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

Lil:

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

Preliminary

Sincerely,

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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*

Funding through October has been received and subcontracts have been augmented. Additional funding will be sent to UMd to cover the unbudgeted accelerator tests at Brookhaven.

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	10/04
3	Testing failure requires rebuild/retest a board (using existing spare parts)	$20,000	10/04
4	EMC rework and retest required (Risk UCB11). Assume rework can be done in a week or two. Does not include cost of retest of vibration & thermal vac.	$30,000	10/04
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. New budget takes this into account.	$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 due to reliability problems. Depends strongly on what kind of replacement is selected.	$500,000	?

13	PLASTIC Software extended effort to complete to 10/04, with continuing effort at a lower level through March 2005; 100% probability	$130,000	9/04
14	LVPS completion, including rescreening and replacement of LTC1877s, 100% probability	$75,000	9/04
15	UCB SWEA/STE effort to complete, 100% probability	$40,000	9/04
16	DCB Actel swap-out with parts programmed with new algorithim, plus replace the 1553 connectors, 100% probability	$8,000	8/04

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	$10,000	3/04

	from JPL. (Amount = ~$10,000 (guess); Probability = 100%; time frame = March 2004).		
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 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).	$25,000	7/04
10	Launch delay costs to Feb 06	$67,757	12/05
11	Extra work due to schedule delays, delivery in Jan 2005, probability 100%	$133,115	10/04
12	LET L1 detector repair, probability 100%	$50,000	08/04

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.	$20,000	8/04
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, 100%	$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 (unlikely since ETU tests passed)	$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*

- Participated in Project EMC & Contamination Control committee meetings
- Participated in various MRB/FRB meetings
- HET/LET FM1 and FM2 went to accelerator testing at MSU (more in Caltech section)
- FM1 Boom/MAG/STE-U through environments (except EMC)

1.3. *System Design Updates*

- None

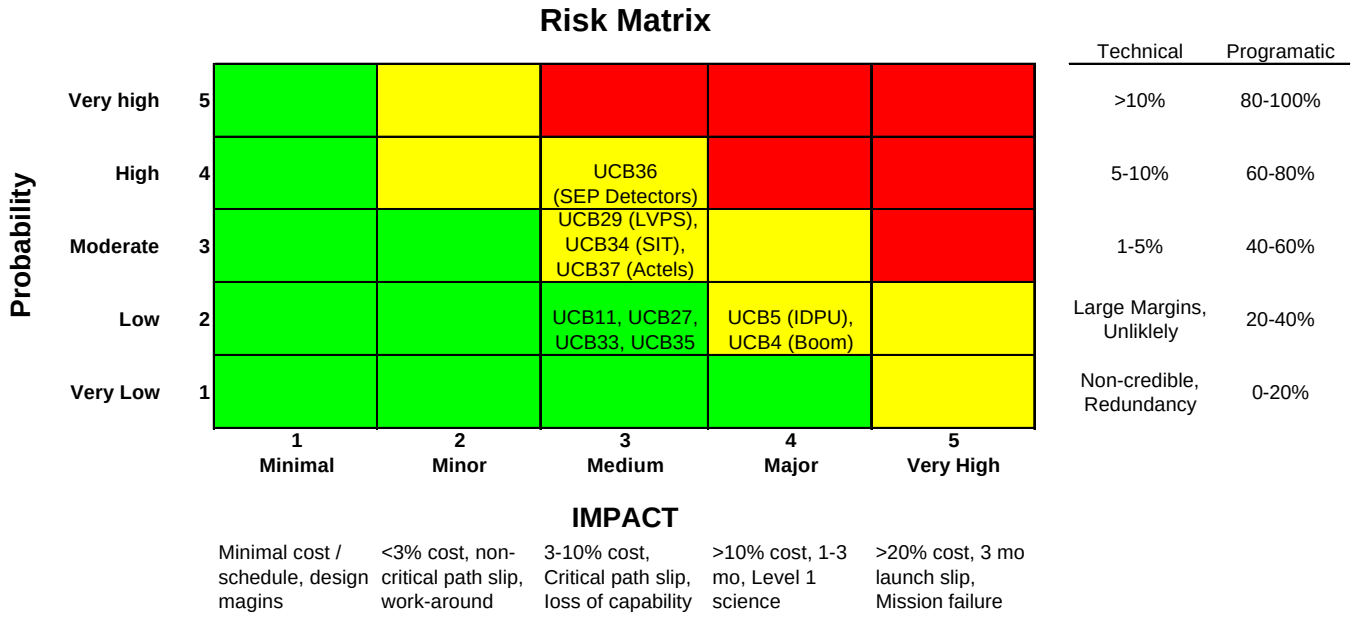
1.4. *System Outstanding Issues*

- Schedule issues due to recent problems in the power converters, LET/HET detectors, and SIT telescope mechanical.

1.5. *Top 10 Risks*

Top 10 risks are attached. Add new Actel risk for parts programmed with the old algorithm.

IMPACT Top Ten Risks 7/2004



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_37	Some Actels have been programmed with the old algorithim. Recent data from RK indicates the possibility of failure of these parts	MEDIUM	Replace Actels in IDPU and SEP Central since these are single point failures for multiple instruments. SEPT, SWEA, STE, HET Actels not changed. Accumulate test hours to reduce risk	LOW	MEDIUM	MEDIUM	MEDIUM
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_33	Instrument fabrication & test schedule limited by available personnel	LOW	Subcontract assembly work, authorize over-time, bring on new people	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

2. Berkeley Status

2.1. *Summary of Status*

Schedule status through June has been provided separately.

2.2. *Major Accomplishments*

SWEA/STE:

- All SWEA/STE boards complete and tested.
- All STE Detector boards tested.
- STE-U FM1 environmental tests (except EMC) complete
  - In calibration test to measure ion response
- STE-U FM2 in environmental test
  - Trouble in thermal vac with the door; PFR1013, 1014.

IDPU:

- FM1 IDPU complete, FM2 waiting for its power supply
  - LTC1877 parts still need to be replaced in both power supplies
  - FM1 DCB Actel has been replaced with one programmed with the new algorithm; FM2 still needs that done

LVPS/HVPS:

- SIT HVPS FM2 in assembly, expect to deliver mid August.
- SWEA/STE-D FM1 LVPS tests complete
- PLASTIC FM1 LVPS delivered
- PLASTIC FM2 in test
- SEP FM1 delivered (less conformal coat)
- SEP FM2 delivered (less conformal coat)
  - Intermittent noise resolved
- IDPU LVPS FM1 delivered.
- Resolution of LTC1877 problem (PFR 1007) involves replacement of all LTC1877s with a new batch; affects all power converters. New batch expected to complete screening mid August.

Boom:

- FM1 unit complete, through vib & thermal vac, mated with MAG.
- FM2 unit ready for tuning deployment(s)

GSE:

- All GSE delivered. Some added features in progress.

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.

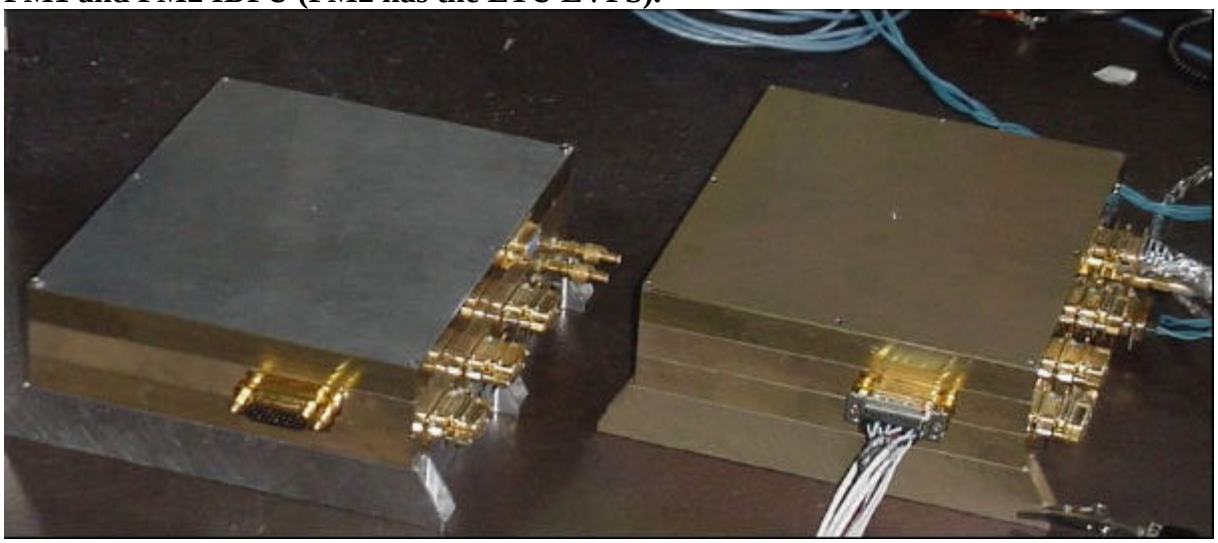
2.6. *Top Risks.*

- LVPS schedule tight
- Open Actel problems

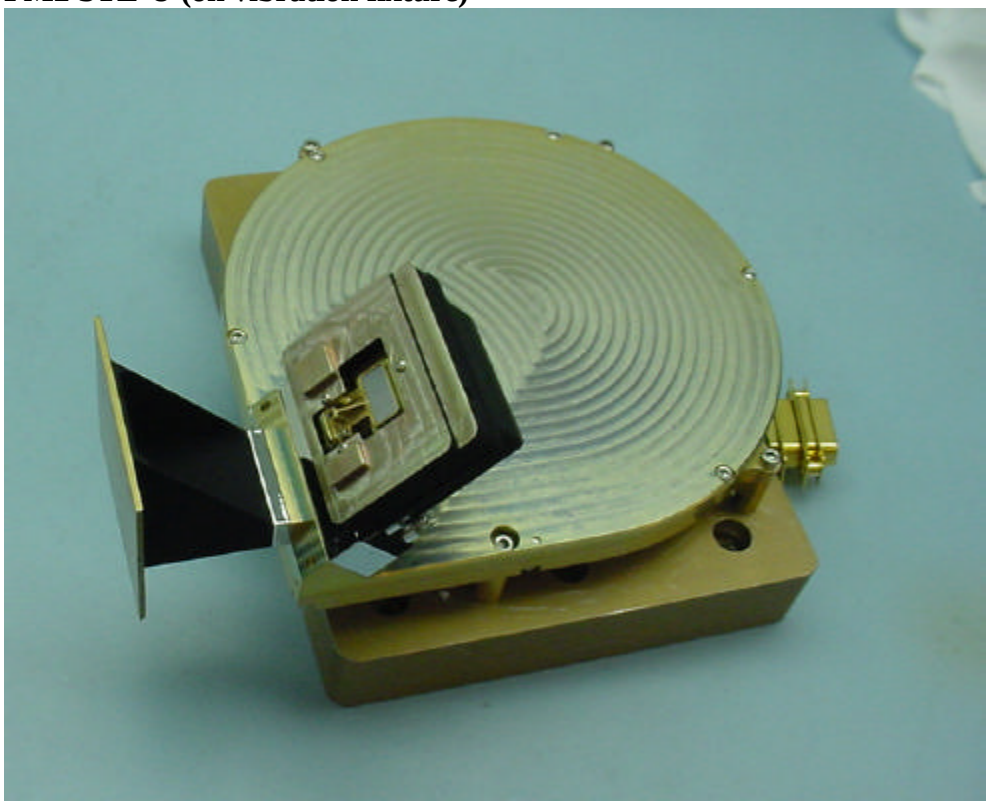
2.7. *Problem/Failure Quick Look*

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	2004-06-25
1004	SEP LVPS Middle FM1 Problem	Heavner	2004-04-23	2004-06-08
1005	SEP LVPS Top FM1 Problem	Heavner	2004-04-27	2004-06-08
1006	STE-U FM1 Mis-wire (thermal vac feed-through)	Curtis	2004-04-30	2004-06-25
1007	SWEA LVPS FM1 LTC1877 Failure	Curtis	2004-05-10	
1008	STE-U FM1 Door failure (cold)	Curtis	2004-05-10	2004-06-25
1009	STE-U FM1 preamp oscillations	Curtis	2004-06-14	2004-06-25
1011	STE-U FM1 Door failure (post-vib)	Curtis	2004-06-28	
1012	IDPU FM1 LVPS part failure	Curtis	2004-07-15	
1013	STE-U FM2 door failure (status sense switch)	Curtis	2004-07-27	
1014	STE-U FM2 door failure, actuator burn-out	Curtis	2004-07-30	

FM1 and FM2 IDPU (FM2 has the ETU LVPS).



FM2 STE-U (on vibration fixture)



3. GSFC (SEP) Status

4. Kiel/ESTEC (SEPT) Status

SEPT Monthly Technical Progress Report
July 2004

4.1. *Summary of Status*

a) Rework activities on all four failure cases mentioned in May report are continuing at reduced level due to vacation period.
b) New problem with reworked Canberra detectors identified: insufficient stress relief of coax cables (see below).
c) Delay introduced by stress relief problem is mitigated by postponement of IMPACT EMC Test, now foreseen for October 2004.

4.2. *Major Accomplishments*

a) Canberra delivered an extra detector stack with newly fabricated PIPS detectors using flexible adhesive AMICON CE 8500 to Kiel. Incoming inspection showed poor coax-cable fixation on one out of 6 cables. Failure review board with Canberra recommended using the Kiel supplied detector brackets (flight hardware) and additional gluing of coax-cables on Canberra supplied G10 frame using Stycast 2850FT with LV24 catalyst. This is a thermally conductive epoxy with low coefficient of thermal expansion and excellent electrical insulating properties. This method should also be applied when reworking the 14 detector stacks which were returned to Canberra for repair of the wire bond problem.
b) 9 out of 14 detector stacks were reworked at Canberra:
   - Each detector chip has been tested, visually inspected and the height of the wire bonds has been measured.
   - A limit was set at 0.6 mm above the detector chip (wires above 0.6 mm had caused problems with the original assembly). The highest wire measured is 0.54 mm (S/N 58259). The bond wires that were too high were redone to fall within the limit. This was the case for the detectors returned with a defect. The detectors returned for safety repair all had bond wires within spec's.
   - 2850FT epoxy with LV24 catalyst was added on the coax shield in order to provide stress relief.
   - The detectors were assembled in new housings with new spacers 0.2 mm higher to have sufficient safety margin. New serial numbers were provided together with a cross reference list to allow history check.
   - The detector stacks were mounted in flight hardware brackets (from Kiel) for stress relief and retested in beta noise performance, leakage currents, and in light. Retest of alpha resolution was not performed as the detectors are the same and time was precious.
c) The remaining 5 stacks await arrival of new coax cables from the company Axon expected in week 34.
d) Incoming inspection of the 9 stacks in Kiel showed slightly increased leakage currents for some detectors. The leakage is sensitive to humidity of the ambient air. Being still in the range below 100 nA the leakage current cycles with the air conditioning humidity control of the clean room. Cooling to 10 °C in ambient also increases the leakage current (contrary to expected silicon diode behaviour). This is attributed to approaching the dew point. Purging with dry GN2 decreases the leakage current to

normal values (< 10 nA). When in vacuum the leakage current is also nominal. This behaviour was not seen in the original assembly and is attributed to the 2850FT epoxy. Conductivity tests at Canberra with 2850FT did not show increased conductance. A decision will be taken in August, whether this behaviour is acceptable. For the time being, this is not considered a failure, however, the test and analysis efforts have delayed the SEPT integration work.

e) 10 pin-pullers were not yet returned to Kiel. TiNi is shipping the pin-pullers via UoB because of the need to resolve the crimp problem.

f) The ACTEL FPGA, damaged by the Kiel incident, was removed from the old FM2 SEPT-NS digital electronics board. A new ACTEL FPGA was shipped to the company Astrium for burning which is expected in August 2004. When completed it will be soldered into the digital board which will be assembled with the analogue board to serve as flight spare.

4.3. *Design Updates*

4.4. *Outstanding Problems*

1. IMPACT PR 7001, 7002, 7003, FM2 SEPT-NS accident

4.5. *New Problems*

1. Humidity sensitive detector leakage current.

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 preparing for and executing the end-to-end test of LET, HET, and SEP Central at the MSU accelerator, which occurred in early July, and inspecting the broken traces on the L1 detector mounts.

Major Accomplishments:

- Accomplished end-to-end test of LET and SEP Central (and HET) at accelerator at Michigan State University.

Critical Milestones status (from Critical/Key Milestone chart of 3/31/04):

- Milestone 12: SEP Suite – FM 1 I&T Complete was not completed.
- Milestone 13: IMPACT Suite EMC Test Complete was not completed.

Detectors:

- Detector testing has largely finished at Caltech. So, in place of the usual report on that subject is the report on the inspections of the L1 detectors that had broken traces after assembly into FM 1 and FM 2. See also last month's report where the problem was reported and IMPACT_PFR_2002. A fix for the problem is underway at JPL.
- The reformatted email below (dated 7/21/04) is a summary of all of the inspections and photographs done by Ryan Ogliore on the broken L1 traces and related topics.
- Photos from the LET disassembly that took place at Caltech are available on thor.srl.caltech.edu in /pub/STEREO/LET_disassembly_photos and also here: http://www.srl.caltech.edu/personnel/ogliore/L1-broken/LET_disassembly_photos/ Note that the contents of these folders will be changing in the next few days as these photos will be organized.
- The 20 L1 detectors came out of the flight unit with a 90-degree bend in the flexi-strips, which made inspection of the entire copper trace impossible. Also because of the bend, I could only inspect and photograph with the lower magnification optic. In a couple of weeks the flexi-strip may relax and flatten out to a point where inspection of the whole trace and with higher magnification becomes possible. I do have pictures with the lower-magnification for the first half of the trace - from the detector halfway to the plug. Previous broken-trace L1's had fissures on the flexi-strip near the detector, so these inspections and photographs should show if similar fissures are present in these flight-module detectors. The pictures are on thor.srl.caltech.edu: /pub/STEREO/L1-Broken/flight_L1 and also http://www.srl.caltech.edu/personnel/ogliore/L1-broken/flight_L1/ I took the following notes for each of these detectors (with plug facing up, left most trace is 'first', second to left is 'second', second to right is 'third' and right most trace is 'fourth', 'complete' fissure is fissure that goes all the way across trace, severing the trace and 'incomplete' does not go all the way across trace):
  1) L1-37 (pioneer): All four traces broken near detector. Also there is a loose wire on the surface of the detector, which Branislav pointed out. There is a picture of this wire: http://www.srl.caltech.edu/personnel/ogliore/L1-broken/flight_L1/L1-37_loose_wire_on_detector.jpg and can be seen easily with the eye.
  2) L1-03 (speedy): All four traces broken near detector

3) L1-24 (pioneer): First trace has perhaps complete fissure; second trace has two fissures near detector with one complete; third trace has start of a fissure near detector; fourth trace may have start of a fissure
4) L1-35 (pioneer): Large fissures on all four traces near the detector; first trace has two incomplete fissures on either side of trace. More towards the plug three of the traces show more fissures
5) L1-13 (speedy): Small complete fissures on all traces near the detector, showing discoloring around fissures as seen on L1-20. Possible fissure in straight trace near white spot on flexi
6) L1-30 (pioneer): Three or four fissures on each trace (some complete, some not) near detector
7) L1-27 (pioneer): No obvious fissures near detector or anywhere else on first half of trace
8) L1-29 (pioneer): Start of or incomplete fissures in first three traces near detector. Possible incomplete fissure in bend on fourth trace
9) L1-54 (pioneer): No obvious fissures near detector. Possible incomplete fissure a little further up on first trace
10) L1-32 (pioneer): Fissures on all traces near detector, two fissures on second trace. Exposed white material in fissures on first and second trace
11) L1-51 (pioneer): Incomplete or start of fissure in all traces (most pronounced in 2,3,4) near the detector
12) L1-05 (speedy): Possible fissures obscured by glue over traces near detector. The same discoloring that was visible on previous speedy-mount detectors around the fissure is visible here (white stripes in copper traces near detector) on all four traces very close to detector – most obvious on fourth trace.
13) L1-19 (speedy): Discoloring and fissures on all four traces near detector, fissures may be incomplete (obscured by glue again)
14) L1-09 (speedy): Severe discoloring (whitening) on all traces near detector but no obvious visible fissure - if a fissure is present it is small or incomplete
15) L1-06 (speedy): Slight band discoloration on all four traces but no fissures.
16) L1-08 (speedy): Band discoloration (whitening) on all four traces very close to detector but no fissures visible (view is partially obscured though)
17) L1-12 (speedy): Band discoloring in all four traces near detector – red, white, gray.
18) L1-56 (pioneer): No noticeable fissures near detector or anywhere else in this first half of copper trace
19) L1B0-ThickThin (speedy): Some discoloring (whitening) in bands on all four traces right next to detector but no obvious fissures
20) L1A2-ThickThin (speedy): Moderate discoloring (whitening) in bands on all four traces (two bands each trace) near detector but no obvious fissures

- Note: Speedy L1 Mounts are darker and have no writing on them, Pioneer mounts are lighter and have writing
- I have inspected and photographed 2 L2's and 2 L3's that came out of the EM unit. The photos are on the anonymous ftp thor.srl.caltech.edu: /pub/STEREO/L1-Broken/EM and also: http://www.srl.caltech.edu/personnel/ogliore/L1-broken/EM/L2_L3/ All of these detectors looked okay: I did not see any fissures.
- I have inspected and photographed five L1's (three in Pioneer mounts, two in Speedy mounts) that have never been installed in an instrument: either FM1, FM2 or the EM.

The files are on thor.srl.caltech.edu: /pub/STEREO/L1-Broken/unused_L1 and also: http://www.srl.caltech.edu/personnel/ogliore/L1-broken/unused_L1/ All of these detectors looked fine: none showed any fissures like those seen in L1-20 and L1-28 (described below).

- I looked at L1 detectors 2250-1-2 and 2250-2-1, the only detectors from the A-side of the EM that were not used in FM1 or FM2 for the MSU run. These were installed into the EM unit by Branislav. The photos are on thor.srl.caltech.edu: /pub/STEREO/L1-Broken and also: http://www.srl.caltech.edu/personnel/ogliore/L1-broken/EM/ Both of these mounts were Speedy Circuits mounts. I did not see any breaks anywhere in the copper traces on either of these detectors. What at first glance looks like a break in the wide picture: http://www.srl.caltech.edu/personnel/ogliore/L1-broken/EM/2250-1-2_wide-ok.jpg is actually just the end of the area of the flexi-strip that has the clear coating over it as seen in the narrower pictures like: http://www.srl.caltech.edu/personnel/ogliore/L1-broken/EM/2250-1-2_3-ok.jpg
- I inspected the bias planes on the ohmic side of the flex-strips for L1-20 and L1-28. The photos are on the anonymous ftp thor.srl.caltech.edu in the /pub/STEREO/L1-Broken/ directory and also at: http://www.srl.caltech.edu/personnel/ogliore/L1-broken/ The files are:
  L1-20-groundstrip.jpg
  L1-20-groundstrip2.jpg
  L1-20-groundstrip3.jpg
  L1-28-groundstrip.jpg
  L1-28-groundstrip2.jpg
  The bias planes looked fine on both detectors.
- I have taken pictures of the broken L1 detectors L1-20 and L1-28. The photos are on thor: /pub/STEREO/L1-Broken and also here: http://www.srl.caltech.edu/personnel/ogliore/L1-broken/ L1-20 is in a Speedy Circuits mount and it showed the two fissures near the detector shown in the photos for two of the four traces. One of the other two traces shows definite signs of developing the same fissure in the same place (L1-20_4_ok.jpg), and the other trace looks less suspect (L1-20_3_ok.jpg). The rest of the copper trace was free from fissures. L1-28 is in a Pioneer Circuits mount. All four of its traces showed fissures in several different locations. All four traces showed cracks in the angle-bends in the copper traces (e.g. L1-28_1_broken2.jpg, L1-28_1_broken3.jpg) and near the plug.

Electronics:

- Assembled and tested both flight LET/HET/SEP_Central units in preparation for the MSU accelerator trip. Some L1 detector flex circuit connections have been broken during the assembly (see inspection report above). The flex strip traces had erroneously received Nickel or Nickel-Gold plating in fabrication at Speedy Circuits and Pioneer Circuits that made them prone to cracking when bent to accommodate mating with LET board. The accelerator end-to-end test was a success - only minor firmware problems were discovered. Upon return both units were disassembled for conformal coating, final fabrication, plating and inspection of mechanical parts, and to fix L1 detector mounts. Travel with flight instruments was smooth and security personnel at airports were helpful. We carried letters from NASA and the airline stating the purpose of the trip and the safety measurements done on the instruments.

STEREO PR material was useful in explaining the mission in general and showing the pictures of hardware inside the boxes.

- Developed a plan for L1 detector mount repair by adding a wire-bondable substrate (made of either polyimide PCB or ceramic, in parallel, to mitigate schedule impact) to the existing mount and using haywires to bypass compromised traces on the flexible circuit. The rework will be done at JPL. Some DPA of samples obtained from Pioneer Circuits is still pending at GSFC.
- SEPT ETU sent to APL for fabrication and fitting of thermal blankets. Expect to get it back next month to work on SEP Central flight firmware used for control of SEPT.
- Continued search for the optimum T/V chamber to be used in LET/HET/SEP Central thermal balance and T/V test this fall. Contamination control issues and thermal requirements are being discussed and some preliminary measurements on chamber # 12 will be performed next month to determine its suitability.
- Most of the flight boards were cleaned at JPL in preparation for final QA inspection prior to conformal coating. However, the inspection had to be postponed due to issue of floating unused connector pins, which may require more soldering and cleaning before conformal coating.
- Non-flight strain-relief material Eccobond 45/15 was removed from LET FM1&2 boards at Caltech and the equivalent flight material, Uralane 5753, was applied at Pioneer Circuits free of charge. The same was done on the spare EM and flight LET boards.
- The Project decided to have the Actel 72S parts on SEP Central Logic FM1&2 boards replaced (they had been programmed with the old algorithm) since SEP Central is seen as a single-point failure in the SEP suite. Spares were identified (one at Caltech and one on loan from THEMIS project at UCB) and the replacement will take place next month.

Software (Davis):

- Participated in MSU accelerator test of LET and HET and subsequent data analysis.
- Began work on the SEPT flight software routines that will pack the SEPT science, housekeeping, and beacon data into packets for telemetry (these routines run in SEP-Central).

GSE:

- Finished the modifications to the GSE software for the LET events from the serial port.
- Participated in the MSU accelerator runs. This was the first extensive use of the serial port interface for LET events. The data was logged as CCSDS packets (normal telemetry), raw data from the serial port (high-speed LET event interface), and as SEP data structures.
- Wrote IDL software to reprocess the LET data from MSU. Some abnormalities in the LET events caused the GSE real-time software that processes events to malfunction. This caused the structured event files to be incomplete. The IDL software isolated the problem, regenerated the structured data from the recorded CCSDS packets and raw serial port data, and added annotations to the data files to indicate the errors found.

5.2. *Design Updates*

- Resource updates will be sent separately.

5.3. *Outstanding Problems*

- The problems with the Actels have been resolved. The plan is to use the new algorithm to program the ones in SEP_Central. The Actels on the LET boards were already programmed with the new algorithm. In August, we will remove the two Actels on the two logic boards in SEP_Central and replace them with Actels programmed with the new algorithm.
- 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.
- Some L1 detector mount traces were discovered broken after assembly into FM 1 and FM 2. See IMPACT_PFR_2002.

5.4. *New Problems*

- No new problems this month.

5.5. *Top Risks.*

- Actel parts may not be reliable. This would affect many NASA projects.
- Some 1-mm detectors 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.
- Faulty L1 detector devices are not replaceable in the near-term, so a repair procedure for th4e four-trace side has been partly defined. It will be executed next month. We plan further inspections on the bias-plane side to see if a fix needs to be defined there also. The preliminary data suggests we won't have to repair the bias-plane side.
- 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*

ID #	Description	Assignee	Opened	Closed
2001	SEP Bias Supply post-regulator failure FM 1	Kecman	2004-04-27	
2002	L1 Detector mounts with fissure in traces	Cummings	2004-07-01	

5.7. ***Lien List***

- At the time of this writing (8/12/04) a new budget had been submitted. 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. The budget was prepared a few months ago and the current schedule is calling for delivery in November or later, rather than October, so some of this lien will mostly likely be needed. Also, solving the L1 detector mount problems will require additional monies (~$30,000?) and will likely cause a delay in the EMC test, currently scheduled for mid-September.

6. SIT MONTHLY TECHNICAL PROGRESS REPORT

6.1. *SUMMARY of STATUS*

a. SIT TELESCOPE – Prototype at UMd for ETU/FM testing. Flight SSDs are still under test at GSFC. Spare SSDs have been ordered.
b. SIT TOF System – FM1 is at UMd and is being tested as part of the integrated FM1 electronics. FM2 has been delivered to UMd and has been tested. The old FM, which we are using as ETU, is at UMd and is available for ETU testing.
c. SIT Energy System – FM1 and FM2 have been trimmed and tested. FM1 is installed in and is participating in the testing of the integrated FM1 electronics. ETU is at UMd available for ETU testing.
d. SIT Logic System – FM1 has been functional tested and is undergoing further test as part of the integrated SIT electronics. FM2 is at UMd and has been tested. The ETU board is at UMd.
e. Motherboard – FM1 and FM2 MBs are at UMd and have been functionally tested. FM1 is integrated with the other FM1 electronics. FM2 was returned to GSFC for touchup and is back at UMd.
f. SIT HVPS - Flight HVPS FM1 is undergoing test at UMd.
g. Flight Software – Version 07/15/04 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

- Logic Board – FM2 fabrication was completed and the unit was tested.
- Mother Board: FM2 was sent to GSFC for touchup which was completed and the unit returned to UMd.
- TOF: FM2 boards were tested.
- FM1 Integrated Electronics – Testing of the integrated electronics and the flight software continued. Several small software issues were found and fixed. A thorough testing for the ROMBOX logic, Matrix Rate assignment, Beacon Rate assignment and priority scheme was performed with external pulsers. The unit was integrated with the ETU telescope, alpha peaks were measured and plans were made for a mid-August calibration run with at BNL with the ETU telescope and the FM1 electronics.

6.2.2. Next Month

Next month, do BNL calibration, conformal coat logic, HVPS and TOF Boards.

6.3. *DESIGN UPDATES*

6.3.1. Resources

	Last Month	This Month	Change
Mass (kg) *	1.46	1.46	0
Power (W)	1.56	1.65	0.09
Telemetry (bps)	418	418	0

The power change now reflects measured power of flight hardware. There may be some further small changes when the flight telescope is installed since the flight plates draw less current than the ETU ones and a slightly lower operating voltage may be required.
* 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*

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

Both flight units delivered to UCB, no open issues. Integration with UCB electronics covered in UCB section.

8. GSFC (MAG) Status

FM1 and FM2 complete and delivered to UCB for integration with the IDPU and Boom. See the UCB section for status of that activity.

9. EPO at UCB

Monthly E/PO Report July, 2004

Formal Education:

L. Peticolas was invited to give a talk on auroras and the Sun, and a workshop on the LHS GEMS *Living With a Star* teacher's guide in Anchorage, Alaska on July 5-7th. The talk and workshop were part of the *Living With a Star* Star Partners Teacher professional Development Conference.

L. Peticolas and N. Craig demonstrated lessons in the STEREO-IMPACT "Magnetism Guide" in a teacher's workshop at the Space Sciences Laboratory at the University of California at Berkeley on July 12-13th. This workshop was supported by the THEMIS E/PO 9 teachers from 9 different states. Each school, where these teachers work, will have a magnetometer installed on its campus.

Laura Peticolas' career has been selected to appear in the Science 2006 elementary school textbook series due to be published by Pearson Education Scott Foresman in Spring 2005. Her biography and career story will be used to motivate students to pursue STEM studies and careers and based on suggestions received by authorized NASA Enterprise representatives. Congratulations Laura!

Informal Education:
L. Peticolas is coordinating with CNMAT and Janet Luhmann further specifics of the IMPACT data for CNMAT and another update meeting is scheduled for August 4th.

N. Craig is in communication with Therese Kucera for the inclusion of STEREO/IMPACT Educational materials to the new STEREO Poster that is being planned by GSFC.

Respectfully Submitted,
IMPACT E/PO Lead, Nahide Craig