MSU RTC Team
February 24, 2012
MSU – Payload 04

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Re: Monthly Status Report – February 2012

The MSU RTC HASP team has been working on a wide range of topics as we continue designing and developing our payload. Primary areas of concurrent design work are payload thermal design and simulation for determining heat dissipation and/or insulation requirements, FPGA circuit card assembly (CCA) system architecture definition, parts selection, and circuit design, power supply CCA architecture definition and system power control strategies, radiation sensor testing, mechanical payload design including mounting hardware, and electrical interface component selection i.e. determining a bulkhead strategy for passing HASP power and communications signals through the payload enclosure to the CCA stack.

We have continued to maintain a system signal list, power conversion/payload interface diagram, itemized weight budget spreadsheets and system architecture block diagrams to bolster our original HASP design proposal. These documents are continually updated as design modifications dictate and allow our team to continually refine our operating parameters. This information feeds back into our payload thermal analysis, circuit design effort, power supply requirements, and mechanical analyses. February work performed and results included:

Justin Hogan – Justin worked on trade studies for selection of FPGA circuit components and power supply CCA architecture. He defined the scheme for configuring the FPGAs upon system startup and during partial reconfiguration of the main FPGA by the control FPGA during flight. He and Ray investigated options for power supply architecture including contingencies for monitoring power consumption and automating system shutdown if necessary. He organized the effort to address and respond to the design weaknesses.

Raymond Weber – Raymond began porting our existing reconfigurable computer architecture to the FPGAs selected for use on the HASP payload. This involved separating the general-purpose partially reconfigurable processing tiles from the FPGA components responsible for controlling the system, including readback scrubbing of the configuration memory, TMR voting circuitry and radiation sensor interface logic. He assisted with component selection, definition of telemetry and command packets, and contributed to defining parameters necessary for design proposal weaknesses.

Todd Buerkle – Todd performed troubleshooting and rework on radiation sensor CCAs to correct for a problem with op-amp DC offset voltages. Outputs were saturating with zero input, and an AC-coupling of amplifier stages eliminated the offset voltage problem. He measured

current consumption on the -3V and +3V supplies for power estimates. He is preparing for cyclotron testing of radiation sensors scheduled to occur in early March.

Jennifer Hane – Jennifer participated in team discussions and answered many questions as we brainstormed system architecture in the lab and as Ray worked to dissect the reconfigurable computer architecture, separate control components from general-purpose processing components. She has also been working on an "agnostic tile" system, which allows reconfigurable FPGA tiles to assume varying functionality based on current system needs.

Lizi Clem – Lizi selected payload enclosure materials, insulating materials and hardware for affixing the enclosure and circuit stack to the HASP mounting plate. She took charge of the thermal analysis for the payload and generated an internal temperature profile during the HASP ascent. She is working on steady-state thermal analyses for expected temperature soaks during the float portion of the flight.

Adrien Lambert – Adrien has recently helped with design and manufacture of mounting hardware for use during cyclotron testing of the radiation sensor. He has also been available for HASP thermal discussions during group meetings.

Issues encountered during payload design and development

We found that the FPGA originally selected for use as the main FPGA was not supported by Xilinx tools for partial reconfiguration. This required design migration to a different part, which necessitated significant redesign of the in-system configuration strategy for the FPGA hardware.

A problem with DC offset voltages present at the inputs of high-gain signal conditioning circuitry was discovered and corrected. The implemented fix is acceptable for use in our HASP payload, but a new revision of the radiation sensor CCA is anticipated.

Milestones Achieved

- Preliminary telemetry and command packets defined
- Successful design synthesis for both main and control FPGAs
- Ascent internal temperature calculations completed
- Refined weight and power budgets

Current team members and leaders

- No change to team members.