CAPE-II

Command and Data Handling Subsystem (CDH)
Subsystem Hardware Specifications

- Power Budget : 250mW
- MCUs : Cirrus Logic EP7312 @ 36.864Mhz
- RAM (per MCU) : 8MB
- ROM (per MCU) : 4MB
- Flash Memory : 64MB
Subsystem Design Objectives

• fault tolerance
• implement an RTOS
• implement non-volatile data storage to “store and forward” data collected from buoys and store any new software or data uploaded while in orbit
Fault Tolerance

Single/Multi Event Upsets

• caused by charged partials and cosmic radiation
• anomalous state changes in memory
• permanent damage to silicon
• disruption of microcircuit processes
Fault Tolerance

Design Approaches

- boot from redundant array of PROM

Diagram:

- MCU
- MUX
- PROM
- PROM
- PROM
Fault Tolerance

Design Approaches

- boot from redundant array of PROM
- check/reprogram MCUs with vulnerable memory

![Diagram showing vulnerable MCUs connected to a Rad-Hard MCU through a programmer bus.](image-url)
Fault Tolerance

Design Approaches

• boot from redundant array of PROM
• check/reprogram MCUs with vulnerable memory
• redundant MCU control

Diagram:

- Other Subsystems
- MCU
- Bus
- MCU
Fault Tolerance

Design Approaches

- boot from redundant array of PROM
- check/reprogram MCUs with vulnerable memory
- redundant MCU control
- error checking and correcting file system for non-volatile data storage
RTOS
Operating Systems

• organized way of offering services such as file management, network interfacing, and process scheduling

• program loader, process control, and memory management makes uploading and running new software easier and safer

• eases development of other subsystem software
RTOS

Linux

• mature and well documented
• supports a wide range of hardware and software
• large development and support community
• many development resources and tools
Non-volatile Data Storage

Data Storage for CDH Subsystem

- stores all software and data not critical to satellite operation
- high capacity to accommodate the temporary storage of sensor data collected from buoys which will be transmitted to a ground station
- capacity also allows for the backlogging of data
Non-volatile Data Storage

Flash Memory

- low power
- standard CFI/JEDEC interface
- serial interfaces also exist (SPI, I²C, etc…)
- fast read/write times
Any Questions?