Monthly Progress Report
August 2004
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1.0 Introduction

This is the monthly progress report for the month of August 2004 of the HMI program for the progress undertaken by LMSAL under the phase C/D/E contract with Stanford. The LMSAL team is in collaboration with Stanford University on the HMI/SDO solar physics investigation being led by Professor Phil Scherrer of Stanford University.

2.0 Summary

August flew by as if it were skipped. The primary activities were a trip to LightMachineray, an IFWG meeting hosted at LMSAL, and the first quarterly review at LMSAL. Significant focus was applied to getting the program planning and EVM tracking in place. The work must go on and some of the highlights were the acceptance test of the SUROM was completed, the life test HCM motors were assembled, several filter elements were received, the shutter has completed 46M exposures (equivalent to 5 year life), and electronic and mechanical parts are getting out for fabrication. The HMI team continues to hold weekly team meetings internally, with the SDO Project and with suppliers.

3.0 Schedule and Milestones

An updated detailed schedule has been submitted and needs to be reviewed. The schedule was reorganized to match the new WBS and more detail was added. One significant item to point out is that the focal plane assembly final alignment was split into two parts and a sunlight test was added. A non-flight FPA assembly is to be used for initial sunlight testing and the functional test with the flight FPA to be installed and aligned prior to HOP calibration. Shown below are some recent milestones and activities.

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Date</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUROM Acceptance Test</td>
<td>Aug ’04</td>
<td>Completed</td>
</tr>
<tr>
<td>Start HCM Life test</td>
<td>Sept ’04</td>
<td></td>
</tr>
<tr>
<td>Receive Lenses</td>
<td>Sept ’04</td>
<td></td>
</tr>
<tr>
<td>Visit RAL</td>
<td>Sept ’04</td>
<td></td>
</tr>
<tr>
<td>Visit e2v</td>
<td>Sept ’04</td>
<td></td>
</tr>
<tr>
<td>Window Selection</td>
<td>Oct ’04</td>
<td></td>
</tr>
<tr>
<td>Receive SM Structure</td>
<td>Oct ’04</td>
<td></td>
</tr>
<tr>
<td>ETU oven assembly</td>
<td>Oct ’04</td>
<td></td>
</tr>
<tr>
<td>HMI CDR</td>
<td>Nov ’04</td>
<td>(at LM)</td>
</tr>
<tr>
<td>Deliver HMI to S/C</td>
<td>Nov ’06</td>
<td></td>
</tr>
<tr>
<td>Launch</td>
<td>Apr ’08</td>
<td></td>
</tr>
</tbody>
</table>

* Five year baseline mission *
4.0 Major Activities During March

4.1 Filters and Optics
The blocking filters were received and preliminary performance tests show two of the three are acceptable, only one is required for the assembly. The front window filter samples were received and are being measured prior to radiation testing. The rotating quartz wave plates have been received. The primary and secondary lenses have been formed and are being AR coated. The Janos quote for the remaining powered optics was too high. The specification was reduced and a second proposal will be submitted. The quotes for the mirrors were received. The calcite pieces were also received; now, all of the optical elements for the Lyot filter are in house and assembly has begun.

4.2 Mechanical
There have been a couple personnel changes that have hindered the schedule a bit, but progress continues. The focal plane assembly tube order was placed and the drawings for the machined parts and assembly are near completion. The metering tube order was placed and the machined parts are routing for release. Several mass model drawings have been released and orders placed. The ETU oven drawings have been completed and orders are being placed.

4.3 Mechanisms
The shutter life test continues at 46M exposures. The HCM life test motors were assembled and are being tested. The start of the life test is on track to begin in September. The front door gearbox parts have been received and the door drawings are routing for release. The alignment mechanism drawings were completed and parts have been ordered. All of the flight motor orders have been placed.
4.4 Electrical
The oven controller and oven pre-amp boards assembly and board level testing is complete. Several boards are out for fabrication: mechanism encoder, revised bridgeboard, housekeeping board and limb tracker board. The limb pre-amp board, space wire breadboard, and motherboard are in layout.

4.5 Software
The SUROM acceptance test was completed. A waiver has been submitted for a couple items not within specification. Focus has been turned toward the kernel development.

4.6 I&T
The vacuum chamber retrofits and testing have been completed. The connector feed through leaked and new ones are being ordered. They are expected in time for the HCM life test start. The error analysis was completed and progress continues on alignment planning for the optics package and the subassemblies.

4.7 Thermal
The electronics box model was completed and the telescope geometry updated. Heater layout and sizing has begun. The CCD decontamination gradient across the CCD was resolved. Stress analysis was performed and resulted in acceptable stress levels on the CCD.

4.8 Major Sub-contracts

4.8.1 CCD – e2v
Progress on the flight batches continues. The third batch is being tested and no variations in the droop and differed charge affects are detected. The affect is being characterized. The significance of these affects will be determined with in-housed testing of the demonstration CCD. The chamber has been assembled, but the camera was sent back to the supplier for some rework. E2v has presented new delivery dates that drive the schedule and the team is negotiating new dates.

4.8.2 Camera Electronics - RAL
This is a tricky section. Everything was moving along fine, most of the boards have completed layout and are going to fabrication. The enclosure design is near completion and the interface issues have been resolved. The waveform generator ASIC passed all of the DPA testing performed at Goddard. RAL apparently was struggling with the layout of the driver board with contains the Actel FPGA and WFG ASIC. They had indicated it was cramped, but that it was doable. Recently, it was learned that it is not possible without increasing the size of the board about an inch. This would throw the schedule out the door by having to redesign the boards and enclosure. They proposed a promising solution using an Aeroflex FPGA, which would replace both the Actel FPGA and the WFG ASIC. They also have a board layout design that utilizes this approach. This would not delay the delivery of the
demonstration CEB; however, the DM CEB would not have the Aeroflex parts. LM team members will discuss this issue with RAL at the upcoming trip.

4.8.3 Michelson – LightMachinery

The visit to LightMachinery occurred. The ETU test results and performance measurements of the first Michelson beam-splitter were reviewed and look great. The coating design for the ISS and BDS beam-splitters were reviewed and need another iteration. The polarizer films were supplied. Three more beam-splitter blanks have been coated and bonded together; once formed, four beam-splitters will be tested and two will be selected to build the first set of Michelsons.

4.8.4 Structure – Vision Composites

All of the machined parts are on order and are driving the schedule. The schedule has slipped to the first week of October. Since this pushes the structural model schedule, the material orders will be placed prior to completion of the structural model testing to mitigate the slip of the flight structure build. Panel fabrication is complete and the bench panel is near completion. All drawings are completed.

Structure Walls and Partitions and Mounting Legs

5.0 Design Updates

The radiators were enlarged to provide higher margin on the CCD temperature to fulfill an action from the focal plane peer review. The height of the focal plane was also increased as agreed to with the project and the MID is being updated.

6.0 Resource Requirements

A detailed mass estimate of the HOP to HEB harness was performed, which resulted in a significant mass increase. The increase combined with the radiator resizing pushed our mass beyond our allocation. The team went through a detail mass analysis that evaluated the mass estimate and design maturity to predict our mass growth based on LM design standards. LM proposed a pass allocation of 79kg based upon this analysis. The project agreed to a mass allocation of 77kg: a 15% growth for the harness, and 5% for the HOP and HEB. The mass report and power budgets are attached.

7.0 Issues/Concerns

- RAL’s design proposal and schedule
- CCD delivery dates