Monthly Progress Report
March 2004
# Table of Contents

1.0 Introduction ........................................................................................................... 3  
2.0 Summary ............................................................................................................... 3  
3.0 Schedule and Milestones ..................................................................................... 3  
4.0 Major Activities During March ........................................................................... 4  
  4.1 Filters and Optics .............................................................................................. 4  
  4.2 Mechanical ....................................................................................................... 4  
  4.3 Mechanisms ...................................................................................................... 5  
  4.4 Electrical ......................................................................................................... 5  
  4.5 Software ........................................................................................................... 5  
  4.6 I&T .................................................................................................................... 6  
  4.7 Thermal ........................................................................................................... 6  
  4.8 Major Sub-contracts ......................................................................................... 6  
    4.8.1 CCD – e2v ................................................................................................. 6  
    4.8.2 Camera Electronics - RAL ......................................................................... 6  
    4.8.3 Michelson – Lightmachinery ..................................................................... 7  
    4.8.4 Structure – Vision Composites .................................................................. 8  
5.0 Other Activities During March ............................................................................. 9  
6.0 Planned Activities For April ............................................................................... 9  
7.0 Design Updates .................................................................................................... 9  
8.0 Resource Requirements ...................................................................................... 9  
9.0 Issues/Concerns .................................................................................................. 10
1.0 Introduction

This is the monthly progress report for the month of March 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

March madness rang true this month. Some of the highlights from this busy month include: RAL and e2v received letters on contract and e2v delivering a functioning CCD to RAL, completed assembly, characterization, vibration testing and post vibration performance testing of the life test shutters, completed assembly of the engineering test unit beam-splitter for the Michelson Interferometer, the fabrication of the brass bridgeboard and motherboard was completed, a common buy plan was defined with the SDO project for EEE parts, the software management plan (combined AIA and HMI) was reviewed internally and released, and HMI participated in the Mission PDR. The HMI team continues to hold weekly SDO Project and instrument telecons, weekly HMI-specific telecons, nearly weekly CCD camera system telecons, weekly telecons with LightMachinery, weekly HMI status meetings, and a constant stream of internal technical meetings.

3.0 Schedule and Milestones

An updated detailed schedule is submitted at the end of each month. Shown below are some key program milestones and activities, with an emphasis on those that will occur in the near term and have recently occurred.

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Date</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Begin shutter test</td>
<td>End Mar '04</td>
<td>Currently in thermal test, start with a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>week</td>
</tr>
<tr>
<td>Mission PDR</td>
<td>Mar 9-12 '04</td>
<td>Attended (at Goddard)</td>
</tr>
<tr>
<td>SDO Science Meeting</td>
<td>Mar 22-25 '04</td>
<td>Attended (in Boulder)</td>
</tr>
<tr>
<td>Michelson Performance Review</td>
<td>April 7-8 '04</td>
<td>Attended (in Canada)</td>
</tr>
<tr>
<td>Complete SM assembly</td>
<td>Sept '04</td>
<td>Structure order in process</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 front window and blocking filter quotations were received, reviewed and selections made. A purchase order was placed for the blocking filter with Andover. A purchase order was placed for samples of the front window with both Andover and REO. The REO design is a single piece fused silica with coating applied to both sides. The Andover design is a glass sandwich, with radiation harden BK7 as the entrance glass and color glass as the exit glass. The coatings will be applied to one side of each of the pieces of glass and bonded such that the coatings are encapsulated in the center. The sample pieces received from both REO and Andover will be radiation tested and the performance results will be used to select the flight filter design. The request for quotes of the primary and secondary lenses were sent and proposals are due the first week of April (not yet received). The Lyot filter calcite pieces were sized from the ADP/KDP sample measurements and the drawings released for all of the Lyot filter elements.

4.2 Mechanical

Designs continue to mature with design reviews and drawing release. The gearbox drawings are near completion. The Lyot cell drawings were released and orders placed for the mechanical assembly test. The Michelson mount design was reviewed and drawings are routing for release. The image stabilization mirror mount design was reviewed. The focus/cal wheel design was completed and drawings are routing for release. The next iteration of spacecraft mechanical interface drawing for the optics package and electronics box were released. The camera electronics box and CCD interface drawings were released. A grounding method for the camera electronics box was determined and is being incorporated in the camera electronics box interface drawing (also for AIA). Progress was made on the detector assembly layout (discussed further in section 7.0). The structure is discussed in section 4.8.4. HMI welcomed a new team member, Brad Watson, who will be continuing the HEB enclosure design.

4.3 Mechanisms

Assembly of the life test shutters was completed. They have been characterized, gone through vibration testing and post vibration performance testing. The shutters are ready for thermal testing and then the life test. Cables are currently being made for the thermal and vacuum chamber test set-ups. The hollow core motor prototype testing continues, but has been complete to the point select the wire size and magnet orientation. There was a review of the HCM prototype test results and the order for the life test HCM finalized. The front door prototype motors were also ordered.

4.4 Electrical

The mini-brass electronics box enclosure drawings were completed and placed on order. The development bridgeboard and motherboards were fabricated. The motherboard assembly was completed and the bridgeboard assembly started. The
mechanism board specification was released and layout has begun. There was an internal review of the oven controller electronics and pre-amp board. A common buy plan for EEE parts was generated in cooperation with the SDO team. The common list was iterated and reviewed for both HMI and AIA EEE parts needs.

4.5 Software

Software has had several reviews this month: internal review of the combined AIA/HMI software management plan, configuration management tools, the 1533 specification, and QHSS. Significant progress was made on the software requirements specification. The EEPROM driver compiles with out errors and is ready for the next level of testing and a full loop simulation with the EGSE was completed.

4.6 I&T

All of the hardware required for the chamber retrofit for the HCM motor life test (and AIA motor life tests) has been ordered and is starting to arrive.

4.7 Thermal

HMI welcomed a new team member, Rachel Richards, who will work on the thermal analysis of the HEB. She will also continue work on the front window thermal analysis. The front window model has been updated with the HMI geometry from the MDI model and the test cases were reviewed. The model is currently being debugged. The oven thermal model has been completed and test cases are currently being analyzed.

4.8 Major Sub-contracts

4.8.1 CCD – e2v

e2v was funded for the flight units and for the work done thus far, but only for HMI. Progress is being made on the addition of the AIA units to the contract. The schedule impact was approximately six weeks due to the challenges in placing and funding the contract. e2v is now working full steam ahead. An evaluation CCD was delivered to RAL and two engineering units are on schedule for delivery to LM in May. Test data was received from commissioning tests at temperature, which provide confidence that the CCDs will meet the specification. Work is also progressing on the flight devices; a few batches are about half way through the process. e2v provided presentation materials for the AIA PDR and is making progress on the test plan for the flight CCDs (a draft has been provided and revisions are in process).

4.8.2 Camera Electronics - RAL

RAL has also been funded and is making progress on preparing their test setup to evaluate the SECCHI waveform generator with the SDO CCD received from e2v. The layout of the CCD headboard (the interface to the camera electronics) is near completion, which requires the resolution of the orientation of the CCD (discussed in section 7.0). The schematic for the flight headboard design was received from RAL. The CDS ASIC is on track and all of the EEE parts have been ordered for the
engineering unit. Discussions were held with Aeroflex concerning options to the present Waveform generator design (SECCHI). Aeroflex quoted a 16-week lead-time for a radiation hardened ASIC, with RAL supplying the VHDL code. Aeroflex also promoted their radiation hardened FPGA; flight parts are expected to be available in Dec 04.

4.8.3 Michelson – LightMachinery

A signed contract is in place with LightMachinery. The Michelson engineering test unit beam-splitter has been bonded and formed for the performance review the first week of April. Preliminary report was that the review was great and following are some photos of the test unit.

![Beam-splitter First Sun Light](image1)

![Beam-splitter with Wave Plates](image2)

4.8.4 Structure – Vision Composites

The proposal has been received and reviewed for the structure, which includes fabrication drawings, mounting legs, testing and precision clean and bake-out of the flight structure. The contract is in the process of being placed and a kick-off meeting will be held in early April.

5.0 Other Activities During March

1. The mission PDR was attended.
2. The SDO science meeting was attended
3. Significant activity in preparation for the AIA PDR

6.0 Planned Activities For April

1. Continue drafting procurement specifications for the optical elements.
2. Work with the Project to determine if the Structural Model instrument needs to be vacuum compatible and contamination free. Both would be up-scopes to our plans but have been mentioned (by the Project) as perhaps being needed.
3. Continue to work with the AIA team to organize LMSAL personnel for both programs in an optimal manner.
4. Get Vision Composite under contract and have a structure kick-off meeting
5. Begin the shutter life test.
6. Continue work on mechanical drawings and detailed design.
7. On a routine (mostly weekly) basis continue to participate in telecons with the complete SDO group, the combined HMI/AIA-Project specific telecons, CCD Working Group telecons, Light Machinery telecons, BAE telecons; and to conduct HMI team meetings as well as specific meetings on Electronics/Software, Filters, and Mechanical topics.

7.0 Design Updates
There were no significant design updates this month. The HMI team is in the process of laying out the printed circuit board for the CCD interface. The bas-line design was to have two different board layouts to maintain the same CCD orientation and have the shortest cable length to the camera electronics box. A concern for assembly and test challenges with two dissimilar boards has been raised. A trade study is being performed to decide on the ideal design to maintain a symmetrical board that is the same layout for both HMI cameras and the AIA cameras.

8.0 Resource Requirements
The monthly mass status report is provided as separate file. The HMI team has been progressing with detailed design, which has caused some mass increases. The mass is expected to increase more next month as well. Once the detector assembly layout is finalized, shielding will be added to the flex-cables to fulfill the internal charging shielding requirement. There are no power estimates and allocation changes this month. The HMI team will be analyzed the operational heater power this month and some power increased for next month may occur (just a heads up).

9.0 Issues/Concerns

- Undertaking the AIA program at LMSAL requires obtaining additional personnel quite rapidly and redistributing personnel between these two, and other, programs. It also requires procurement planning, resource planning and understanding schedule overlapping.

- The new ASIC design for the waveform generator has been abandoned and testing of the SECCHI ASIC design will begin in April.

- The existing version of the SMCSLite chip that is used in the CEB and in the Camera Interface board needs to undergo radiation testing to verify it is acceptable, and we need to keep on top of whether the newer version of this chip will be available in time for our programs.