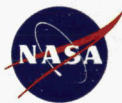# RAD750 SBC
# Usage for the Solar Dynamics
# Observatory (SDO) Program

Kenneth Li
SDO SBC COTR
NASA, GSFC
Code 561
301-286-5777
Kenneth.e.li@nasa.gov

---

# Solar Dynamics Observatory
# (SDO) Program

- SDO website: http://sdo.gsfc.nasa.gov
- First Space Weather Research Mission in the Living With a Star (LWS) Program
- Science Objective: to understand the solar variations that influence life on Earth.
- Mission development and management by NASA/GSFC
- Launch Date: 2008
- Mission Life: 5 years
- Orbit: Inclined Geosynchronous
- 3 Science Instruments:
  - Helioseismic and Magnetic Imager (HMI)
  - Extreme Ultraviolet Variability Experiment (EVE)
  - Solar Helispheric Activity Research Prediction Program (SHARPP)

- **RAD 750 serves as main spacecraft processor in redundant Command and Data Handling subsystem.**
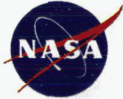
# SDO SBC Configuration

Type: 6U RAD750 SRAM Computer (Enhanced)

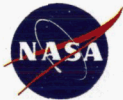| Build | Qty | Chassis & Black Box I/F | cPCI Conn. | RAM | Boot-Up Memory |
|-------|-----|-------------------------|------------|------|----------------|
| BBU | 3 | 3 | cPCI / Amp | 8MB | EEPROM |
| ETU | 1 | 0 | Hyp | 8MB | EEPROM |
| FU | 3 | 0 | Hyp | 8MB | PROM |

---
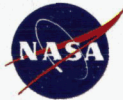
# Major SUROM Code Additions

- Monitor Capability via UART
  - Includes jump, dump, fill, invoke loader, checksum commands
- Loader Capability via UART
- Jump to off-card PROM, via cPCI, for in-flight 1553 EEPROM loader

## SBC H/W Configuration Changes

- cPCI Connectors -> Hypertronics Connectors
  - Includes adapters to connect to commercial backplanes.
- Hypertronics Connectors -> Front-Panel & Wedgelock adjustments
  - Due to slight dimensional connector body dimensional differences
- Front-Panel -> Replace with card-extension to lengthen card to 280mm
  - replacement will be made post-delivery

Kenneth Li, "RAD750 SBC Usage for the SDO Program", RAD750 User's Workshop, June 6, 2005, Pasadena, CA          5

---
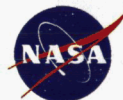
# SBC H/W Interfaces

- Front Panel
  - Extension incorporates harness to translate J7 front-panel connector to two D-connectors – one to support UART loads of Flight S/W during spacecraft testing.

- Backplane
  - EEPROM -> Powered on at all times
  - EEPROM Enable & Reset signals-> Externally applied.
  - Watchdog Timer -> SUROM code set to generate SBC reset upon expiration.
  - Watchdog Timer Expired PID signal -> Configured as output and used to increment external reset counter (for FSW purposes of determining reset cause).

Kenneth Li, "RAD750 SBC Usage for the SDO Program", RAD750 User's Workshop, June 6, 2005, Pasadena, CA          6

3

## Hypertronics Test Qualification Plan Highlights

- Hypertronics Baseline Test Program
  - MIL-55302/EEE-INST-002
  - Mixed Flowing Gas Test/EIA 364-65A (simulates ground living conditions)
  - 500 Hr T/H Test (Accelerated Life Test)

- Add'l Tests w/ 6U Chassis, backplane, 5 daughter cards
  - Random Vibration as per GEVS
    - 2min duration, 3-axis, Qual level (14.1Grms)
  - Thermal-Vacuum test
    - -20C to +60C
  - Setup detects connector interrupts to 1ns resolution

## 6U Vibration Test Chassis
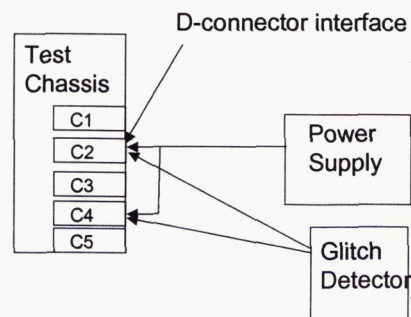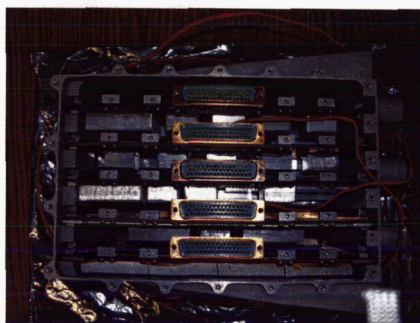


-Cards in Slots C2 and C4 have Hypertronics connectors populated on J1, J2, J4
-Motherboard/Daughter card pins daisy-chained together for each of J1, J2, J4
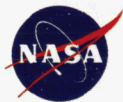-Glitch detector monitors each daisy-chained connector separately – 6 monitors total
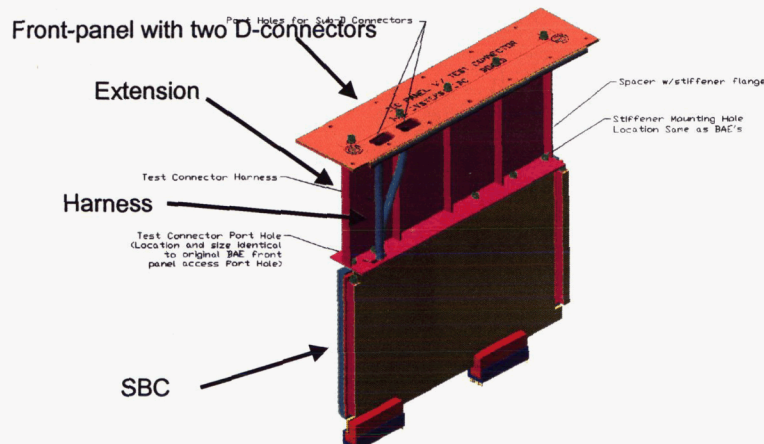
# Qualification Test Results

- 6U Qualification Vib test has been completed with successful results (no interrupts detected at 1 nanosecond).
- Other Test results to be reported at Workshop.

# SBC Extension to Achieve Total Length of 280mm

# SBC Extension – Finite Element
## Structural Analysis Results vs BAE Test Result

| Analysis Model | First Frequency |
|---|---|
| BAE Vibration Test Result | 478Hz |
| NG Analysis of BAE SBC model | 533Hz |
| NG Analysis of SBC model with extension | 517Hz |