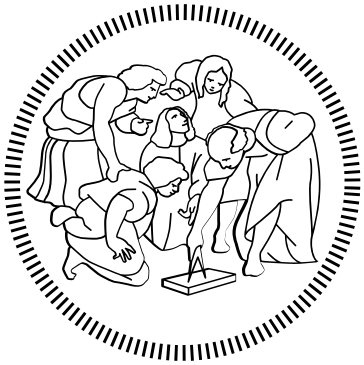

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Reverse Engineering of Juno Mission

Homework 7

Course of Space System Engineering & Operations
Academic Year 2023-2024

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Contents

Notation

EOM	End Of Mission
OBDH	On Board Data Handling
TRL	Technology Readiness Level
NVM	Non-Volatile Memory
DRAM	Dynamic Random Access Memory
DTCI	Data, Telemetry and Command Interface
EDAC	Error Detection And Correction

1 Juno configuration

2 Juno OBDH

2.1 Introduction of OBDH

Given the long term exposure of the S/C to extreme environments, such as the one around Jupiter characterized by high levels of radiation, Juno's OBDH system was designed to ensure proper functioning up to EOM. This was achieved by selecting radiation hardened hardware characterized by high TRL. The OBDH system also needs to constantly interact with all other subsystems to handle both telemetry and scientific data.

2.2 Architecture of OBDH

The OBDH system is based on two redundant, single fault redundant C&DH boxes, each including:

- **RAD750 Processor:** a 3U radiation hardened single-board computer by BAE systems with 256 Mbytes of NVM flash memory and 128 Mbytes of DRAM local memory.[1] It's able to handle 100 Mbps of instrument throughput, much higher than needed for payloads requirements, and can operate at up to 200 MHz with a substantial performance improvement over older rad-hard processors. Furthermore the CPU itself can withstand a total radiation dose of up to 1 Mrad (Si) and has already been employed on various missions such as NASA's Mars Science Laboratory proving its effectiveness.[2][3]
- **DTCI card:** it contains the interface between the C&DH box and all the instruments of the spacecraft, while also providing science data storage capabilities. In particular 32 Gbits are available for data storage with a further 8 Gbits dedicated to EDAC. This is sufficient both for all science orbit downlink data requirements and representative stress cases. Unlike all other cards present in the C&DH box it's characterized by a 6U format instead of a 3U one.[1]
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2.3 Reverse sizing of OBDH

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[2] BAE Systems. *RAD750® radiation-hardened PowerPC microprocessor*.

[3] Various. *Spacecraft Information*. Website. Site: https://spaceflight101.com/juno/spacecraft-information/. 2024.