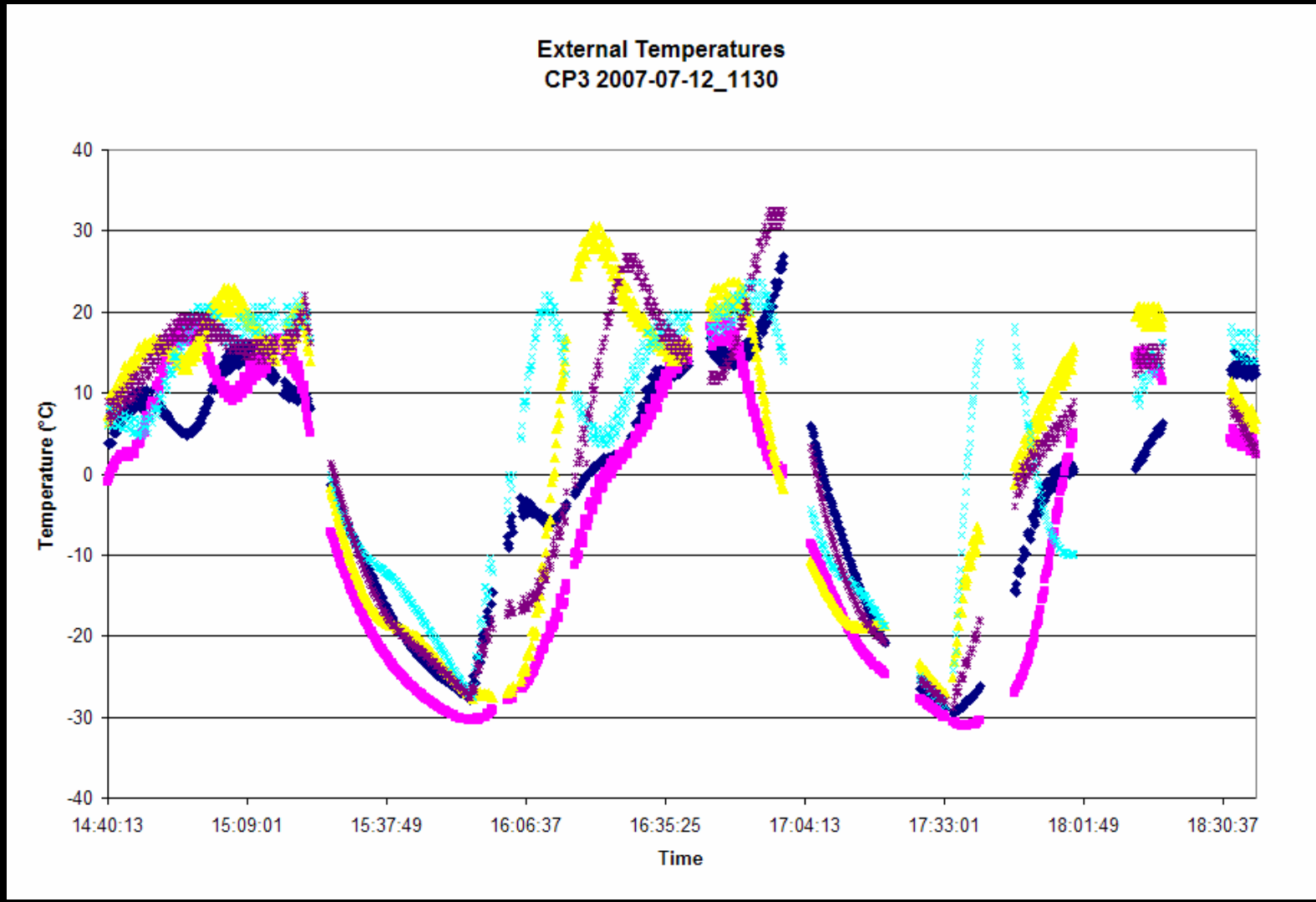


- CP3
  - Attitude Determination using a suite of sensors
  - Attitude Control using Magnetorquers in each side panel
  - Observation Imagers: lots of data to download!

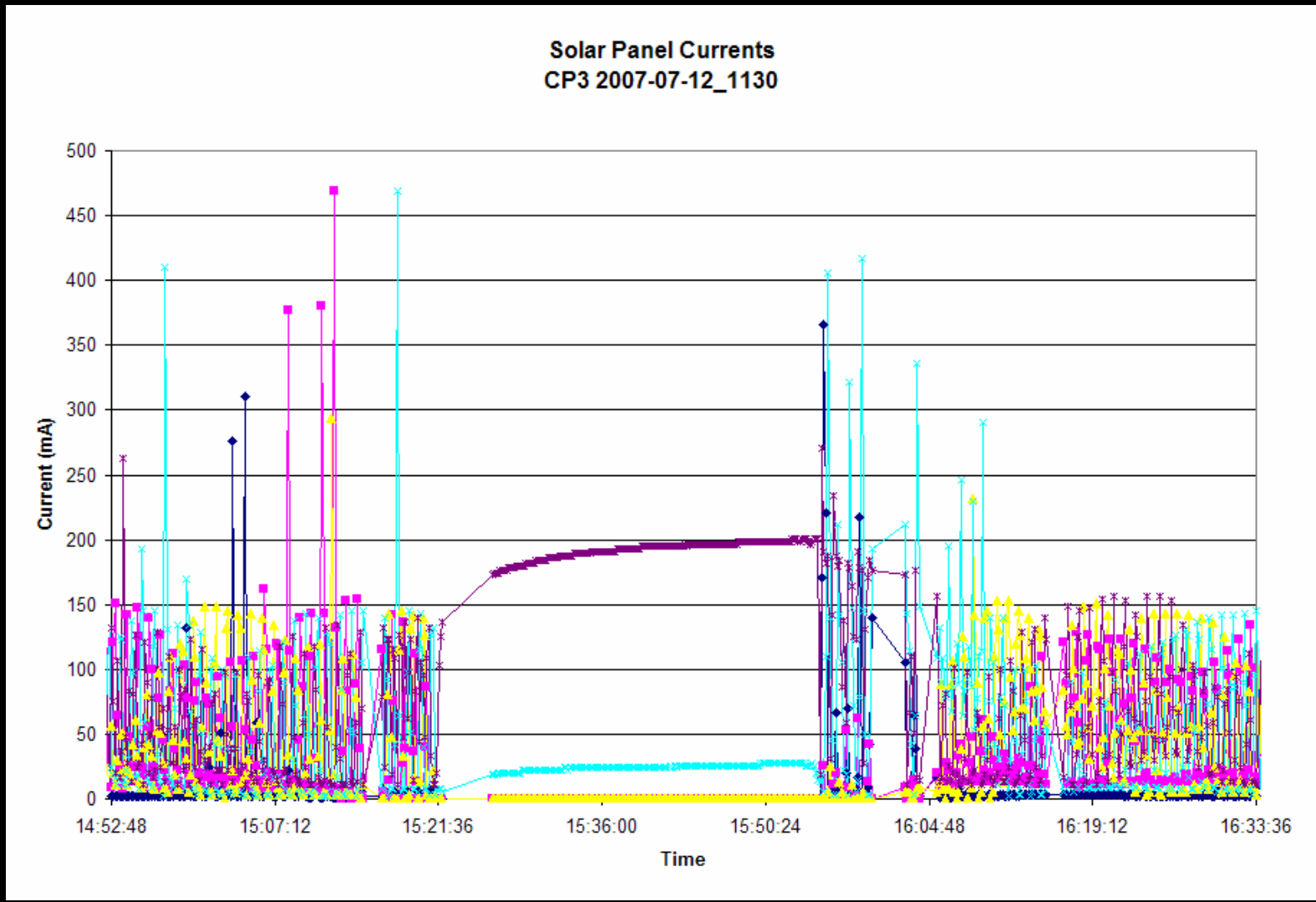
Lessons Learned

- Beacons
  - Object identification
  - Immediate data
- RF power
- Solar panel efficiency
- Contingency plan

On-Orbit Data



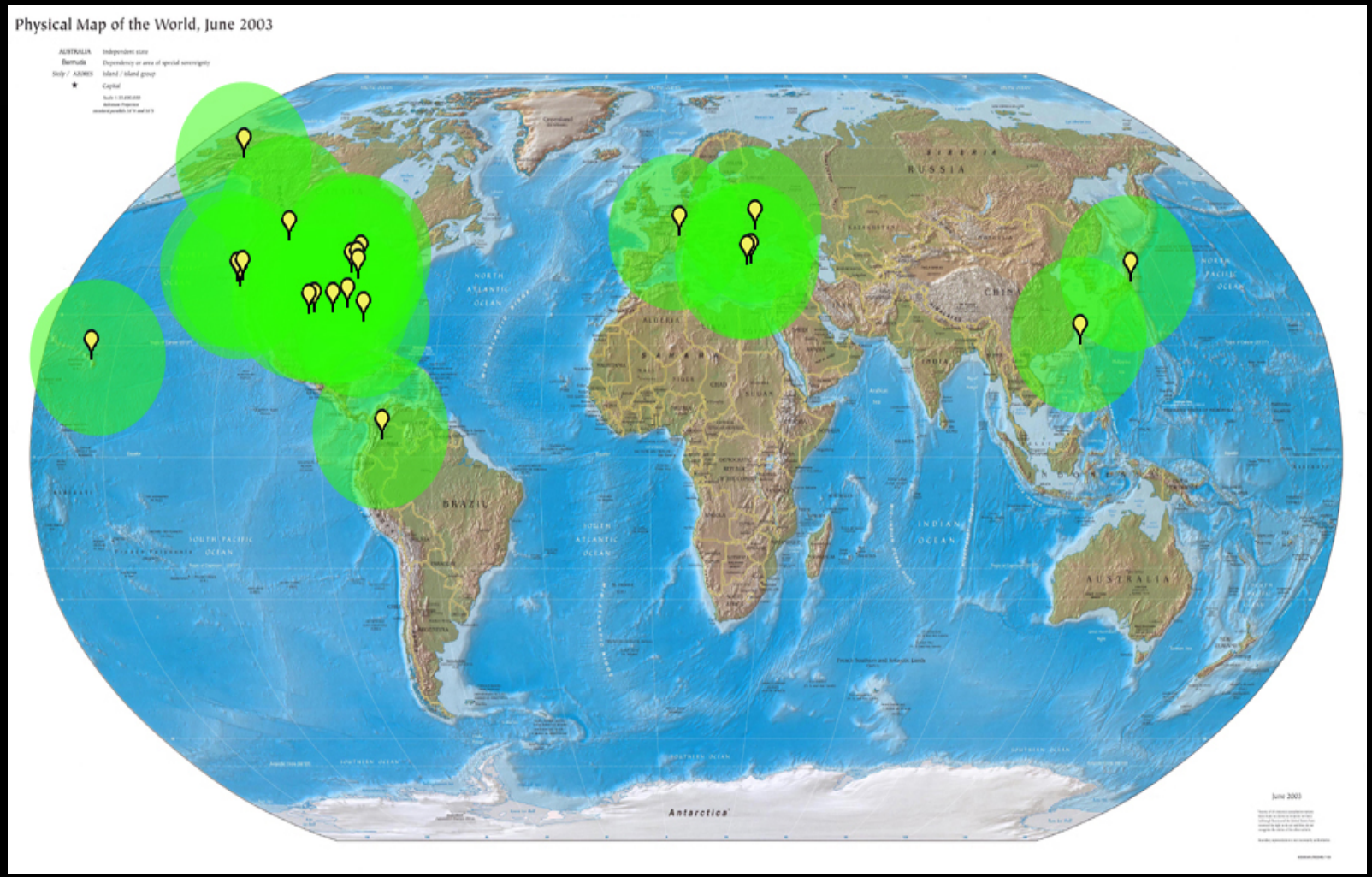
On-Orbit Data



Amateur Radio Involvement

- 80% of lab personnel are hams
- Training the next generation of satellite builders and operators
- Huge community of active listeners
  - Colin Hurst and Mike Rupprecht

The Ground Station Network



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

Canada

元素

esa

JAXA Japan Aerospace Exploration Agency

NASA National Aeronautics and Space Administration

genso

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

Central Server

- 3 central servers located around the world
  - Europe
  - California (Cal Poly or SRI)
  - Japan
- Tasked with Authentication and Registration only
  - Registration of IP addresses of GSS and MCC
  - Statistics
- All other functions (scheduling, data transfer) will go peer-to-peer between Mission Control Clients and Ground Station Servers
  - This keeps the load off a single server when system scales up

Mission Control Client

- A program that runs on a personal computer that can control Ground Station Servers
- Uses the Central Servers to get IP addresses for individual GSS, then contacts the GSS's directly to:
  - Schedule an active session
  - Download decoded data
  - Control the radios and rotors to track a satellite during an active session
  - IRC Client ?
  - Skype Client?

Ground Station Server

- Compatible with a majority of ground stations currently operating
- “Passive” tracking:
  - Will continuously track all satellites it can decode
  - Will forward data on to MCC
- “Active” tracking:
  - Someone at a MCC is actively controlling the rotors and radio, looking at the decoded data, and listening to the audio
  - Must be scheduled prior to satellite pass and cleared with GSS
  - Requires offline interaction and parties that know each other
- Store audio/data locally and stream to MCC as bandwidth allows
- IRC and/or Skype client?

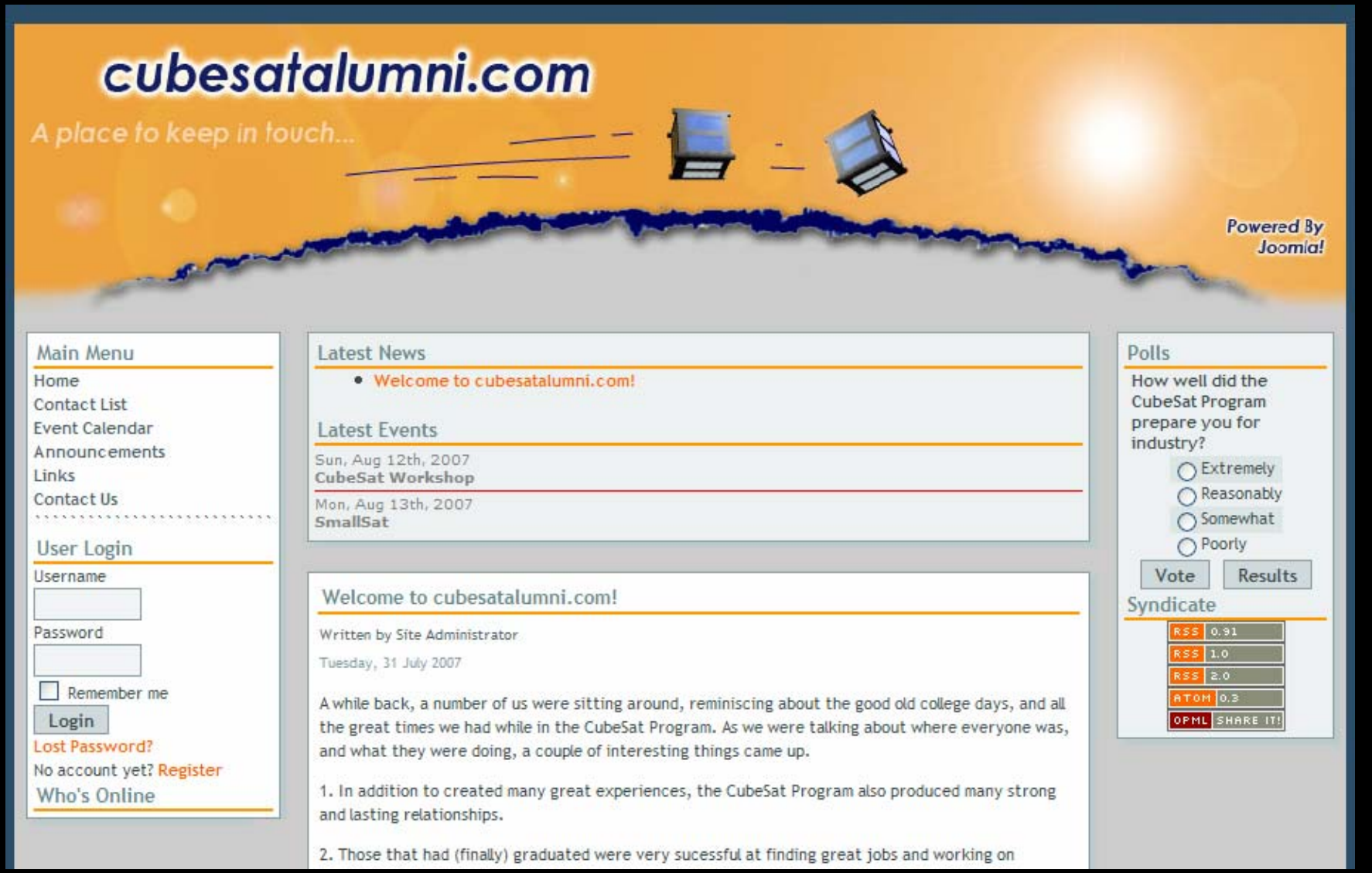
“Standard” Earth Station

- Icom IC-910 radio with computer interface
- M^2 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)

Workshop IV

- At Cal Poly 2-6 July 2007
- Completed PDR
- Documentation Finished
- Started to work on the code
- Initial testing slated for late summer

www.cubesatalumni.com



Spring Workshop

- April 2008 (possibly 10-12 April)
- Huntington Beach, CA
- Looking for presenters and sponsors
- Contact Riki, Lori, Matt D, or Dr. P
- cubesat-workshop@atl.calpoly.edu

Announcements

- SmallSat Conference
  - Booth upstairs in 7U and 8U
  - Inside Room 311
- Camera Charger
- Thanks for coming to this workshop
- Presentations are online at cubesat.org
- This room is open

Thanks!

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cubesat.org

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