ChargerSat-1 C&DH
C&DH Devices

- ATxmega128A1U Microcontroller
  - Extensive hardware module support
  - 32 MHz max clock speed
- ADXL345 Accelerometer
  - 4 mG sensitivity
- L3G4200D Gyroscope
  - 8.75 mdps sensitivity
- MicroMag3 Magnetometer
  - 0.015 μT sensitivity
- AT45DB642D Data Flash
  - 64 Mb capacity
  - SPI compatible
- MLX90614 IR Sensor
  - 0.5 °C sensitivity
ChargerSat-1 C&DH Subsystem Breakdown

- Power Management
- On-Orbit Communications
- Inertial Measurement Unit
- Task Scheduling
- Task Execution
- Data Decryption
- Decision Making
- Data Storage
- Imaging System
C&DH Subsystem Requirements

• Task Scheduling:
  – Capable of receiving tasks from the ground, sorting by time

• Task Execution:
  – Capable of interrupting program flow to execute a task, then returning after scheduling next task.

• Data Decryption:
  – Capable of decrypting AES-128 data received from the ground

• Decision Making:
  – Capable of making deployment/operational decisions based on given data from IMU and other subsystems
C&DH Subsystem Requirements

• Inertial Measurement Unit:
  – Capable of measuring 3-axis acceleration, rate of rotation, and magnetic field, and returning the data to other subsystems

• Data Storage:
  – Capable of storing mission-critical data in a filing system for easy retrieval, as well as large (MB) files for non-critical mission objectives (taking a picture)
C&DH Subsystem Requirements

• Power Management:
  – Capable of monitoring power status on the bus, as well as enabling/disabling power to certain sections of the satellite

• On-Orbit Communications:
  – Capable of sending/receiving data to/from the ground station, as well as sending a beacon using alternating radios (dipole, monopole)

• Imaging System:
  – Capable of taking a picture from either the side or boom-mounted camera and returning the data to other subsystems
C&DH Deployment Algorithm

1. Deploy Dipole
2. Deploy Monopole
3. Rate of Rotation
   - Slow? (Yes/No)
4. Deploy GG Boom
5. Stabilized?
   - Yes
   - No
6. Pointing @ Earth?
   - Yes
   - No
7. Deploy Solar Panels
8. Activate RCW
C&DH Operational Flowchart

- Task Scheduling
- Housekeeping
- Task Scheduling
- Task Execution
- Radio Rx
C&DH Task Scheduling/Sorting & Execution

Basic Queue Format

Task Scheduling

Task @ Time n  ...  Task @ Time 1  Task @ Time 3  Task @ Time 2

Task Sorting

Task @ Time m  ...  Task @ Time 3  Task @ Time 2  Task @ Time 1

Task Execution
Current Subsystem Software Technology Readiness Levels

- Task Execution: TRL 8
- Inertial Measurement Unit: TRL 8
- Task Scheduling: TRL 8
- Data Storage: TRL 8
- Data Decryption: TRL 8
- On-Orbit Communications: TRL 8
- Decision Making: TRL 8
- Imaging System: TRL 8