



# Heliosiesmic & Magnetic Imager

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## Monthly Progress Report February 2005

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## **1.0 Introduction**

This is the monthly progress report for the month of December 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**

February was a milestone month getting the structural model testing completed and the ETU oven in vacuum testing. February highlights: HCM life test is at 53M of 180 M moves, DM2 camera was received, the secondary lens was sent to LM for IR coating. The HMI team continues to hold weekly team meetings internally, with the SDO Project and with suppliers.

## **3.0 Technical Progress Report**

### **3.1 Filters and Optics**

The Andover order was placed and are due mid-July. The secondary lens was sent to LightMachinery for IR coating to reduce the amount of IR load into the system, which is an elegant design solution. Two of the Lyot elements have been potted into their cells and measurements continues on the other three. One of the elements has a gradient across the field and is being analyzed further. Other pieces of calcite (for the spare Lyot) are being screened to replace element one. The dye laser was repaired and has been instrumental in evaluating the Lyot elements. The plasma radiation testing first round has been completed and no notable change in the coating or glass was observed. They are going in for the next level of dosage.

### **3.2 Mechanical**

Flight fabrication drawings are progressing very well and optical mounts are on order for the near term I&T activities: CCD fold mirror mounts, BDS fold mirror mounts, telescope primary lens mount, secondary lens mount, front window mount, and most of the oven pieces. The metering tube assembly is on order the fabrication is progressing. The tubes are complete are in CTE testing. The isolator tubes for the CCD, and oven pieces are complete as well as the oven legs. Design changes are being incorporated in the CEB mounting area to accommodate the growth in the CEB and additional radiator area due to the 6V change in the CEB. The grounding of the structure is also in review.

### **3.3 Mechanisms**

The HCM life test is up to 53M of 180M moves. The encoder boards for the HCM are on order and the second set of HCM are due in March. The focus/cal wheels are due in April. Since the material used to strip wire is no longer available, the supplier will provide the motors with pre-stripped wire. This is an addition week in

the motor delivery, but there is not a schedule impact (one less step performed in house). The alignment mechanism parts are on order.

### **3.4 Electrical**

All boards are at various stages of test. The brass board electronics box has the RAD6000 computer, PCI Bridge, and housekeeping board installed and the ISS boards are ready for integration. The boards for the HSB test are complete and the team is schedule for the HSB test at Goddard mid-March. The camera interface board testing continues and the Camera interface / DCHRI combined testing will begin after the HSB testing at GSFC. The testing of the spacewire breadboards is complete and will be used to investigate how the single port Atmel based system responds to and recovers from various error conditions, including common mode noise. The power brass board is assembled and is in test. The oven controller board and pre-amp board are in layout and will be the first flight boards to get on order later in March.

### **3.5 Software**

The ESGE is complete for the 1553 and HSB testing and is being used for the brass board electronics box testing. Goddard came out to upgrade the spacecraft simulators and are not both identical and functioning well. The kernel build 2 is progressing as well as the software modules for individual boards.

### **3.6 I&T**

The structural model vibration testing has been completed and no significant issues were observed. A test report is being prepared for review to discuss a couple minor points. There is a challenge in scheduling the acoustic test with Sunnyvale; this will also be discussed. The ETU oven test began and is going well.

### **3.7 Thermal**

The CEB change to 6V has resulted in increased power, which affects the size of the radiators. There has been an initial review of the implications and design trade studies are progressing. The sun shield design also requires a design change for the same reason.

### **3.8 Major Sub-contracts**

#### **3.8.1 CCD – e2v**

Five of the seven packaged CCDs are good for flight and e2v is making great progress on the processing of the batches. All batches required for the flight build have been started and are various stages of processing. The droop affect has been understood and screening requirement added to the specification. Several team members visited E2v to review the performance measurements and discuss the contract.

#### **3.8.2 Camera Electronics – RAL**

The DM2 Camera was received!! RAL will be out to run an acceptance test on the camera in March. The change to reading out the CCD at 6V was decided and is

being implemented. The delivery dates are still holding including the 6V change. RAL was also visited.

### 3.8.3 Michelson – LightMachinery

The Michelons are progressing a little slower than expected, but they are nearly finished with assembly and are looking good to ship by the end of March. They will also ship the ISS and BDS beamsplitters at the end of March. The IR coating for the secondary lens is being added to the contract.

### 3.8.4 Structure – Vision Composites

The structure is moving right along. All of the structural model updates have been completed and all of the machined parts are on order. The updated SOW, specification and envelope drawing are routing for release. The grounding of the structure was reviewed a couple minor design changes are being implemented to meet the appropriate requirement. The delivery is still holding.

## 4.0 Design Updates

As discussed, the most significant design change is going to 6V on the CEB. This affected the thermal model, radiator design, flexcable design, flexcable shield design, and the MICD for the CEB. The increase in mass needs to be analyzed.

## 5.0 Resource Requirements

The mass and power updates are attached. The mass is stable, but there was a power increase due to the 6V change in the CEB. The power increase is greater than that of AIA because HMI reads out at a faster rate.

## 6.0 Schedule and Control Milestones

An updated detailed schedule is attached and following is a list of the control milestones and their status.

CM#	Line#	WBS	Task	Finish Date		Slack Days	%
				Feb	Jan		
CM01	14	4.1	Primary and Secondary Lenses Fabrication	11/24/04	11/24/04	0	100%
CM02	52	4.1	Fabricate Flight Blocker Filters	8/20/04	8/20/04	0	100%
CM03	298	7.5	Development Camera 2 Delivery	2/24/05	11/16/04	97	0%
CM04	337	10.1	Structural Model Test Complete	3/15/05	1/28/05	41	0%
CM05	307	8.3	Test s/c High Rate Interface Brass Board	2/10/05	2/10/05	0	100%
CM06	8		Critical Design Review	11/20/04	11/20/04	0	100%
CM07	128	5.1	Michelson Delivery (first set)	3/21/05	12/3/04	9	0%
CM08	345	4.2	BDS BS Alignment (dry fit)	06/01/05	N/A	4	0%
CM09	309	9.4	Build 2 Test (Enhanced Kernel Complete)	12/13/04	12/13/04	0	100%
CM10	311	9.5	Build 4 Test (ISS/Analog Data Acquisition Complete)	1/19/05	1/19/05	0	100%
CM11	157	5.2	First Lyot Filter Complete	5/26/05	4/29/05	11	0%
CM12	310	9.1	Build 3 Test (Mechanism/Oven/Op Heaters Complete)	1/17/05	1/17/05	0	100%
CM13	89	4.3	Receive Pre-Amp Flight Electronics	6/15/05	3/1/05	17	0%
CM14	47	4.1	Fabricate Flight Aperture Filter	7/8/05	3/31/05		0%

CM15	254	6.5	AM Flight Assembly and Test	4/22/05	4/1/05	28	0%
CM16	107	4.4	Flight Structure Delivery	5/5/05	3/18/05	9	0%
CM17	313	9.5	Brassboard Acceptance Test (Build 3-7)	3/15/05	3/15/05		0%
CM18	88	4.3	HMI ISS BB Testing Complete	1/24/05	1/24/05	0	100%
CM19	312	9.5	Build 5 Test (Camera Interface and DCHRI Complete)	3/8/05	3/8/05	0	0%
CM20	245	6.4	Door Flight Assembly and Test	7/27/05	7/29/05		0%
CM21	224	6.2	Shutter Flight (2) Assembly and Test	5/31/05	1/18/05	9	0%
CM22	68	4.2	Telescope Assembly and Alignment	5/5/05	4/15/05	4	0%
CM23	233	6.3	FW Flight (2) assembly and test	6/15/05	3/21/05	8	0%
CM24	301	8.3	HEB Brassboard Ready	6/20/05	4/22/05	55	0%
CM25	215	6.1	HCM .7 quartz Optic Assembly	7/8/05	3/29/05	6	0%
CM26	182	5.3	Oven Controller Pre-amp Needed	3/1/05	3/1/05	36	0%
CM27	192	5.3	Flight Oven Complete	8/5/05	7/22/05	5	0%
CM28	289	7.4	Flight CCD (2) Delivery	6/17/05	5/19/05	90	0%
CM29	299	7.5	ProtoFlight Cameras 1,2 Delivery	10/28/05	10/10/05	26	0%
CM30	327	10.4	Mass Model Delivery to SDO	7/15/05	7/15/05		0%
CM31	371	11.1	OP Integration Complete	11/18/05	11/18/05		0%
CM32	314	9.5	Build 3 updates	9/23/05	9/23/05		0%
CM33	315	9.5	Build 5 updates	10/27/05	10/27/05		0%
CM34	302	8.6	HEB Flight Ready	11/8/05	11/8/05	9	0%
CM35	304	8.9	HEB-HOP Flight Harness Completion at Goddard	11/11/05	11/11/05	2	0%
CM36	316	9.5	FSW Acceptance Test	12/8/05	12/8/05		0%
CM37	374	11.2	HMI Instrument Functional test	1/6/06	1/6/06	0	0%
CM38	379	11.3	HMI Calibration (in Air)	4/21/06	4/21/06	0	0%
CM39	380	11	HMI Pre-Environmental Review	3/16/06	3/16/06		0%
CM40	402		Instrument Delivery	11/30/06	11/30/06	60	0%

## 7.0 Critical Path

The schedule was updated with parallel paths in the I&T section. The critical path has changed from the structure to the telescope and oven. The telescope is progressing well and the oven may receive more slack. The 6 weeks of vacuum testing of the oven is being defined and may be reduced or removed.

## 8.0 Risk Assessment

A risk management review board was held this month.

ID	Risk	Comments
RMHMI001	CEB Noise	RMRB 3 Mar 2005 No change. Camera still in UK, tests scheduled for March.
RMHMI003	CCD Development	RMRB 3 Mar 2005 Changed Ranking to very low. Two devices are packaged and initial test results meet requirements.
RMHMI004	CEB-HEB Noise	RMRB 3 Mar 2005 No Change in rankings. Breadboard circuit board is still in test.
RMHMI005	Calcite Availability	RMRB 3 Mar 2005 No change. We have acceptable calcite for all flight and flight spare components. Risk will be closed when elements are tested as a Lyot filter. Dye laser is up and running.
RMHMI006	Front Window	RMRB 3 Mar 2005

		No change. Purchase order to Andover in process. Low energy plasma tests are in process in B/205.
RMHMI007	Mechanism Life	RMRB 3 Mar 2005 Hollow core motor life test continues -- 48 M moves completed out of 180 M (Tuning motor lifetime has been reached). Shutter life test has successfully completed.
RMHMI010	EPDM and ERP rollout	RMRB 3 Mar 2005 EPDM is currently not working well and ERP system is performing marginally. For document release, we are using a manual system. ATC management working with AIA/HMI to address ERP performance issues.
RMHMI011	FPP Rework	RMRB 3 Mar 2005 No change. New transistor flaking problem may add a month and conflict with HMI schedule.
RMHMI012	CEB 6 V Serial Drivers	RMRB 3 Mar 2005 No change to rankings. Meeting with LM and RAL held 3-4 March.