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Subject: IMPACT Monthly Technical Progress Report, Contract NAS5-00133

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Enclosed is the monthly technical progress report for the STEREO IMPACT project for the month of April 2004.

Sincerely,

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IMPACT Team

1. IMPACT Overview

This report is presented in sections by institution. Section 1 is an IMPACT Project Manager / System Engineer's overview.

1.1. *Contracting / Funding*

We are preparing a formal proposal to respond to changes in launch and Phase E dates. This mostly involves a budget which is expected to be similar to the recent POP04 submittal. Funding through May has been received. Because of pipe-line delays in the system through to the subcontractors (Caltech and UMd) it is important that IMPACT be funded somewhat in advance of expected spending.

1.1.1. Liens

This is a list of Liens. Liens for activities at other institutions are sometimes repeated in their subsections of this report. These liens are estimated additional costs that might be incurred if problems happen. Only problems with a significant likelihood of occurrence are tracked. These liens are usually associated with risks in the risk list (see section 1.5), and you can see the predicted likelihood of occurrence there. Some of these liens have been requested to be encumbered by Project, marked (*). Items included in the POP04 budget recently submitted are marked in yellow.

UCB:

No.	Cause	Amount	Date
1*	LVPS schedule delays extend manpower (Risk UCB29). Cost a 1-month delay at full LVPS team spending rate.	$35,000+	01/04
2	Late failure in thermal vac requires rework/retest (Risk UCB27, etc).	$30,000	02/04
3	Testing failure requires rebuild/retest a board (using existing spare parts)	$20,000	~02/04
4	EMC rework and retest required (Risk UCB11). Assume rework can be done in a week or two.	$30,000	05/04
5	Schedule delays cause the consumption of boom suite schedule contingency (various risks). Cost 35 days of contingency at UCB I&T team rate.	$50,000+	07/04
~~6~~	~~STE calibrations sources.~~	~~$2,500~~	~~11/04~~
7	SEP Thermostats. These were over the budgeted amount. Budget was $10K at Caltech. Parts were actually $21,200, paid by UCB (for now Caltech will hold the $10K against other liens)	$11,200	11/03
8	Subcontract J&T for board assembly work to maintain schedule	$50,000	1/04
9	Calibration and thermal vac chambers at UCB use oil roughing pumps. Replace those pumps with dry scroll pumps to reduce risk of contamination	$14,000	3/04
10	Increase travel to cover staffing requirements at APL during I&T	$40,000	10/04-1/06
11	Launch delay costs (launch 2/06)	$226,000	12/05
12	Redesign & rework costs should Actels need to be replaced	$500,000	?

	due to reliability problems. Depends strongly on what kind of replacement is selected.		

Caltech:

No.	Cause	Amount	Date
1	Budget does not contain funding for investigations of part failures or contamination failures, re-makes of boards if coupons fail, etc. Some of this has already occurred, as more rework has been required in the hybrid development area than we budgeted for. Some die have failed test, some units have failed PIND testing, and in a couple of cases leaks have occurred after lead bending, which was caused by a problem with the tooling that has been corrected. In addition, QA costs have been a far bigger percentage of the overall cost than anticipated. Currently the yield of hybrids has improved with 16 of 20 passing electrical test in the last batch. (Amount = ~$50,000 (guess); Probability = 100%; time frame = March 2004).	$50,000	03/04
2	Unfunded schedule reserve: ~$25,000. This is becoming a reality, as our latest schedules show delivery in September 2004 (as required), whereas we had budgeted for delivery in July 2004. (Amount = $25,000; Probability = 100%; time frame = August 2004).	$25,000	8/04
3	Possible under-budgeting of environmental testing and bake out. $100K has been allocated. However, recent estimates suggest that the thermal balance/thermal vacuum test may require about 3 weeks. Recent cost estimates at JPL suggest that that might take the entire $100K. We are investigating other places for the environmental test program where the costs may be less. (Amount = ~$50,000 (guess); Probability = 50%; time frame = July 2004).	$50,000	7/04
4*	GSE Software support (extend a few months after January 2004)	$60,000	1/04
5*	Engineering Assistant (Risk UCB033)	$24,000	1/04
6*	Engineering support to maintain schedule (Risk UCB033)	$63,000	1/04
7*	Technician Support to maintain schedule (Risk UCB033)	$38,000	1/04
8	Overlooked hybrid costs: it was not realized that the cost estimate we were given for the hybrids did not include the qualification costs of 10 units. We have asked for a quote from JPL. (Amount = ~$10,000 (guess); Probability = 100%; time frame = March 2004).	$10,000	3/04
9	Unbudgeted tests: there are a number of tests outlined in the STEREO/IMPACT Requirements Verification Matrix that we are listed as responsible for but for which we did not budget. (Some I wasn't aware of and some I mistakenly thought would be done at UCB as part of EMC testing.) Test	$25,000	7/04

	plans and procedures will need to be written and existing instrumentation either calibrated or new instrumentation obtained. These include requirements 4.10, 4.12, 4.23, 4.27, 4.28, and 4.42. If we have to get JPL to help us, the cost could be significant. (Amount = ~$25,000 (guess); Probability = 50% (UCB might help us); time frame = July 2004).		
10	Launch delay costs to Feb 06	$67,757	12/05
11	Continued detector testing at Caltech in the event that delivery is delayed from October 04 to January 05	$118,089	10/04

UMd:

No.	Cause	Amount	Date
1	SIT foils fail acoustic test	$20,000	2/04
2	SIT Vibration (currently planned to be combined with HET instruments, but may not work out)	$15,000	2/04
3	Parts screening (some parts not yet Oked by PCB and may need addition screening)	$10,000	9/03
4	Particle Calibration at BNL. This is desired but not required.	$20,000	11/03
5*	Engineering Support to maintain schedule (Risk UCB033)	$60,000	1/04
6	Replacement SSD detectors (only 2 of 5 detectors passed)	$10,000	5/04

GSFC (Tycho):

No.	Cause	Amount	Date
1	Revise SEP Central/LET/HET vibration analysis if required	$5,000	11/03
2*	Extra Solid-state Detector Lab manpower support to accommodate late detector delivery (Risk UCB033)	$20,000	12/03
3	Travel for accelerator end-to-end test	$5,000	6/04
4	Tom Nolan flight software support (Risk UCB033)	$15,000	5/04
5*	Engineering support to maintain schedule (Risk UCB033)	$40,000	1/04
6	Tycho's thermal vac chamber is planned for SIT and SEPT tests. If that fails we will have to rent a chamber. Probability low-moderate.	$25,000	8/04
7	Late HET Detector delivery resulting in additional acceptance tests for one instrument	$40,000	7/04
8	LET foils fail acoustic testing	$10,000	5/04
9	HET Actel additional testing	$20,000	6/04
10	SEPT re-test if Kiel cannot pay for it	$30,000	5/04

1.2. *Significant System-Level Accomplishments*

- Boom/Mag/STE-U TRR
- STE-U FM1 Thermal Balance
- Participated in Project I&T and Operations meetings at APL
- Participated in Project EMC & Contamination Control committee meetings

- Participated in quarterly Project/IMPACT site visit
- Participated in various MRB/FRB/PCB meetings

1.3. *System Design Updates*

- None

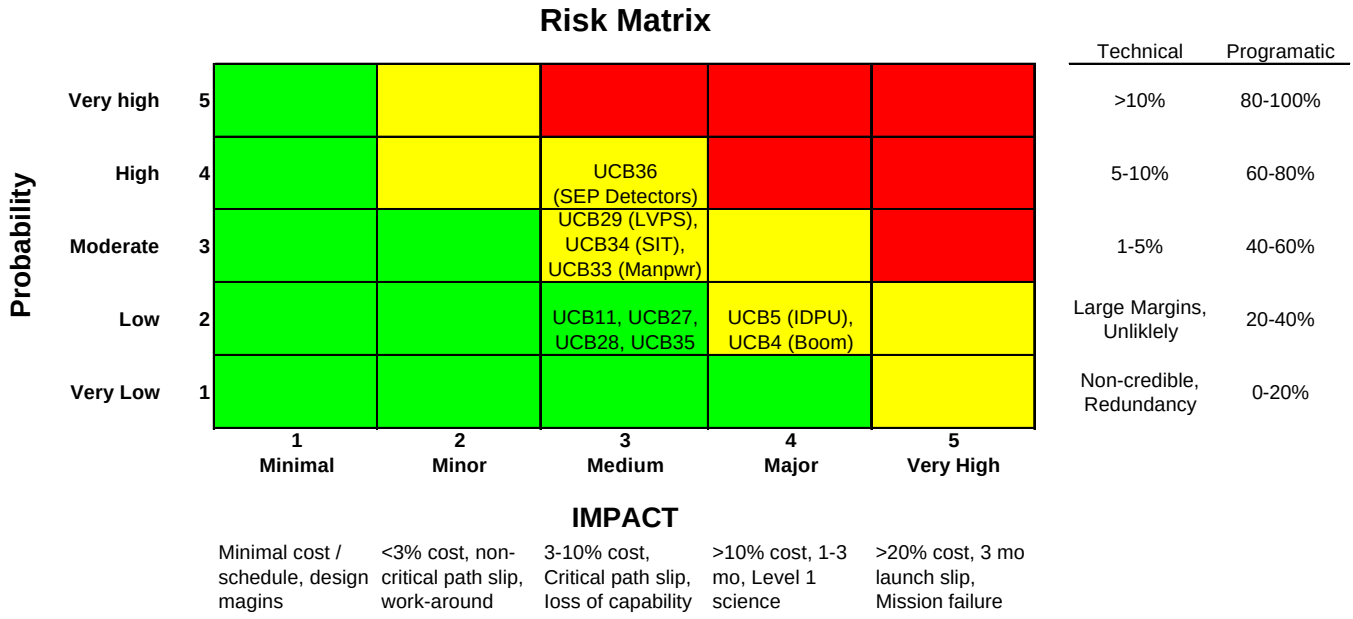
1.4. *System Outstanding Issues*

- The Thermal Balance waiver is still pending CCB action
- SEPT environmental test failures, and how to pay for re-test after repair

1.5. *Top 10 Risks*

Top 10 risks are attached. No changes to the list.

IMPACT Top Ten Risks 2/2004



No.	Risk Item	Score	Mitigation	Mitigation Schedule			
				Sub-system Test	System Test	Env test	Early Orbit Test
UCB_5	IMPACT boom is a new design. Failure could affect Imager pointing requirements as well as boom-mounted instruments.	MEDIUM	Design for reliability. Early prototype testing. Qual model testing completed. Adequate force margins demonstrated.	MEDIUM	MEDIUM	MEDIUM	LOW
UCB_4	The IDPU is a single point failure mechanisim for the IMPACT suite and PLASTIC	MEDIUM	IDPU is a simple, reliable system. Extra attention has been paid to ensuring its reliability, minimizing the risk of fault propagation. Extensive EM & FM testing	MEDIUM	MEDIUM	MEDIUM	MEDIUM
UCB_36	HET, LET, and SIT detector fallout during life test. Not enough HET detectors for the flight build, and few or no spares for SIT and LET. New detectors being obtained, but a there is a schedule risk	MEDIUM	Pree for early delivery of replacement detectors. Proceed with poor detectors and replace them with new ones later in the schedule	MEDIUM	MEDIUM	MEDIUM	LOW
UCB_34	SIT Schedule slippage, on critical path	MEDIUM	Add manpower to recover schedule	MEDIUM	LOW	LOW	LOW
UCB_29	LVPS behind schedule, on critical path; further slipping could delay delivery to spacecraft	MEDIUM	Add manpower to LVPS task to avoid further slippage	MEDIUM	LOW	LOW	LOW
UCB_33	Instrument fabrication & test schedule limited by available personnel	MEDIUM	Subcontract assembly work, authorize over-time, bring on new people	LOW	LOW	LOW	LOW
UCB_35	New undiagnosed Actel part failures may impact flight hardware	LOW	Keep abrest of Actel's analysis results; Make changes to minimize ground bounce which may be related to failures according	LOW	LOW	LOW	LOW
UCB_11	Stringent EMI requirements may delay schedule if testing fails	LOW	Careful design, ETU power converter testing, early system testing	LOW	LOW	LOW	LOW
UCB_27	Actel timing differences between flight & ETU parts may cause failures late in testing impacting delivery schedule	LOW	Do FM Thermal Vac early to allow time for finding and fixing timing problems; for designs on the critical path, consider installing a flight Actel in the ETU &	LOW	LOW	LOW	LOW
UCB_28	Thermal limitations of detectors result in a low bakeout temperature which might require a very long bakeout	LOW	Bakeout subsystems prior to detector integration to reduce time of instrument-level bakeout; early bakeout	LOW	LOW	LOW	LOW

2. Berkeley Status

2.1. *Summary of Status*

Schedule status through February has been provided separately.

2.2. *Major Accomplishments*

SWEA/STE:

- All FM1 and most FM2 SWEA/STE boards delivered from assembly at J&T.
- Second (last) batch of loaded flight STE Flight Detectors boards in test.
- Repaired STE detector returned from bonding house
- STE-U FM1 assembled, in test
    - Potential over-stress due to thermal vac feedthrough wiring error, PFR1006, fixed.
    - Thermal Balance Complete
    - Note from May 10: STE door failures during thermal vac test, PFR1008

IDPU:

- PLASTIC software Build #2.5 test completed at UNH. Next build in progress

LVPS/HVPS:

- SIT HVPS FM2 in assembly.
- SWEA/STE-D FM1 LVPS in test.
- PLASTIC FM1 LVPS bench test complete, ready for thermal test.
- PLASTIC FM2 assembly started
- SEP FM1 bench test nearly complete.
- SEP FM2 assembly started
- IDPU LVPS assembly complete, ready for test.

Boom:

- FM1 unit assembled, ready for first deployment prior to harness termination.
- FM2 unit ready to replace potentially deformed parts

GSE:

- All GSE delivered. Some added features in progress. Still waiting for definition of SEP housekeeping so appropriate displays can be added.

2.3. *Design Updates*

- None.

2.4. *Outstanding Problems*

2.5. *New Problems*

- A number of issues with the power converters have been discovered and dealt with.
- There was a problem with the thermal vacuum feedthrough which potentially stressed the STE-U FM1 unit. Stressed parts replaced. PFR1006
- STE-U FM1 door failed in thermal vac. PFR1008

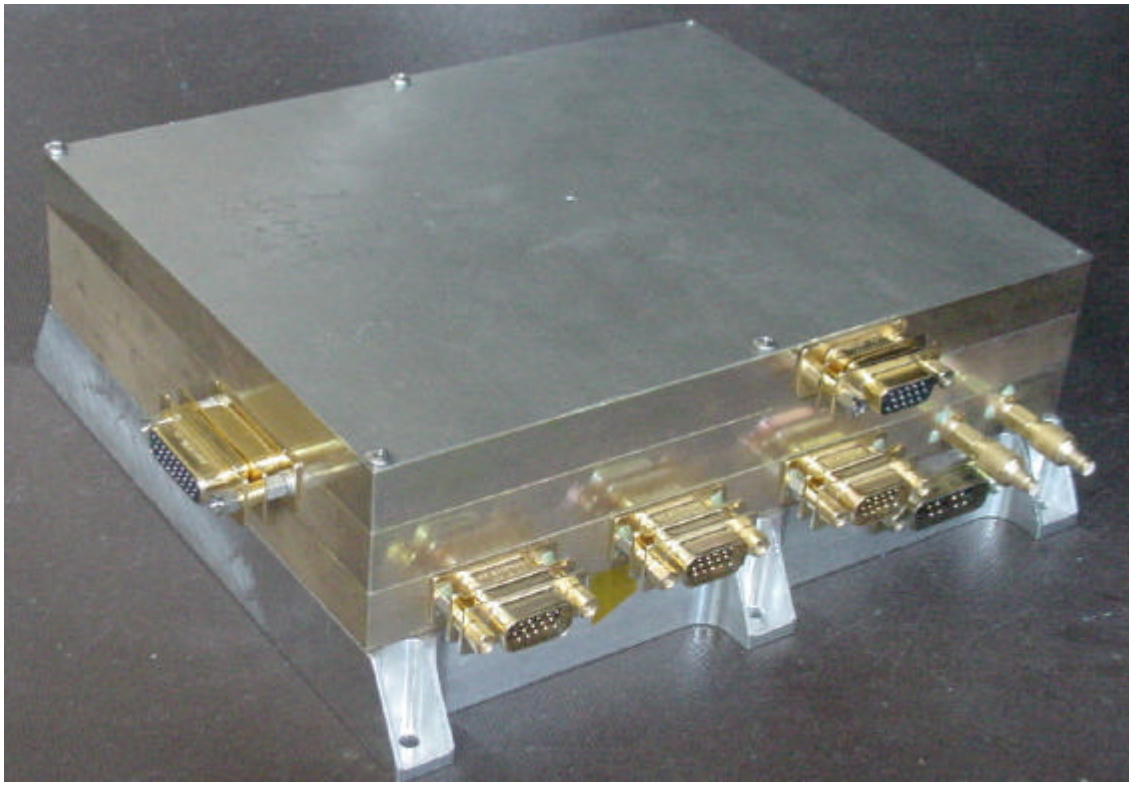
2.6. *Top Risks.*

- LVPS schedule tight
- Open Actel problems

2.7. *Problem/Failure Quick Look*

ID #	Description	Assignee	Opened	Closed
1001	Qual boom deployment failure in Thermal Vac	McCauley	2003-08-15	2004-01-07
1002	STE-U Assembly problems (broken bond wire)	Curtis	2004-04-12	
1004	SEP LVPS Middle FM1 Problem	Heavner	2004-04-23	
1005	SEP LVPS Top FM1 Problem	Heavner	2004-04-27	
1006	STE-U FM1 Mis-wire (thermal vac feed-through)	Curtis	2004-04-30	
1007	SWEA LVPS FM1 LTC1877 Failure	Curtis	2004-05-10	
1008	STE-U FM1 Door failure (cold)	Curtis	2004-05-10	

FM1 IDPU with ETU LVPS



3. GSFC (SEP) Status

STEREO/IMPACT/SEP/GSFC Progress Report for April, 2004 – (von Rosenvinge, Baker, Hawk, Shuman, Nahory, Wortman)

3.1. *Summary of Status*

The current delivery dates of the HET flight units to Caltech are the end of June.

3.2. *Major Accomplishments*

A mu meson test was conducted using a flight HET board and a partial HET telescope (one H1, one H3, and an H6 detector). All the other HET detectors were tied up in lifetest number 2. This test appears to have worked well.

An acoustic test was performed using the LET ETU. A full set of detectors was received with the ETU unit. Each detector was checked and photographed under a microscope to verify that all bondwires were in good condition prior to the test. Single LET foils were mounted in front of the L1 detectors on one end of the LET and double foils were mounted on the other end. There were some differences between the ETU and the eventual flight unit. For example, the collimators in front of each L1 detector are not yet available. This means that, where there were two foils, the outer foil was mounted considerably closer to the inner foil than will be the case for the flight unit. In addition, the engineering unit has a socketed Actel chip which projects above the level of the cover. A fairly snug hole was cut to allow the Actel chip to project through the cover. The reason that we performed this test without waiting for a flight unit is that we didn't want to wait until late in the game to find out that we might have an acoustics problem. Heritage versions of LET had detectors without wirebonds. They also were on spinning spacecraft and so didn't have detectors permanently staring at the sun. The latter situation has required a change in the thermal coatings on the one third mil Kapton foils, potentially making the foils more brittle. Fortunately the test was a complete success with no broken detectors, wirebonds, or foils.

As reported earlier, our outstanding problem remains the low yield of detectors with stable leakage currents from our thermal vacuum lifetesting. The second HET/SIT detector lifetest which was started on March 29 is continuing: it appears that we have 2 good H1s, 2 possibly OK H1s, and one possibly OK H1 prototype; 4 good H3s + one good prototype H3. We need a total of 4 flight H1s and 14 H3s.
We will soon be starting a new lifetest. If all the H3 detectors in that test are good, then we will be short 1 H3 for flight. 20 new H1 mounts and 40 new H3 mounts were shipped to Micron, the HET/LET detector manufacturer.

Continued work on SEP Central Enclosure design, the HET, the LET, HV bias shield, and internal spacers. Some parts have already been sent out for fabrication and a few have been already received. We have a very tight but possible schedule to be ready for the HET/LET accelerator run at Michigan State (beam starting nominally on July 9). The design and fabrication of carrying cases for HET/LET and for SIT has been farmed out.

The SIT enclosure fabrication has been completed and the enclosure is in mechanical inspection.

Inspection of the two HET flight boards has revealed some chips/cracks in the glass seals where leads enter the clock circuits (one clock circuit on each HET). Whether these circuits need to be replaced is being investigated. Replacements have already been received from Caltech. The boards are also going to be x-rayed to verify that some leads are adequately wetted with solder along their length.

Scroll pumps have been ordered to eliminate the possibility of oil contamination in our thermal vacuum chambers. A 15 MHz TQCM head has been acquired.

The SIT flight logic boards have been populated except for the memory chips and the Actel chips. We had been holding off on installing these parts until the logic board design had been reviewed and some Actel issues were resolved. A decision has just been taken to build one flight board and then test it to make sure that the fast Actel signals and lead inductances are not causing excessive transient voltages. We will wait until Actel releases its new procedure for burning the SIS Actels (real soon now).

3.2.1. Next Month-

- Finalize the designs of the SEP Central enclosure and the HET and LET telescopes; submit remaining parts for fabrication.
- Continue testing flight detectors for HET and SIT.
- Order purge outlet filters and SIT door springs.
- Complete cross-check of drawings and SIT ETU parts.
- Update ICD with APL to include mounting hole diameters and correct LET FOV.
- Update mass of SEP Main.
- Work on defining the HET and SEPT radioactive sources to be supplied by GSFC.

3.3. *Design Updates*

None.

3.4. *Outstanding Problems*

HET detector leakage currents growing in vacuum. See previous discussion.

3.5. *New Problems*

None.

3.6. *Top Risks*

Inadequate numbers of good HET detectors. The whole HET telescope can easily be retrofitted late in the game if necessary.

3.7. *Problem/Failure Quick Look*

4. Kiel/ESTEC (SEPT) Status

April 2004

4.1. *Summary of Status*

a) Test of failing detector stacks reveals cause of failure during cold soak: wire bond causes short-circuit.
b) Thermal analysis of door opening mechanism reveals cause of failure during cold soak: different coefficients of thermal expansion results in negative play in door hinge.
c) Test at pinpuller manufacturer TiNi reveals failure during hot soak: the tab could have been damaged during reset due to additional forces applied.
d) Accident in Kiel damaged electronics of FM2 SEPT-NS. Actel FPGA needs to be replaced. Use spare electronics to save time, declare damaged electronics as spare after repair.
e) Old schedule obsolete due to above four failures, new schedule will be established once Failure Review Board resolutions are known.

4.2. *Major Accomplishments*

a) After the Canberra failure review board meeting, further tests were agreed both at the University of Kiel and at Canberra. The tests were successful in revealing the cause of the failure: the height of the arch suspended by the wire bonds is higher than the separation distance of the two detectors in the stack. Failure reports were submitted as attachments to the IMPACT PR-7002. A STEREO failure review board was held identifying corrective actions. All eight detector stacks (not only the two failing ones) will be disassembled, wire bonds removed, new wire bonds applied with maximum height of 0.6 mm, detectors separated by 1.0 mm instead of 0.8 mm and mounted in new housing. Some new detector stacks will be manufactured in parallel to have replacement stacks available in case a stack is damaged during opening.
b) Coefficient of thermal expansion analysis for titanium and aluminium parts in door opening mechanism reveals negative play at low temperatures. Additional information and photos were submitted as attachments to IMPACT PR-7001. Several Failure Review Board telecons on the door opening problem did not yet reach final resolution. Still under discussion: incompatibility of various metals titanium, aluminium, bronze, brass and their respective surface treatment: bare, alodine, anodise, tiodise, paint.
c) Discussions continued with pinpuller manufacturer TiNi (see Problem/Failure Report IMPACT PFR 7003). Final TiNi NCR pending. Interim solution: do not restow pinpuller by pulling, but by pushing using the TiNi tool. Make holes in aluminium tape which covers the pinpuller in order to access the holes for the tool.

4.3. *Design Updates*

4.4. *Outstanding Problems*

IMPACT PR 7001, 7002, 7003

4.5. *New Problems*

Accident with FM2 SEPT-NS on 04-MAY-04. See report next month.

4.6. *Top Risks*

4.7. *Problem/Failure Quick Look*

ID #	Description	Assignee	Opened	Closed
7001	SEPT-DoorOpening	Mueller-Mellin	2004-02-20	
7002	SEPT-Detector	Mueller-Mellin	2004-03-05	
7003	SEPT-Pinpuller	Mueller-Mellin	2004-03-10	
	FM2 SEPT-NS accident	Mueller-Mellin		

5. Caltech/JPL (SEP) Status

5.1. *Summary of Status*

Activities centered on detector development, electronics development, and flight and GSE software development.

Major Accomplishments:

- The LET ETU survived an acoustics test at GSFC with no problems. A complete set of detectors was installed and a double window was used, although the spacing between the two windows was not in flight configuration.

Critical Milestones status:

- Milestone 18 (HET-All Flight Detectors Received) has not been accomplished. All HET detectors should be received by sometime in May 2004. However, some already received have failed in testing and replacement detectors will be needed. The replacements are expected in May.
- Milestone 28 (SEP Package – FM 1 I&T Complete) has not been accomplished.
- Milestone 29 (SEP Package – FM 2 I&T Complete) has not been accomplished.

Detectors:

- Micron Semiconductor delivered a number of HET detectors made from the new silicon crystal: three H1 devices and six H3 devices. In addition, at the end of the month they were preparing to ship three L3 detectors made from this crystal. Tests were carried out on the three H1 detectors in which the current vs. bias voltage (IV) curve was measured a number of times over several days. For this test the detectors were in a high vacuum at room temperature; during the periods between measurements of the IV characteristics the bias was held fixed at the nominal value of 150 V. Previous measurements on L3 detectors indicated that this test provides a rather good indication of which detectors will exhibit long-term current growth in vacuum. Specifically, the current growth behavior seems to be well correlated with instability of the IV curve in vacuum even over just a few days of operation. Of the three H1 detectors that were tested, 2 had stable IV characteristics while the third did not. The instability of this latter device indicates that the current growth problem is not solely a function of the crystal from which the detectors were made. It has been suggested by Micron Semiconductor that the current instability might be related to a gradual change in the surface passivation of the detector resulting from diffusion of moisture out of the thin protective silicon dioxide layer that is grown on the device surface. We have asked Micron to try omitting this oxide from some devices in order to check this idea.
- The 3 H1 detectors were sent to Goddard for further testing. We will do a similar test of the stability of the IV characteristics of the H3 detectors in early May and then send these to Goddard as well.
- Detectors were selected for the acoustic test of the LET engineering model. For this purpose we chose devices that were least likely to be useful for flight, either because of electrical problems (e.g., current growth in L3's) or thickness non-uniformity. We were able to include L1 detectors with thicknesses covering nearly the full range of the devices we may be using for flight. Thus the fact that there was no problem with the

survival either of the L1 detectors or their wire bonds in the acoustic test gives us confidence that these thin detectors should survive upcoming acoustic tests at the instrument and spacecraft levels.

Electronics:

- LET S/W:
  - Focus was first on understanding the results of the accelerator run performed at the Berkeley 88" cyclotron. We had noted that while the LET S/W seemed to mostly work, there were occasional anomalies. A highly reproducible one was characterized by system crash whenever the "DUMP" memory display routine was run during data acquisition. Less reproducible was failure of the FORTH system to be able to perform dictionary searches (i.e. command execution) after a period of operation at high beam rates. The first of these anomalies was possible to simulate back at Caltech using the built-in stim pulse generator to stimulate events. So investigation was possible and led to understanding that the maximum return stack depth (24) was being exceeded. The stack depth was exceeded by the combined usage of the foreground DUMP routine, a background round-robin task and an interrupt routine. A general solution to such a problem is to save and restore the stacks for each task. However, this incurs too much performance penalty. A compromise solution was to save and restore the stacks only for foreground tasks. (Since foreground tasks are only used to execute infrequent commands, the performance penalty is not important in this case.) Once this fix was in place stack margins were verified to be adequate at about 8 out of 24 for both the data and return stack. It may be that the other anomalies observed at the accelerator were due to loss of data stack margin, which this fix may also have eliminated. We will soon be stimulating LET at a high random rate using a gamma-ray source, while also running the test pulser sequence, in an effort to shake out any remaining bugs.
  - Analysis of data from the accelerator run and from stim pulser runs have revealed some anomalies, which require further study. One anomaly is that the reference DACs for the stim pulsers appear to take longer than would be predicted by the RC time constants to settle adequately. The problem may be dielectric absorption in the filter capacitor, so a type of capacitor with lower absorption is being located for test.
  - Main remaining work on LET S/W includes verification of the dynamic threshold operation (S/W is done), implementation of the beacon data readout, and code and command table checksum monitoring.
- SEP Central: FU2 logic board has been checked with an engineering Actel. (FU1 works with flight Actel installed). FU2 will be operated with LET prior to installation of flight Actel.
- Installed TI thermostats on Analog/Post-Reg boards and passed QA inspection on both boards. They are now ready for staking/conformal coating.

a) Finished rework, testing, and QA inspection on both Bias Supply boards. They are now ready for staking/conformal coating (HET/L3 bias select components will be masked off so that final component values can be replaced when the bias voltage is decided upon).

b) One more Actel 72S device failed to program. It was sent back to Actel for reimbursement. Subsequent device programmed fine and will be installed on SEP Central Logic board FM2 in early May.
c) Received 8 flight PHASIC hybrids from JPL and started installing them on LET boards. Identified 5 PHASIC hybrid units for qual test at JPL and expect to start it in early May.
d) SRAM by-pass capacitor issue was resolved and the soldered parts can stay on LET and SEP Central Logic boards. In the future, by-pass capacitors should be installed by using epoxy rather than solder.
e) Sent LET ETU to GSFC for preliminary acoustics test which it passed without problems.
f) Continued preparations for ESD and clean room certification of the I&T facility.
g) Received second IDPU simulator from UCB and started integrating it with GSE unit #2.
h) Returned LVPS ETU to UCB for comparison testing with FM1.

Software (Davis):

- Continued to work on LET event-processing software.

GSE:

- Wrote IDL software to plot all (~700) LET counters. The plots are in units of counts. Once counting efficiency is defined, the ability to display rates will be added. Software was used for both the accelerator and the STIM data sets.
- Wrote IDL software to plot the LET housekeeping data. Plots are in raw units (ADC and DAC values). Once conversion functions are defined, plots in engineering units will be added. Used the software for both the accelerator and STIM data sets.
- Helped with the search for anomalies in the LET data. Started writing software to identify anomalous LET events and routinely display them (if they occur) on the GSE.

5.2. *Design Updates*

- Resource updates will be sent separately.

5.3. *Outstanding Problems*

- Actel and Rich Katz at GSFC are investigating the problems with the flight Actels. A new programming algorithm has been developed at Actel and it may be used on the LET flight Actels.
- Higher than expected thermal vacuum run failures of the L3 detectors and HET detectors is requiring Micron to provide a few additional flight devices. This may require retrofitting of HET sometime in the summer.
- Preliminary analysis suggests that the nominal fairing release time will cause excessive heating to the L1 detectors (to 65C) based on the heating levels specified, which may have considerable margin (factor 3) over what might actually be experienced. The lower heating level would only heat the detectors to 45C. In the meantime, partly for other reasons, an additional window is being added to LET and perhaps that will mitigate the problem. More calculations are underway.
- Current-limiting resistors on the LET board need to be changed to ones rated higher in voltage.

5.4. *New Problems*

- Anomalies from LET stim pulser tests and the accelerator test are being investigated and resolved.

5.5. *Top Risks.*

- Actel parts may not be reliable. This would affect many NASA projects.
- 1-mm detectors may have a serious leakage current growth problem. However, enough good LET detectors have been identified to populate both flight instruments. HET detectors may be more of a concern, perhaps requiring swapping out detectors later than desired.
- Higher than expected free molecular heating might require a re-design of the LET sensor head.
- The budget is very tight with no reserve being held at Caltech.

5.6. *Problem/Failure Quick Look*

- None.

5.7. *Lien List*

- At the time of this writing (5/12/04) a new budget is being prepared for submission. It features delivery of both flight units to APL in October 2004, an additional year of Phase E, an additional 3 months of Phase C/D, and covers all liens listed in this section in previous reports. We have been asked to list in this section the amount of money required to keep testing the flight units in case it is decided that we deliver in January 2005 instead of October 2004. According to the new budget, this amount is $118,089.

6. SIT MONTHLY TECHNICAL PROGRESS REPORT

April 2004

6.1. *SUMMARY of STATUS*

a) SIT TELESCOPE – Prototype at UMd for ETU/FM testing. Flight SSDs are still under test at GSFC.
b) SIT TOF System – FM1 is at UMd and has passed functional test. FM2 is under construction at MPAe. The old FM, which we are using as ETU, is at UMd and being used in ongoing testing.
c) SIT Energy System – FM1 and FM2 are at GSFC, waiting trimming. ETU is at UMd available for ETU testing.
d) SIT Logic System – Flight board is at GSFC for assembly. The ETU board is at UMd.
e) Motherboard – The flight MB is at GSFC for assembly.
f) SIT HVPS - Flight HVPS FM1 is undergoing test at UMd.
g) Flight Software – Version 02/26/04 is installed in the ETU under test at UMd.

6.1.1. Schedule Changes

The current SIT schedule is available from the project scheduler.

6.2. *MAJOR ACCOMPLISHMENTS*

6.2.1. This Month

Energy Boards – The FM1 and FM2 energy boards were trimmed at UMd. A problem was discovered with one of the Peak-Hold chips on the boards: an Amptek PH300RH. (U4 on FM1) The boards and trim parts were sent to GSFC to have the trim parts installed and the bad PH300 chip removed for DPA. We have no spare PH300 chips but Ron Jackson at UCB has ordered two spares from Amptek.

Logic Board: Logic board coupons were approved and fabrication was begun. Concern continues about whether the layout is adequate for the flight Actel and their new-found sensitivity to 2.5v fluctuations. A review of the board design has been scheduled for early May.

Mother Board: The new mother boards arrived from Rigiflex and the coupons passed. The boards and parts have been sent to GSFC for assembly.

Solid State Detectors: We have ordered two additional SSDs from Ortec. Expected delivery is 120days ARO which puts it in mid-August. Detector holders are also in short supply so we have ordered ten more to be machined from ceramic and then thick-filmed. When these are delivered (end of May) we will negotiate with Ortec to replace our bad SSDs with units they can mount in the new holders.

6.2.2. Next Month

Next month we will finish the assembly of the Energy boards and begin testing them, receive FM2 of the TOF boards and test them, finish assembly of the mother boards and test them, and review the logic board design.

6.3. *DESIGN UPDATES*

6.3.1. Resources

	Last Month	This Month	Change
Mass (kg) *	1.46	1.46	0
Power (W)	1.56	1.56	0.0
Telemetry (bps)	418	418	0

* Includes 200g book-kept by GSFC for SIT structure

6.4. *OUTSTANDING PROBLEMS*

Excess current in as many as three of our SSDs.

6.5. *NEW PROBLEMS*

Bad PH300 Amptek hybrid on FM1 energy board.

6.6. *NEW RISKS*

6.7. *PROBLEM/FAILURE QUICK LOOK*

Starts at first turn-on of flight hardware.

ID #	Description	Assignee	Opened	Closed
SIT1	Apparent failure of PH300 chip U4 of FM1 energy board	PHW	4/29/04	

7. CESR (SWEA) Status

CESR- TOULOUSE- France **Author : Claude Aoustin / Project Manager**

SWEA PROGRESS REPORT # 31
(May 5, 2004)

April 2004

CESR is in charge of :
- Electrostatic analyzer with deflectors, grids and Retractable Cover
- Detector consisting of two MCP rings
- Amplifiers and discriminators
- 3 High voltages

7.1. *Summary of Status*

7.1.1. ETU1

Delivery to UCB was planned for 12/07/2002 : done 26/09/2002

7.1.2. ETU2

Mechanical fabrication 100 % done
Integration done for the vacuum test configuration.
Electronic boards tested (100 %).

7.1.3. FM1 / FM2

Mechanical fabrication 100 % done.
Electronics boards fabrication : 100% done

7.2. *Major accomplishments*

7.2.1. FM1:

Delivered to SSL : 8 December 2003.

7.2.2. FM2 :

MCP characterization performed in the vacuum chamber started on the 19 February 2004 ended on the 4 of March 2004.

Calibrations are on going and will be finished soon. We have got some delay due to electron source failure.

Delivery to SSL UCB : 7 June 2004.

7.3. *Design Updates*

Mass : 967 g (EM is 950g without cover opening mechanism)
Power : 446 mW min ; 662 mW max

7.4. *Outstanding Problems*

7.5. *New problems*

7.6. *Top Risks*

7.7. *Problem Failure Quick Look*

HV multiplier from VMI HM 402 P 10 failed at -70°C !
Failure analysis done by GSFC. It is showing a bad bonding inside the component.
New IMPACT_PFR_6001_HVPS sent to GSFC by Dave Curtis.

8. GSFC (MAG) Status

FM1 complete and delivered to UCB early May. Electronics integrated with FM1 IDPU at UCB (see picture in section 2).
FM2 in final test at GSFC, ready for delivery to UCB in late May

EPO at UCB
Monthly E/PO Report April, 2004

Formal Education:

We attended the National Conference of the National Science Teachers Association in Atlanta, Georgia. We had a three-hour short course in which we taught our STEREO-IMPACT Exploring Magnetism teacher's guide as well as about the Sun-Earth connection in space. We also took part in a four hour teacher's workshop with the Sun-Earth Connection Forum on Great Explorations in Math and Science (GEMS) guides that were developed with NASA.
We are preparing for a one-day teacher professional development workshop for Middle and high school teachers on July 31 at Space Sciences Laboratory where "Exploring Magnetism" and Living with a Star GEMS guide will be used.

We submitted the "Exploring Magnetism" Teacher's Guide to the OSS Education Product Review.

Informal Education:

We met with Stuart Bale, Edmund Campion, Roberto Morales, Andy Schmeder, and Ben Jacobs to discuss progress on the STEREO-IMPACT/SWAVES music project (STEREO incandescence) at the Center for New Music and Audio Technologies (CNMAT). Roberto Morales presented the MAX-MSP application he created for the Helios 1 SEP data. This will be used in L. Peticolas' poster presentation at the American Astronomical Society (AAS).

Public Outreach:

We participated in Cal Day on April 17th on the UC Berkeley campus and at the Space Sciences Laboratory where people from the public came and learned about NASA missions at UCB and our E/PO programs. 952 people came by the booth and 78 people visited the laboratory.

Respectfully Submitted,
IMPACT E/PO scientists Nahide Craig, Laura Peticolas