

Hardware and Software Development for MOSES II Flight Operations

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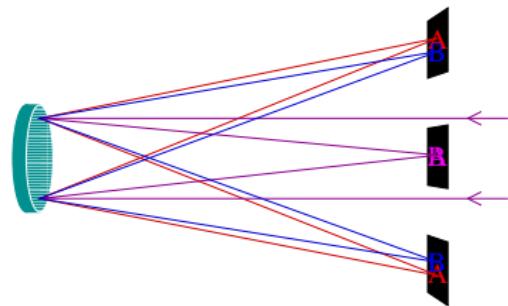
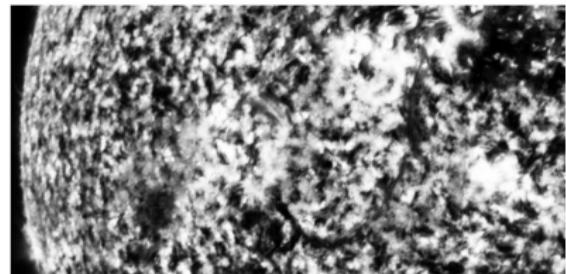


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MOSES Scientific Goals



- hey!
- Extreme Ultraviolet Wavelengths (EUV):
- UV absorption by Ozone (O_3) [1].
- ~ 300 -second image window



First Launch



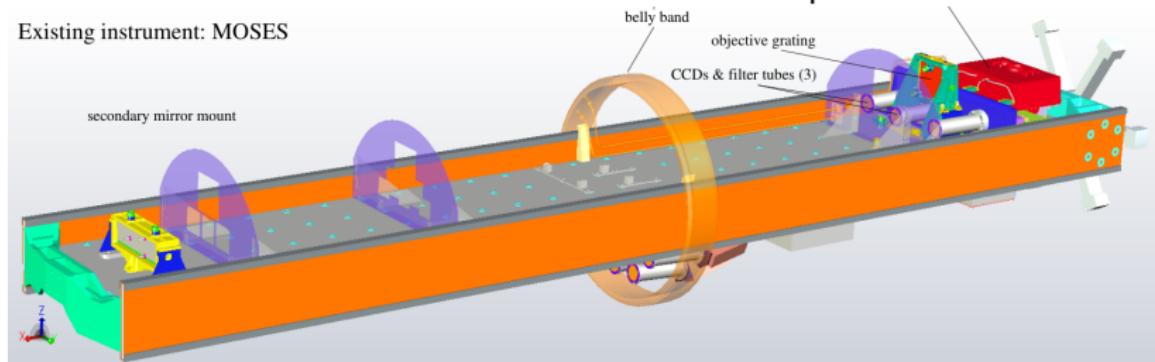
- MOSES first launched on February 8th, 2006 [2].
 - Utilized a Black Brant IX sounding rocket
 - Observed the Sun in He II 304 \AA
 - Identified a Transition Region Explosive Event.
 - Hercules EBX flight computer was damaged after launch. We hypothesize that this occurred upon splashdown into atmosphere.
- MOSES II
 - Following the first operation, the MOSES research group planned to try again with updated optics.
 - Necessitated replacing the malfunctioning flight computer. Unfortunately the Hercules board used for the first flight is no longer available.
 - New flight computer was to be developed to act as a drop-in replacement for the old system.

System Requirements



- Data characteristics
 - MOSES captures the sun in three spectral orders $m = -1, 0, 1$.
 - Each spectral order is captured by CCDs at 2048×1024 resolution.

Existing instrument: MOSES

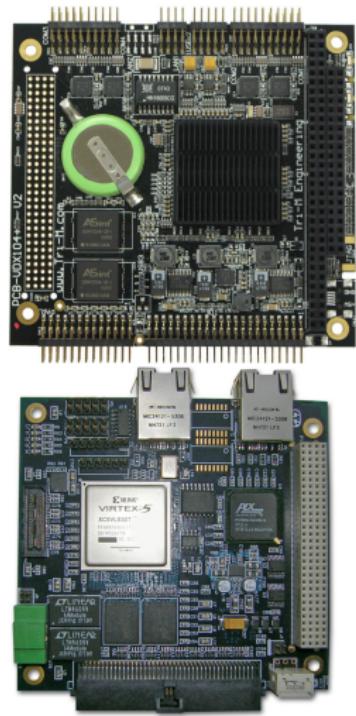


- Challenges
 - Short flight time, FC must be fast enough to prevent bottlenecks.
 - Camera data is presented as 32 Mbit/s 16-bit parallel data.

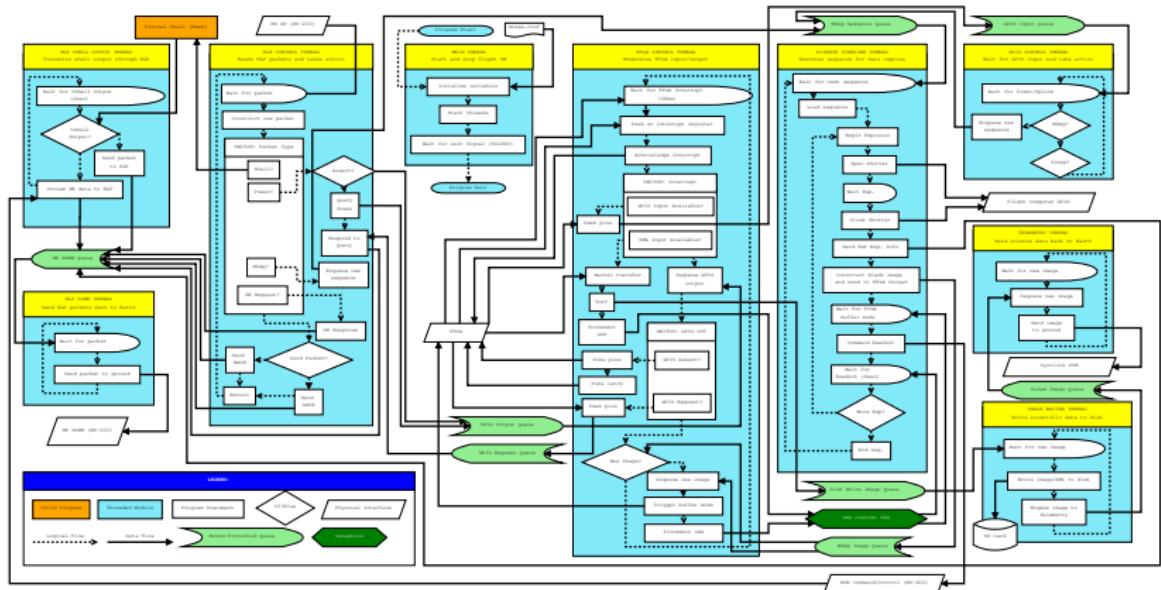


Hardware Overview

- Originally attempted to replace the Hercules EBX with the TS-7600 embedded system.
 - Found that the FPGA implementation was too slow to keep up with the data rate.
- VDX104+ Flight Computer
 - Moderates communications between the ground, cameras, and FPGA.
 - Executes flight software we developed.
- Connecttech PCI104 FPGA
 - Captures parallel data produced by cameras and transfers it back to VDX FC.



Flight Software





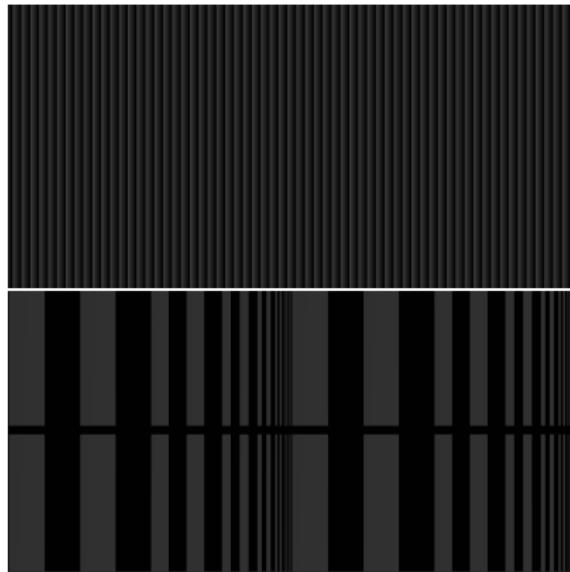
Ground Station Software

- Server module
- Client module
- Grounded communication
 - Serial console
 - Ethernet
- In-flight communication
 - Housekeeping Link Protocol (HLP)
 - Timers
 - High-speed telemetry

Two screenshots of the Moses software interface. The top screenshot shows the "Moses Server" window with tabs for "Uplink Com Port" and "TCP IP Server". It includes dropdown menus for port, baud rate, and parity, along with buttons for disconnect, connect, and start/stop. The bottom screenshot shows the "Moses Client" window with tabs for "Received Data" and "Timers Shell Power Housekeeping Custom Uplink HDAC". The "Received Data" tab displays a log of housekeeping data, and the "Timers" tab contains various configuration options for timers and sequences.

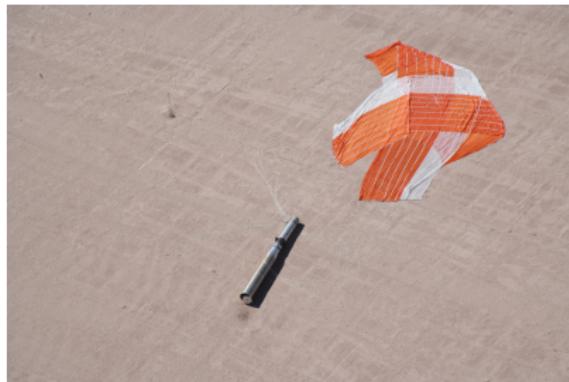
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Capturing Data



- STIM(S)
- ReadOut Electronics (ROE)
shown to be functional

Data Retrieval



- High-Speed Telemetry
- Synclink implementation
- Pre-Mod Filter
- Groundstation Laptop / IDL image view

Next Launch



- Scheduled for launch:
August 17(27?)
- Horizontal test in progress
 - Interaction/control over other payload components





References



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A transition region explosive event observed in He II with the moses sounding rocket.

The Astrophysical Journal, 719:1132–1143, August 2010.

<http://solar.physics.montana.edu/MOSES/papers/2010/FoxKankelborgThomas2010.pdf>.