

Helioseismic Magnetic Imager Program at LMSAL

Contract PY-2223 Progress Report for December 2003

Introduction

This is the 15th monthly progress report on the HMI program at LMSAL. It would have been the fourth report under the second phase of the contract but the original contract was extended three months to allow more time to establish the Phase C/D/E contract. We/LMSAL are collaborators with Stanford University on the HMI/SDO solar physics investigation being led by Prof. P. Scherrer of Stanford University.

Summary of Status

Programmatic highlights this month included completing negotiations of the Phase C/D/E proposal, making significant progress in establishing the interrelationships between the AIA and HMI programs, getting formal RFPs out to e2v and RAL, and enjoying a nearly 2-week long Christmas Holiday. On the technical front, designs continued to mature in a wide variety of areas; for example the PCI Bridge Board got almost to the PWB layout state and the prototype hollow-core motor was shown to perform quite well. We also continued to have weekly SDO Project telecons, weekly HMI-specific telecons, bi-weekly CCD camera system telecons, weekly telecons with LightMachinery, weekly HMI status meetings, and a constant stream of internal technical meetings.

Schedule and Milestones

The original HMI proposal contained a top-level schedule that was based on the dates given in the AO. Now that the program is in full swing and the 8-month launch slip is a fact, a more detailed schedule has been developed and is undergoing constant iteration/expansion. The latest version was provided at the PDR. Shown below are some key program milestones, with an emphasis on those that will occur in the near term, or have occurred recently (for completeness).

HMI PDR	Nov 18-19	At LMSAL
Numerous splinter meetings	Nov 18-21	Project, e2v, RAL, I&T, AIA, Ops
Completed calcite inventory	November	Supply is adequate but useful to obtain more
Received prototype HCM	Nov 20	Performs nicely
Order life-test HCMs	January	Vendor is H. Magnetics
Define GSFC common buy	January	EEE parts
Begin Phases C/D/E	Jan 15, 2004	Phase A/B was extended three months

I/F Working Group Meeting #4	Jan 12-14	At LMSAL
First packaged CCD	Jan 30	Non-flight sample for use by RAL
Peer Review of HEB & Oven	Feb 4	Mechanical aspects only
Begin shutter life test	February	Slipped from November
Visit RAL and e2v	February	Various topics as moving into flight phases
Mission PDR	March 9-12	At GSFC
Complete SM instrument	August '04	
HMI CDR	Nov '04	
Deliver HMI to S/C	Nov '06	
Launch	Apr '08	
Five year baseline mission		

Major Activities During this Reporting Period

We previously reported that HMI was confirmed by Headquarters to transition from Phase A to Phase B, that SHARPP was not, and that it was decided to put the AIA investigation proposed by A. Title onto the mission in place of SHARPP. Since we/LMSAL are responsible for AIA this affects how we conduct the HMI program as there will be considerable sharing of designs and personnel between the two programs. The AIA program began on 7 November. An SDO organization chart that covers both programs was formulated and staffing is being increased. Larry Springer is the overall LMSAL SDO Program Manager with Barbara Fischer and Gary Kushner as Deputy Program Managers for HMI and AIA respectively. Both of them are phasing out of their other obligations (Gary as Systems Engineer on Solar-B FPP and Barbara as Lead Mechanical Engineer on HMI). Likewise, Glen Gradwahl, who is presently the Lead Mechanical Engineer on SECCHI, is phasing into the position of Lead Mechanical Engineer on HMI, replacing Fischer. At the end of December, John Miles joined the team to take over the position of HMI Systems Engineer. Brock Carpenter will guide him during his phase in, be available for consultation after that, but spend most of his time as the AIA Systems Engineer.

Steady progress was made in the mechanical and optical areas. The HEB enclosure and Oven structure are maturing to where we will have a Peer Review (mechanical only) on them in early February. The bracket for mounting the door mechanism matured to a level to merit an internal review in early January. Various procurement drawings for the more simple optics were completed. We provided the Project with a FEM with node locations appropriate for the jitter analyses they plan to run. Design of the oven internals progressed hand-in-hand with the appropriate thermal analyses of subtle design options.

Good progress continued to be made at LightMachinery. It is likely that we will meet with them in late February to look at test results from the prototype beam-splitter they are producing. The front window/filter and blocking filter specifications evolved and were shared with potential vendors. A trip to Sonoma Photonics indicates they are capable, and eager, to do these two filters; as is REO and Barr. Sample ADP and KDP crystals were ordered from Cleveland Crystals. Evaluating them will both enable us to confirm their appropriateness for flight and establish more precisely the lengths of the Calcite elements that will go into the Lyot filter with them.

As partially described last month, we are making new shutter housings for the life-test units because the existing ones were out of specification in some critical areas. And, we are ordering some higher precision rotors to see if the performance using them surpasses that with the rotors that come with the motors. On the HCM front, the prototype unit functions nicely. We are now evaluating whether the skewed or normal set of magnetic assemblies is superior. When the new year begins we will start to push LM to procure additional vacuum chambers for life testing these (and AIA) mechanisms.

With the NRL SHARPP investigation being replaced by the LMSAL AIA investigation, the SDO CCD Working Group has shrunk in size and the group telecons with e2v and RAL have decreased in frequency. However, telecons between ourselves and these two suppliers have increased as we work out the details of their respective SOWs and specifications for the flight programs. Formal RFPs (with released Specifications and SOWs) were sent (with all the proper ITAR approvals!) to the UK shortly before the Holiday Break. Their proposals will be received in January. The PRTs and capacitors were also sent (to e2v) before the break, so this will not impact the assembly schedule for the initial demonstration-model CCD (in late January). e2v has received the metal headers and will get the ceramic end pieces in early January. RAL continued with all of their design activities. They investigated the various options for obtaining a wave-front generator ASIC or FPGA since no clear path exists for accomplishing this comfortably within the know schedule and performance constraints. A dual approach will be followed for a few months. It was described to the Project for use in their Risk reportings.

Steady progress was made this month in the electrical area as key engineers (finally) completed their efforts on Solar-B FPP. The PCI to Local Bus Bridge/1553 Interface board design was completed, including the FPGA that is central to it. The board will go to layout shortly. It is a high priority because we want to build a partial HEB (only the CPU, Bridge board, and one Mechanism Controller board) as soon as possible for use by the software team. Work was initiated on the motherboard for this box. Progress continued to be made both in understanding whether any of our baseline EEE parts will be difficult to obtain to a high enough quality level and in determining likely candidates for a Project-wide common buy.

Software continued to move forward on a variety of fronts. A draft telemetry list was produced and distributed for review. The two Sun Workstations that will be central to the software development lab were received and located in one of our labs. A review of the Software Requirements Document was held. The next version will take into account the findings during that review; one of which was the desire to have more specifics in this document rather than having to always go to the Electrical Board specifications for needed information. And, we continued to consider what, if any, fundamental differences will exist between the basic software for HMI and AIA; on AIA's nickel of course.

Other Activities During December

1. We began to consider what fixed assets will need to be procured by LM in CY-04.
2. Our proposal for Phases C/D/E was negotiated with Stanford along with the Stanford proposal being negotiated with GSFC.

3. We did not receive the final versions of the SOW, Contract Performance Specification, and CIDRL that will apply to the remainder of the program. No surprises are anticipated, however.
4. The RFAs (28 of them) for our PDR were received and we provided the Project with a memo asking for clarification on a few of them. It also provided a time scale for completing all of them.
5. We hosted a visit by a couple of persons from NASA Upper Management who were interested in seeing our facilities and ascertaining how we can accomplish the development of both SDO instruments along with our other obligations.
6. CCD protective covers were fabricated. Once they are out of Receiving, and the proper ITAR blessings have been obtained, we will provide a few to e2v.
7. Internal requirements/design meetings were held on a variety of subsystems and assemblies.
8. A quite long Holiday Break was enjoyed by all.

Planned Activities During January

1. Participate in the 4th Interface Working Group meeting, to be held in Palo Alto. The S/C-HMI ICD will then be updated, released, and put under configuration control; all well before the Mission PDR.
2. A few persons from the Project will visit LMSAL near the end of the month to discuss our Risk Management approach, a goal being to make it blend well with the approach the Project is using.
3. Lay out the two HEB printed wire boards that are needed early by the software and mechanisms teams.
4. Francis Lee, the HMI Contamination Control Lead, and Syndie Meyer, the AIA Contamination Control Lead and ex-HMI Lead, will attend the Project's Contamination Control Peer Review and participate in working sessions associated with it.
5. Continue drafting procurement specifications for the optical elements.
6. Order, and receive, rotors for the life-test shutters that have more precisely aligned magnetics than those that come with the motor originally.
7. Receive the final SOW, CIDRL, and Contract Performance Specification from the Project.
8. Order the two life-test HCMs.

9. Work with the Project to determine if the Structural Model instrument needs to be vacuum compatible and contamination free. Both would be upscoptes to our plans but have been mentioned (by the Project) as perhaps being needed.
10. Continue to work with the AIA team to organize LMSAL personnel for both programs in an optimal manner.
11. Receive the non-flight CPU board from BA.
12. Get Vision Composite under contract for the flight phase portion of their work, including the structural model box and telescope.
13. On a routine (mostly weekly) basis continue to participate in telecons with the complete SDO group, HMI-specific telecons, CCD Working Group telecons, LightMachinery telecons, BAE telecons; and to conduct HMI team meetings as well as specific meetings on Electronics, Software, Filters, and Mechanical topics.

Design Updates

There were no significant design updates this month.

Resource Requirements

The monthly power and mass status reports are being provided as separate files. The HMI estimates and allocations are not changed this month, and remain as shown at the recent PDR. A more in-depth update is planned for next month.

Issues/Concerns

- Undertaking the AIA program at LMSAL requires obtaining additional personnel quite rapidly and redistributing personnel between these two, and other, programs.
- Obtaining the waveform generator for the CEB is presenting a schedule concern and various options are being discussed with RAL. They are also being described to the Project who are incorporating this into their Risk documentation.
- 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.