Purdue University – Student Built Imaging Satellite

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Mission Statement

To design a low cost student-built satellite to take pictures of the Earth’s atmosphere and land masses and post them on Purdue University’s website for public relations purposes.
Satellite Subsystems

- Payload
- Satellite Structure
- Mission Life and Power
- Attitude Control
- Thermal Control
- Command and Data Handling
- Telecommunications
Payload

• Camera Requirements
  – Space Hardened CCD Camera with Frame-grabber System
  – Resolution of at least 1 km
  – Power Requirement of 10 Watts
  – Operating Temperature Range of 0 to 32 °C
  – Pointing of Satellite to be Determined Later
Satellite Structure

• Structure Requirements
  – Total Spacecraft Weight to be less than 50 kg
  – No Sensitive Materials or Special Care needed
  – Design for American Launch Vehicles
    • Titan, Delta, Atlas, Space Shuttle
  – Mounting Design Relies on Primary Payload
Mission Life and Power

• Mission Life Requirements
  – At Least 2 Months in Orbit, but Possibly Longer Depending on Solar Panels

• Power Requirements
  – Will Use Ni-Cd Batteries and Solar Panels
  – Full Power ~ 16 to 20 Watts
  – Standby Power ~ 3 to 5 Watts
Attitude Control

• Attitude and Control Requirements
  – Active Control
    • 3 axis Stabilized
    • Reaction Wheels and/or Magnetic Torquers
  – Passive Control
    • Barbeque Roll for Thermal Control
    • Magnets, Ballast, and Hysteresis Rods
Thermal Control

• Thermal Requirements
  – Keep Electronics and Batteries within Operating Range of 5 to 20 °C
  – All Sides of Satellite Covered with Solar Panels
  – Barbeque Roll to Distribute Heat
  – Black Silicone-based Paint to Increase Conductivity and Thermally Conducting Mats where needed
Telecommunications

• Basic elements to be determined
  – Type of Data
  – Coverage Area & Ground Site Locations
  – Capacity of Signal
  – Signal Strength
  – Connectivity to Ground Station
  – Availability of Communication with Satellite
Command and Data Handling

- Systems to be Controlled
  - Attitude Control / Position
  - Control Cameras
  - Thermal System
  - Sending and Transmitting Data
  - Power Management
  - Housekeeping Data
Conclusion

• Areas of Concern
  – Stabilization
  – Data Transfer
  – Thermal Control
  – Camera Operation
  – Redundant Systems