



# Heliosiesmic & Magnetic Imager

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## Monthly Progress Report August 2005

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## **1.0 Introduction**

This is the monthly progress report for the month of August 2005 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 Executive Summary**

August has been a challenging month getting all the necessary parts required for assembly of mechanical and electrical hardware. Some highlights for July include: completed heater wire routing on the bottom of the optics package and completed assembly and test of the alignment mechanism, completed mechanism FPGAs, completed the oven pre-amp board assembly, received the flight oven housing and the HCM life test is at 129M of 160 M moves. The HMI team continues to hold weekly team meetings internally, with the SDO Project and with suppliers. The daily stand up integration and test meeting continues.

## **3.0 Technical Progress Report**

### **3.1 Filters and Optics**

The wave plates received from LightMachinery were found to have small tracks, dendrites, about fifty microns wide along the edge of one of the optics (spare). The dendrites are well out of the field of view of the optical path as shown in the last monthly review. They are determined to be an artifact of stress relieving of the cement used to bond the optics together. The infected wave plate was baked out for a week and they appeared to grow only a few microns. They will continually be monitored, but are not expected to degradate the performance of the instrument. The calcite for element one was received and not acceptable for assembly: deep surface scratch, poor polish and the diameter was not correct. The calcite is good, but the require rework would diminish the thickness beyond the requirement. The calcite is being held for the future. In the meantime, two courses of action is being carried out. The original element one is being fine tuned for assembly of the first Lyot. Both element one and element two are completed. A new element one will be built in parallel to sun testing and time in the schedule was added after the sun testing to rework the Lyot. The cut raw calcite was received back from Lambrecht (different supplier than the other piece) and looks great. It was returned for polishing. The front window delivery has slipped again and now is starting to cut close to the need date. The supplier has had challenges meeting the uniformity requirement. They have had operational issues with the coating chambers that are being resolved and they are confident they can meet the requirement.

### **3.2 Mechanical**

Several parts required rework including the oven housing, which was plated incorrectly. I was finally received and is being fit checked with all mating parts prior to any heater work. The mount for the ISS beam-splitter was also received back.

The BDS beamsplitter mount pieces were also received. We now have all the parts to complete alignment of the optical elements for the sun test.

### **3.3 Mechanisms**

The HCM life test is up to 129M of 160M moves. The flight HCM assembly is complete. They are being set up for optical assembly with the wave plates. The alignment mechanism bake-out, assembly and testing is complete. The shutters are pending flux for soldering and the focus/cal wheels are pending staking compound for conformal coating. Both materials were out of date and the company was out of stock. The flux is due imminently and the staking compound was tested to extend the date.

### **3.4 Electrical**

The oven pre-amp board was completed. The flight board assembly work continues to be delayed due to part shortages. Now that nearly all parts are on order and delivery dates are known the schedule impacts are being evaluated. The DCHRI and camera interface recovery plan is in place and the schedule has been updated with the impacts, which is a two month slip in delivery. There was only 3 weeks of slack on the HEB need date and results in a 28 day loss of schedule contingency of the program (more discussion in critical path). The internal harness assembly for the mechanism is nearly and the oven/sensor internal harness has begun. Both harnesses are needed for the sun test and are on schedule.

### **3.5 Software**

The FPGAs for the mechanism controller board are completed and the brass board HEB was assembled with all four mechanism boards. After assembly was completed, the PCI bridge board was not functioning correctly. The problem was found to be partially due to an installation issue of one of the parts on the board and an upgrade to the spacecraft simulator. The part was corrected and the brass board HEB is back up and running. A test of each of the mechanisms is being performed prior to moving the system. The area outside the clean room is ready for the move, which will occur next week.

### **3.6 I&T**

The optics package was moved to the HMI cleanroom after completion of the heater routing on the bottom of the optics package and the legs were installed after the alignment mechanism assembly was completed. The telescope will be installed this week and progress can continue on the remaining optics now that all the pieces have arrived. The oven housing is being fitted in the optics package and wire routing will begin next week.

### **3.7 Thermal**

The thermal model was incorporated into the spacecraft model and there is a discrepancy in the temperature of the front door that is being analyzed. The heaters for the front window and telescope are being ordered.

### 3.8 Major Sub-contracts

#### 3.8.1 CCD – e2v

There is a visit schedule this month to inspect the back thinned CCDs ready for delivery for the AIA instrument. The new process CCDs were reallocated between the two programs: three for HMI and five for AIA. HMI will now have seven flight CCD of the old process and three of the new. The four flight CCDs in house all operate within the specificaiton at 6V.

#### 3.8.2 Camera Electronics – RAL

There is a visit schedule this month to visit the new board supplier, SPUR. The electronics parts shipment from LMSAL to RAL still has some part shortages, which will slip the flight camera deliveries. There has been a video gain issue discovered in the DM1 camera and is being analyzed.

#### 3.8.3 Michelson – LightMachinery

The second set of Michelsons are coming along the NB Michelson will be ready for shipment in early October.

### 4.0 Design Updates

No updates.

### 5.0 Resource Requirements

The mass and power updates are attached.

### 6.0 Schedule and Control Milestones

The base-line schedule has been submitted.

CM#	Line#	Task	Baseline	Aug	Sept	Slack	Status
CM01	14	Primary and Secondary Lenses Fabrication	11/24/04	11/24/04	11/24/04	0	100%
CM02	52	Fabricate Flight Blocker Filters	08/20/04	08/20/04	08/20/04	0	100%
CM03	300	Development Camera 2 Delivery (return)	02/24/05	02/24/05	02/24/05	0	100%
CM04	344	Structural Model Test Complete	03/15/05	03/15/05	03/15/05	0	100%
CM05	317	Test s/c Hight Rate Interface Brass Board	02/10/05	02/10/05	02/10/05	0	100%
CM06	8	Critical Design Review	11/20/04	11/20/04	11/20/04	0	100%
CM07	130	Michelson Delivery (first set)	05/09/05	05/09/05	05/09/05	0	100%
CM09	321	Build 2 Test (Enhanced Kernel Complete)	12/13/04	12/13/04	12/13/04	0	100%
CM10	324	ISS (Build 4)	01/19/05	10/03/05	10/03/05	0	0%
CM11	160	First Lyot Filter Complete	08/01/05	09/16/05	10/07/05	8	0%
CM12	322	Mechanism Control (Build 3)	01/17/05	08/26/05	08/26/05	0	90%
CM13	93	Receive Pre-Amp Flight Electronics	10/03/05	10/03/05	10/03/05	41	0%
CM14	47	Fabricate Flight Aperture Filter	07/12/05	08/31/05	10/19/05	2	71%
CM15	261	AM Flight Assembly and Test	07/29/05	08/26/05	08/26/05	0	100%
CM16	109	Flight Structure Delivery	06/30/05	07/08/05	07/08/05	0	100%
CM17	319	BB HEB System Test	03/15/05	11/17/05	11/17/05	0	0%
CM18	92	HMI ISS BB Testing Complete	01/24/05	01/24/05	01/24/05	0	100%
CM19	318	BB Camera Interface and DCHRI Integrated Test	03/08/05	10/27/05	10/27/05	0	0%

CM20	251	Door Flight Assembly and Test	11/21/05	11/30/05	12/20/05	1	0%
CM21	230	Shutter Flight (2) Assembly and Test	08/26/05	09/02/05	10/03/05	15	73%
CM22	67	Telescope Assembly and Alignment	06/28/05	06/28/05	06/28/05	0	100%
CM23	239	FW Flight (2) assembly and test	08/05/05	08/26/05	09/26/05	10	33%
CM24	303	HEB Brassboard Ready	09/01/05	10/03/05	10/03/05	14	0%
CM25	221	HCM .7 quartz Optic Assembly	08/10/05	08/26/05	09/22/05	20	0%
CM26	189	Oven Controller Pre-amp Needed	07/15/05	08/22/05	08/22/05	0	100%
CM27	198	Flight Oven Complete	08/26/05	09/28/05	10/20/05	2	0%
CM28	292	Flight CCD (3rd set) Delivery New process	07/19/05	11/01/05	11/01/05	0	0%
CM29	301	ProtoFlight Cameras 1,2 Delivery	11/11/05	02/02/06	02/02/06	18	0%
CM30	336	Mass Model Delivery to SDO	01/10/06	01/10/06	02/13/06	0	0%
CM31	392	OP Integration Complete	02/06/06	02/07/06	02/03/06	2	0%
CM32	323	Oven Operation Heaters (Build 3)	NA	02/02/06	02/02/06	0	0%
CM34	305	HEB Flight Ready	03/01/06	03/01/06	04/27/06	0	0%
CM35	307	HEB-HOP Flight Harness Completion at Goddard	11/11/05	11/11/05	11/11/05	82	0%
CM36	397	FSW Acceptance Test	NA	05/02/06	06/08/06	0	0%
CM37	398	HMI CPT	05/15/06	05/16/06	06/22/06	0	0%
CM38	393	HMI Calibration (in Air)	03/20/06	03/21/06	03/20/06	0	0%
CM39	400	HMI Pre-Environmental Review	03/16/06	06/02/06	06/26/06	0	0%
CM40	423	Instrument Delivery	02/02/07	02/02/07	02/02/07	32	0%

## 7.0 Critical Path

The machined part deliveries have delayed the start of the initial sun test but have not impacted the delivery of the instrument. The flight HEB is now the main critical path with having consumed 28 day of schedule contingency. The late delivery of the DCHRI and camera interface board for the brassboard may impact the start of in air calibration (no slack).

## 8.0 Risk Assessment

A risk management review board was held this month.

Risk ID	Title	Board	Status
RMHMI005	Calcite Availability	RMRB 2 Sep 2005 Increased likelihood to high. Calcite delivered for element 1 was unacceptable. It will be sent back for rework, and will take at least 2 to 4 weeks to get back.	Open
RMHMI007	Mechanism Life	RMRB 2 Sep 2005 No change. Life test at 125M moves.	Open
RMHMI013	FY2006 Funding	RMRB 2 Sep 2005 No change in ranking.	Open
RMHMI016	FPP Tunable Filter Rework	RMRB 2 Sep 2005 Reduced likelihood to low. Decision has been made to not disassemble the TF. TF is scheduled to return to Japan in November.	Open
RMHMI017	Flight Filter Oven Production	RMRB 2 Sep 2005 Likelihood increased. Risk has been reevaluated for further impact to the August schedule. Parts were delivered late, but needed rework, and so are	Open

		delayed again.	
RMHMI018	Front Window Charging	RMRB 2 Sep 2005 Reduced likelihood to low. Meeting with local expert indicated a low probability of damage due to discharging.	Open
RMHMI019	Electronic Parts Deliveries	RMRB 2 Sep 2005 Ranking stayed the same. Good progress has been made in the parts procurement, but it's too early to change the evaluation.	Open
RMHMI020	Camera Interface Board Design	RMRB 2 Sep 2005 No change in rankings. Risk restated to more accurately represent the issue. First detailed CIF review held 31 August.	Open

### 9.0 Change Control Board

There was CCB held this month on the ISS mirror mount. It was discover that the design was made with an incorrect size for the length of the PZT. This drawings were corrected, reviewed and sent out for fabrication.