



Heliosiesmic & Magnetic Imager

Doc# **HMI00823**

Date: 07/17/06
Contract #: PY-2223
Cage Code: 65113
Total Pages: 7

Monthly Progress Report June 2006

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1.0 Introduction

This is the monthly progress report for the month of June 2006 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

This month was a struggle performing testing, but progress is being made learning how to run the instrument and the performance of the instrument. The highlight accomplishments for the month were: the ISS limb sensor assembly, the ISS limb pre-amp board assembly, and both flight focal plane assemblies were completed. Also, the EEPROM boot up issue was resolved. The team continues to make progress testing the camera interface board and data compression board testing. 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 second round of testing is nearing completion. It was learned that the focus difference between the stimulus telescope and heliostat measurements is about 30 focus steps and is predominately due to deformation of the heliostat mirror, which is caused by heating during exposure to sunlight. However, a focus drift potentially due to heating of the front window or primary lens when exposed to sunlight was also observed. A thermal test of the radiation test front window will be performed to correlate the thermal model and calculate the appropriate focus offset. The Michelson interferometer measurements show a significant amount of contrast, which indicates that the first set of Michelsons may be preferred. Also, the calculation of the solar line width is much greater than what was seen in February. It is not determined what is causing this affect. More cotuning measurements using the dye laser need to be performed to help determine the cause of this issue. The dye laser failed operation and was sent out for repair (two weeks of down time). Until this is resolved, the Michelson's cannot be bonded and the final alignment of the instrument completed. The laser is not in house and being aligned. Hopefully, we will understand the issue very soon.

3.2 Mechanical

The radiators were delivered to Goddard and are in the process of being painted. All GSE drawings are completed. The thermal vacuum test GSE is in house and is being assembled for bake-out. The shipping container is due mid-August and the rotation fixture was sent out for quote. The mechanical test plan was submitted to Goddard for review.

3.3 Mechanisms

Assembly has resumed on the front door. The harness drawing was completed and wiring of the motors and micro-switches is in process.

3.4 Electrical

Good progress continues in several areas of the HMI Flight Electronics. The testing of Camera Interface (CIF) and Data Compressor High Rate Interface (DCHRI) boards had a successful test of a test image routed through the CIF, compressed by the DCHRI, and decompressed at Stanford on the data analysis system. This demonstrated that the basic functions of these boards now work. However, more testing of the brassboard CIF & DCHRI is required in order to verify the various modes of the FPGAs. The CIF & DCHRI test system now has two CIF boards and two DCHRI boards and will be used to test various data path combinations. At the end of the month, a CIF and a DCHRI board will be installed in the HEB brassboard to enable HMI to test with the camera data handled by flight software and brassboard hardware as intended for flight. The CIF & DCHRI is taking longer than planned, but continues to make positive progress. The flight CIF & DCHRI boards have now been ordered and are the last boards that will be fabricated for HMI & AIA. The HMI power system board has started assembly. At this point 12 of 17 flight boards used in the HMI Electronics Box (HEB) have completed assembly and 11 of these have completed test. Integration of the flight HEB will start shortly.

All of the flight HOP to HEB cables have been routed and cut to length on the S/C mockup. These will be completed and baked out at LMATC prior to being used for HMI instrument testing. The EMI/EMC test plan was submitted to Goddard for review.

3.5 Software

During testing of the instrument the EEPROM would hang up during the boot up sequence. Power cycling the system would then cause corruption in the EEPROM. It was discovered that the delay time programmed in the code was not ideal and was corrected. The EEPROM was burned with the updated code and the instrument power cycled over a dozen times and the failure was not repeated. A few issues with the sequencer were discovered. Testing reverted back to using the STOL procedures from the Sun test in February and the sequencer when back under development. Testing of the sequencer will resume shortly. Team members have been diverted to concentrate on camera interface board flight software development and CIF/DCHRI board testing in preparation for introduction of the system in the brassboard HEB.

3.6 I&T

The ISS limb sensor was reassembled with new diodes and installed in the instrument. The ISS was tested and the lab sets resistors selected for the limb tracker pre-amp board. The resistors were soldered in place and the board retested to verify the location of the resistors. The board is now headed to conformal coating and the limb sensor was put into bake-out. The two flight focal plane assemblies were assembled, tested and the headboards baked-out. The post bake-out test is

completed and the assemblies are ready for CCD co-alignment. The heater blocks for the focal plane assemblies were started and are near completion. The heater routing is progressing very slowly. There was drawing confusion that has been sorted out and the shop order has been completed. Routing is in progress. The external harness routing is near completion. Instrument testing is progressing; it toggles between software testing, aliveness STOL development testing and instrument testing. The instrument testing has been slow due to the availability of the dye laser and trying to understand the focus issue, see section 3.1.

3.7 Thermal

A MLI working group meeting is being planned to finish definition of the MLI interface with the spacecraft. The thermal vacuum test plan was submitted to Goddard for review.

3.8 Major Sub-contracts

3.8.1 Camera Electronics – RAL

FM1 and FM2 have slipped to Mid-August, which causes schedule grief, but they are not the only driving force on the critical path of the program. However, they are making good progress. All boards have completed testing and are being conformal coated. The integrated test and test with a cold CCD is targeted to be complete by the end of this month, July. A trip is planned to visit RAL the first week of Aug to witness the vibration test. The pre-ship review is scheduled for Aug 16th, 2007.

4.0 Design Updates

No updates.

5.0 Resource Requirements

The mass and power updates are attached. Percent measured mass was added to the report.

6.0 Schedule and Control Milestones

The updated schedule is attached.

CM#	Line#	Task	Baseline	May	June	Slack	Status
CM01	NA	Primary and Secondary Lenses Fabrication	11/24/04	11/24/04	11/24/04	0	100%
CM02	NA	Fabricate Flight Blocker Filters	08/20/04	04/19/04	04/19/04	0	100%
CM03	303	Development Camera 2 Delivery (return)	02/24/05	02/24/05	02/24/05	0	100%
CM04	NA	Structural Model Test Complete	03/15/05	03/15/05	03/15/05	0	100%
CM05	322	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	129	Michelson Delivery (first set)	05/09/05	05/09/05	05/09/05	0	100%
CM09	326	Build 2 Test (Enhanced Kernel Complete)	12/13/04	12/13/04	12/13/04	0	100%
CM10	329	ISS (Build 4)	01/19/05	12/22/05	12/22/05	0	100%
CM11	158	First Lyot Filter Complete (w/ bad E1)	08/01/05	10/28/05	10/28/05	0	100%
CM12	327	Mechanism Control (Build 3)	01/17/05	08/26/05	08/26/05	0	100%
CM13	93	Receive Pre-Amp Flight Electronics	10/03/05	11/22/05	11/22/05	0	100%
CM14	NA	Fabricate Flight Aperture Filter	07/12/05	03/07/05	03/07/05	0	100%
CM15	NA	AM Flight Assembly and Test	07/29/05	08/22/05	08/22/05	0	100%
CM16	NA	Flight Structure Delivery	06/30/05	07/08/05	07/08/05	0	100%
CM17	324	BB HEB System Test	03/15/05	07/07/06	07/24/06	0	97%
CM18	92	HMI ISS BB Testing Complete	01/24/05	01/24/05	01/24/05	0	100%
CM19	323	BB Camera Interface and DCHRI Integrated Test	03/08/05	07/07/06	07/24/06	0	97%
CM20	253	Door Flight Assembly and Test	11/21/05	06/21/06	07/21/06	7	96%
CM21	NA	Shutter Flight (2) Assembly and Test	08/26/05	08/08/05	08/08/05	0	100%
CM22	NA	Telescope Assembly and Alignment	06/28/05	05/31/05	05/31/05	0	100%
CM23	241	FW Flight (2) assembly and test	08/05/05	10/17/05	10/17/05	0	100%
CM24	308	HEB Brassboard Ready w/o DCHRI & CIF	09/01/05	10/03/05	10/03/05	0	100%
CM25	NA	HCM .7 quartz Optic Assembly	08/10/05	09/16/05	09/16/05	0	100%
CM26	190	Oven Controller Pre-amp Needed	07/15/05	08/22/05	08/22/05	0	100%
CM27	200	Flight Oven Complete	08/26/05	03/30/06	03/30/06	0	100%
CM28	296	Flight CCD (3rd set) Delivery New process	07/19/05	12/19/05	12/19/05	0	100%
CM29	304	ProtoFlight Cameras 1,2 Delivery	11/11/05	06/06/06	06/06/06	0	100%
CM30	341	Mass Model Delivery to SDO	01/10/06	03/01/06	03/01/06	0	100%
CM31	414	HOP Integration Complete	02/06/06	08/14/06	09/29/06	0	82%
CM32	328	Oven Operation Heaters (Build 3)	NA	01/10/06	01/10/06	0	100%
CM34	310	HEB Flight Ready	03/01/06	09/25/06	10/20/06	0	89%
CM35	312	HEB-HOP Flight Harness Completion at Goddard	11/11/05	06/19/06	06/19/06	0	100%
CM36	435	FSW Acceptance Test	NA	10/13/06	11/02/06	0	0%
CM37	436	Comprehensive Performance Test (CPT)	05/15/06	10/27/06	11/16/06	0	0%
CM38	417	HMI Calibration	03/20/06	09/12/06	10/04/06	0	39%
CM39	425	HMI Pre-Environmental Review	03/16/06	08/01/06	08/01/06	0	0%
CM40	463	Instrument Delivery (leaves LM)	02/02/07	03/16/07	03/16/07	0	0%

7.0 Critical Path

Well, the program is in the heart of integration and test. The team is learning how everything works together and issues come up that need to be resolved, which impacts schedule. There are four major critical path items that are currently parallel tasks, which result in independent and coincidentally equal affects on the schedule. The camera electronics box has slipped other three weeks from what was reported in last months schedule and results in an overall program slip of three weeks. This leaves the program with zero margin on our delivery date of March 16, 2007. The delays in optics package testing due to EEPROM issues, dye laser, reworking the ISS, delays in harness fabrication and sorting out focus issues has caused a three week slip in completion of the optics package to begin air and vacuum calibration. The camera interface board is still on track to be integrated when the instrument testing is ready. The software to run the board needs to be completed prior to introduction to the instrument. There is no schedule margin on the CIF/DCHRI, but it has not slipped from last month. The flight electronics box has slipped four weeks from last months schedule and a week of slack existed, so it is an overall slip of three weeks. This is primary due to delays in the

CIF/DCHRI testing. The CIF/DCHRI design is a more complex system than anticipated and has resulted in more time required for testing. The schedule has been optimized as much as possible with the flow and order of tasks, duration of tests have remained the same. As each of these deliveries change they have a direct impact on the overall schedule.

8.0 Risk Assessment

A risk management review board was held this month.

Risk ID	Title	Board	L	C	I	A
RMHMI019	Electronic Parts Deliveries	RMRB 6 Jul 2006 No change in rankings. GSFC has visited vendor of oscillator and the vendor has agreed to a 2 week improvement of delivery time.	3→	4→	S	M
RMHMI020	Camera Interface Board Design	RMRB 6 Jul 2006 Risk Closed. Board and FPGA design completed and in test, see risk (CEB to HSB testing) for system level issues.	Closed			
RMHMI025	CEB deliveries	RMRB 6 Jul 2006 Increased Consequence due to delays in RAL schedule.	4→	4↑	S	M
RMHMI026	CEB to HSB data flow fidelity	RMRB 6 Jul 2006 Increased Likelihood. Testing of the CIF/DCHRI is more complicated than anticipated as it includes concurrent testing of flight software and data analysis software. Consequence increased as HEB is on the HMI critical path.	4↑	4→	S	M
RMHMI027	7075 Aluminum Anodize Issue	RMRB 6 Jul 2006 Risk closed. Have identified all 7075 parts on HMI. Some parts have been reworked. The remaining two parts are acceptable as is (focus wheel passed tape and Eddy current tests, and any fragments that might be produced in the Lyot housing would be contained).	Closed			
RMHMI028	Focus Uncertainty	RMRB 6 Jul 2006 New Risk.	3N	4N	P	M
RMHMI029	Filter System Performance	RMRB 6 Jul 2006 New risk.	3N	4N	S	M

9.0 Change Control Board

No changes to report.

10.0 Discrepancy Reporting

The Q-note report is attached.