Power Generation and Distribution
Spring 1998 Review

Brad McCarthy

Team Leader

Team Composition

- Last Semester: 1 member
- This Semester: 11 active members
- Mentor: Dr. Hal Tharp (ECE)
- Leader: Brad McCarthy
- Members:
    - Suryadi Adiputra
    - Hanee Omar Barqawi
    - Hua-chih Chen
    - Mason Hereford
    - Weechye Lim
    - Ferry Lukito
    - David Lundell
    - Brandon Miller
    - Appandi Mustafa
    - Omar Shafiq

Areas of Investigation

- Power Source - Solar Panels
- Energy Storage - Batteries
- Source Control - Peak Power Trackers
- Miscellaneous - Web Site

Solar Panels

- Setback - Global Solar (CuInDiSe)
- 20W - 35W power requirement
- $1000 Cost Cap
- Bus Voltage = 28V DC
- Material = Si
    - » Theoretical Efficiency = 18%
    - » Percentage of Time in Sunlight = 40%
    - » Probable Achieved Efficiency = 8% to 14.5%
    - » Output Power = 33.88W to 59.28W
    - » Degradation = 2 years
    - » Interconnection Material = Al
    - » Configuration = Cells in Series, Strings of Cells in Parallel
    - » Redundancy and Protection = Bypass and Blocking Diodes

Solar Panels 2

- Need for Further Investigation:
  - » Prototyping of Power Source
  - » More Thorough Testing of Cells - Dr. Peck (AME), Ray Ramadori (Solar Car)
  - » Vendor to Provide Space Grade Cells
  - » Material of Satellite
  - » Adhesion of Cells to Satellite
  - » Integration With Other PGD Systems

Batteries

- Investigated: NiCd, NiMH, Li-ion
- Chose NiCd D Size Cell:
  - » Capacity = 600 to 800 mAH
  - » Output Voltage = 1.2V
  - » Lifecycle = 1000
  - » Memory Effect
  - » High Self-Discharge Rate
  - » Simple Charging Mechanism
  - » Moderate Weight
  - » Low Price

Batteries 2

- Configuration = 3 Batteries in Parallel, 24 Sets in Series
- Supplied Voltage = 28.8V DC
- Supplied Power = 35W
- Redundancy of Design - Current and Power Decrease with Failure
- Charging Mechanism
- Memory Effect Solution = Complete Discharge of Batteries
- Need for Further Investigation:
    - » Testing of Charge and Discharge of Batteries
    - » High Cycle Testing
    - » Integration with Other PGD Systems
    - » Careful Consideration of Battery Lot for Flight

Peak Power Trackers

- Function = Source Control
- Will Regulate Output Voltage to Maintain 28V Bus
- Will Work at Maximum Power Point
- Need for Further Investigation:
    - » Prototyping Circuit
    - » Integration with Other PGD Systems

PGD Web Site

- URL = http://www.ece.arizona.edu/~pgd/
- Will Serve as a PGD Information Resource for Other Teams
- Will Provide Links to PGD Related and SSP Related Sites
- Will Provide Detailed Information About PGD for Interested Students

Conclusion

- Much Has Been Accomplished This Semester
- There Remains a Great Deal of Work Ahead
- PGD Team Need for Further Investigation:
  - » Power Needs of Other Teams
  - » Power Needs Hierarchy and Budgeting
  - » Maximum Power Availability
  - » DC Voltage Needs - DC-DC Converters
  - » Distribution of Power Throughout Satellite
  - » Work Much Closer with Other Teams
  - » Prototyping of Entire PGD System
  - » Bus Protection and Grounding