FM2 Boom Suite Pre Ship Review 2005 May 23



Review History

- IMPACT held a suite-level PER in January 2004 to cover general plans and the detailed plans of the first instruments (SEPT)
- A more detailed Technical Readiness Review was held for each IMPACT subsystem as it became ready to start environmental tests
 - The TRR for the IMPACT Boom (and MAG, STE-U) was held on April 19 2004
 - The TRR for SWEA and IDPU was held on October 5 2004
- The PSR for the FM1 Boom Suite was held previously, and the FM1 Boom Suite is at APL
 - FM1 IDPU PSR was held on March 2 2005
 - FM1 Boom PSR was held on March 31 2005
- This PSR covers the FM2 IMPACT Boom Suite, which has completed testing and is ready to ship to APL for integration with the Behind spacecraft.
 - Planned Shipping May 24
 - Includes: FM2 IDPU, FM2 Boom, FM2 SWEA/STE-D, FM2 MAG, FM2 STE-U
- This PSR covers the unique information for the FM2 suite; refer to the FM1 PSR for common information

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Boom Suite FM2 Test Flow (5/20/05)



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IMPACT FM2 IDPU



FM2 IDPU Test History

- 12/16 Vibration test. No problems.
- 12/22 12/29 Thermal Vac cycles 1,2
 - Failed to start at cold (PFR1031). Missing part; installed, returned to test
- 12/29 1/8 Thermal Vac cycles 2-7
 - Failed last cycle, cold (PFR1032). Reversed Tantalum capacitor. Replace (effects FM1, which was also retested).
- 2/1 2/8 Repeat Thermal Vac, 4 cycles, no problems
- 2/14 Workmanship vibration, passed
- 2/15 2/16 Qualification Bakeout, Passed
- 4/26 Magnetics test, passed
- 4/15 5/9 Support FM2 SWEA Thermal Vac
- 5/11 5/20 Integrate with Boom Suite, EMC, Collect Operating Hours
 - IDPU EMC CE exceeds spec, above FM1 level
 - Will deliver to spacecraft and retest on spacecraft; if level still bad, will return to UCB for repair (probably power supply filter problem)

IDPU Verification Matrix

		Verification Matrix for STEREO/IMPACT/IDPU																		
	Hardware Description	Test																		
Level of Assembly	ltem	Elect. test, rm. Temp	Elect. Test, hot	Elect. Test, colc	Vibration, Sinusoidal	Vibration, Random	Shock	Acoustics	Pressure change	Voltage margins	Thermal Vacuum	Thermal balance	>100 hours Operation	EMC/EMI	Magnetics	Leak	Bakeout	Mass Properties	Outgassing	Contamination
С	PWB, EM	С	С	С						С			С							
I	IDPU EM									С			С	С						
С	PWB, F	С	С	С						С			С							
I	IDPU, FM1	С	С	С	С	С			Α	С	С		С	С	С		С	С	С	С
I	IDPU, FM2	С	С	С	С	С			Α	С	С		С	С	С		С	С	С	С
Legen	d:																			
	Level of Assembly	Uni	t Typ	be								X =	Tes	t rec	quire	d				
												A =	Ana	alysi	s					
	C = Component	BB = Breadboard										H = at higher level of assembly							oly	
	I = Instrument	EM	=	Eng	ginee	ering	Мо	del				C =	Tes	st Co	omp	lete	d			
		PT = PF =		Pro	toty	be														
				Pro	toflig	ght														
		F =		Flight																

Full IMPACT Verification Matrix at:

 $http://sprg.ssl.berkeley.edu/impact/dwc/Verification/IMPACTVerificationMatrix_2005-3-25.pdf$

IDPU FM2 Problem/Failures, pre-PER

- All power converters had a problem with the LTC1877 regulator used to generate 2.5V (PFR1007)
 - Part was over-stressed in screening
 - Some parts failed in circuit
 - The burn-in fixture used by the screening house was reworked and a new lot of parts was screened
 - All flight parts have been replaced with parts from this new lot.
- A layout error discovered on the FM1 IDPU LVPS (PFR1012) was corrected on FM2 prior to power-on
- These PFRs have been signed-off and closed (not "Red-Flag" PFRs)

IDPU FM2 Problem/Failures since PER

- PFR1027:
 - The FM1 IDPU failed to turn on at bus voltages below 26V
 - Problem caused by a shorted diode
 - Failure analysis of diode was inconclusive as to cause
 - FM2 diode was replaced with a part from a newer lot date code
 - Prior to the start of FM2 testing
 - No further problems in FM1 or FM2 testing
- **PFR1031**:
 - The FM2 IDPU failed cold-start in Thermal Vac in the first cycle
 - Root cause tracked to a missing part on the LVPS
 - Part was short in original build, overlooked in subsequent completion of the board
 - Without the part a FET gate floats at power-on and can disable the supply from starting (no parts are stressed in this condition)
 - FM1 documentation checked; part was loaded
 - The missing part was installed and the unit returned to thermal vac, worked fine. Later a workmanship vibration was performed.

IDPU FM2 Problem/Failures since PER, Continued

• PFR1032:

- The FM2 IDPU failed cold-start in Thermal Vac in the last cycle
- Root cause tracked to a reverse-biased Tantalum capacitor
 - Silk screen on PWB was wrong
 - Increased leakage cause the circuit to fail
 - No other parts were stressed by the increased leakage
 - An investigation found another instance of this problem in the SEP supply
- All effected units had the reverse-biased capacitors replaced
- Both IDPU units had 4 more cycles of thermal vac and a workmanship vibration
- These PFRs have been signed-off and closed (not "Red-Flag" PFRs)

Waivers

- Pre-environmental waivers related to the IDPU involve waivers to the EMC requirements, including:
 - CCR460-26 and CCR460-41 regarding single-ended interfaces to instruments
 - EMC committee approved IMPACT design
 - CCR460-40 regarding IDPU to STE distributed secondary power
 - EMC committee approved IMPACT design
 - CCR463-132 regarding harness shielding thickness (deep dielectric discharge)
 - EMC committee approved IMPACT design
 - CCR462-9, 19, 66, 134 regarding IMPACT Suite power consumption
- Waivers can be found at:
 - <u>http://sprg.ssl.berkeley.edu/impact/dwc/Waivers/</u>
- All Waivers approved by CCB

Environmental Tests

- Test Plans/Procedures can be found at:
 - <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/</u>
 - EMC: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/IMPACT-BoomSuite-EMC-</u> <u>Acceptance_A.pdf</u>
 - CPT: http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/IMPACT-IDPU-CPT_H.pdf
 - Vibration: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/IMP-585-DOC--</u> %20IDPU%20Vibration%20Test%20Procedure.pdf
 - Tvac: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/IMPACT-IDPU_TvacProc_A.pdf</u>
- Test Reports can be found at:
 - <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestReports/</u>
 - Tvac: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestReports/IMPACT-IDPU-FM2-TVac-Report.pdf</u>
 - Magnetics: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestReports/IMPACT-IDPU-FM2-</u> <u>Magnetics-Report.pdf</u>
 - Vibration: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestReports/IMP-610-</u> DOC%20STEREO%20IDPU%20FM2%20Vibration%20Report%20R-.pdf
 - Mass Properties: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestReports/IMP-626-DOC%20STEREO%20IDPU%20FM2%20Mass%20Properties%20R-.pdf</u>

FM2 IDPU Vibration Testing – Results

- All axes performed
- No notching performed
- Retest performed
- No structural degradation or loss of functionality

FM2 IDPU Thermal Vacuum Test Results

- As mentioned above, the test was interrupted to deal with PFR1031 and PFR 1032
 - All operational cycles, with cold-start demonstration on first and last cycles, CPTs at each soak.
 - Four additional cycles were added after PFR1032 was fixed.
- There were no other problems encountered
- Temperatures were controlled with Thermocouples attached to the outside of the instrument
 - Internal temperature sensor ran 10-15C warmer than the outside when IDPU was operational
- No significant trends or adverse temperature dependencies were seen

IDPU Bakeout Results

- Following thermal vac, a bakeout of the two IDPU units was performed using a TQCM-monitored chamber
- Rates seen were 45Hz/hour, corresponding to an outgassing rate of 3.4E-13 g/cm²/sec (per unit), compared to a requirement of < 5e-11.

FM2 IDPU Magnetics Test

- The IDPU was rotated while monitoring the magnetic field 60cm away.
 - Repeated for each of 3 axes
 - Measured field was ~20nT peak to peak, corresponding to a magnetic moment of 5-10nT-m^3, and a worst case field at the Magnetometer sensor of ~0.08nT (full spacecraft objective is 1nT DC).
 - MAG Col finds the level acceptable.

IMPACT FM2 Boom Suite EMC Tests

- The IMPACT Boom Suite was integrated and completed Acceptance EMC tests per the Project EMC Requirements document (7381-9030C) and the IMPACT FM2 Boom Suite EMC Test Plan
 - Bonding & Isolation
 - CE01, CE03
- Testing completed at U.C. Berkeley
- The IDPU Power Service showed a forest of power converter harmonics, up to 15dB higher than seen on FM1, and up to ~20dB over the specification in places
 - Noise is in the multiples of 50KHz band and is crystal controlled.
 - Almost no noise seen when shielded power cable is used
 - STEREO EMC committee has some concern with this noise
 - Noise probably caused by a problem with the power converter input filter
 - Plan is to deliver as is and re-measure unit on the spacecraft. If levels are unacceptable, unit will be returned to UCB for rework.

FM2 IDPU Common Mode Noise



Performance Data

- Mag, STE-U and Power Supply measurements were trended throughout testing
 - MAG and STE-U analog interfaces included In the IDPU
 - No significant trends were found
- All performance measurements met or exceeded the requirements
 - Current processor load is 58%, code space is 54% of available memory
 - Anticipate no problems accommodating remaining PLASTIC software tasks

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135 25 2.45 4.50 4.67 12.55						103	28	2.00	4 99	4.91	12.07	
Feb 14 2005 0502141544 ftm Dostwid CDT 24 31.7 220 24 2.50 4.00 4.00 12.00	Eeb 14 2005	0502141544 thm	Post-vib CDT	24	31.7	220	24	2.40	4.00	4.07	12.90	EM2
160 35 2/4 2/3 4/30 4/30 12/30 180 35 2/40 4/00 4/20 12/30	1 00 14 2000	0002141044.000	FORCHDOFT	24	91.7	160	24	2.00	4.00	4.00	12.86	1 1912

Sample Trend Data

IDPU FM2 Performance Trend

IDPU Flight Software

- PROM boot code (Rev 0, 2004-10-14) is complete, passed Acceptance Tests, and has been in place for ~1 year. No issues.
- IMPACT Instrument code (Rev 25, 2005-02-25) is complete and passed acceptance tests. No outstanding issues
- PLASTIC Instrument code is still in progress
 - Current version includes PLASTIC rev 2.6
 - Stable but missing several functions
 - Version 2.8 of PLASTIC code in test, includes almost all functions
 - Plan a full up IMPACT/PLASTIC test of the flight software at UNH next week
 - Once PLASTIC code is complete, acceptance tests will be repeated
- Instrument code is held in EEPROM (4 copies), and can be easily loaded from the POC by commands
 - Takes ~ 5 minutes/copy

Operating Hours

- Most of the FM2 IDPU has operated for over 1,000 hours
- Since the last change (reverse biased capacitor, PFR1032)
 - Thermal Vac #2: 119.9 HoursPost Vib CPT: 2.5 Hours
 - FM2 SWEA Thermal Vac 143.3 Hours
 - Boom Suite I&T: 167.0 Hours
 - Total at delivery to APL 432.7 Hours

Quality Assurance

- Parts Lists
 - All IDPU Parts Lists approved
 - Parts qualification, screening (including radiation) completed
- IDPU Materials Lists Approved
- IDPU FM2 PFRs Closed
 - PFRs can be found at: <u>http://sprg.ssl.berkeley.edu/impact/dwc/Problems/</u>
- IDPU-related Waivers Closed
 - Except possible FM2 IDPU EMC Test Results waiver
 - Waivers can be found at: <u>http://sprg.ssl.berkeley.edu/impact/dwc/Waivers/</u>

Outstanding Issues

- IMPACT FM2 EMC Lien
 - Requires a waiver or rework
 - To be decided after measurements on spacecraft
 - May require return of the unit to UCB
- IDPU Flight Software is not complete
 - Will be loaded from the POC via the commanding system when it is complete and passed acceptance tests
 - Should be in place prior to PLASTIC integration on the spacecarft

FM2 Boom Suite Pre Ship Review 2005 May 23



FM2 Boom Suite Pre Ship Review 2005 May 23

IMPACT FM2 SWEA/STE-D



FM2 SWEA/STE-D Test History

- 2/13 4/8 Calibrations
 - Actel input failure (PFR1035); Actel replaced
 - Preamp output failure (PFR1037); preamp replaced, broken HV Filter capacitor replaced; no further anode problems
- 4/13 Vibration, Passed
- 4/15 5/9 Thermal Vac
 - STE-D Door failure during cycle 4; set screw missing (PFR1039), fixed
 - Post STE-D door fix workmanship vibration
 - Failed post-vib CPT; SWEA LVPS transformer broken (PFR1040), fixed
 - Post LVPS fix Workmanship vib, return to thermal vac
 - STE-D Door failed again first cold CPT; latent failure from PFR1040, actuator wires replaced, returned to thermal vac
 - Passed 4 thermal vac cycles including 20 door motions hot and cold on first and last cycle
- 5/10 SWEA Magnetics Test, passed
- 5/11 Integrate with FM2 boom
- 5/12 5/19 Boom suite FM2 Acceptance EMC test (SWEA passed)

SWEA Verification Matrix

						Ve	rifica	ation	Ma	trix f	or S	TER	REO/	IMP	ACT	/SW	/EA					Revision Date: 3/22/2005
																		Revision Number: 4				
	Hardware Description										Tes	t										
Level of Assembly	ltem	Pedestal Interface Tes	Elect. test, rm. Tem	Voltage margins	Bench Calibration	Beam Calibration	Elect. Test, ho	Elect. Test, cold	Vibration, Sinusoidal	Vibration, Random	Self Shock	Acoustics	Thermal Vacuum	Thermal cycle	Thermal balance	Life Test	EMC/EMI	Magnetics	Bakeout	Contamination Inspectior		Comments
C	MCP, F		С	Ű	_	С	-			-		Ű										
С	Preamp, F		С		С																	
С	Optocouplers, F		С		С																	
S	Electronics, EM		С	С	С		С	С														
S	Electronics, F		С	С	С		С	С											С			
I	Instrument, EM1	С	С	С		С												С			UCB test unit	
I	Instrument, EM2		С	С		С						Α									CESR test unit	t
I	Instrument, PF (FM1)	С	С	С		С			С	С	С		С	С	С	С	С	С	С	С		
I	Instrument, PF (FM2)	С	С	С		С			С	С	С		С	С		С	С	С	С	С		
Legen	d:																					
	Level of Assembly		Unit Type X = Te										X =	X = Test required								
													A = Analysis									
	C = Component		BB	=	Bre	adb	oarc						H =	Tes	st at	high	er le	vel	of as	sem	bly (at UCB)	
	S = subsystem		EM	=	Eng	ginee	ering	g Mo	del				C =	Tes	st Co	omp	lete	d				
	I = Instrument		PF	=	Protoflight																	
			F =		Flig	ht																

Full IMPACT Verification Matrix at:

http://sprg.ssl.berkeley.edu/impact/dwc/Verification/IMPACTVerificationMatrix_2005-3-25.pdf

SWEA FM2 Problem/Failures, pre-PER

- FM2 SWEA HV Multiplier part failure (PFR6001)
 - Problem showed up during thermal cycling at low temperature, well below expected onorbit temperatures (all flight units subjected to this test)
 - GSFC Part failure analysis indicates bonding problem
 - Part replaced and board retested, including thermal test
- All power converters had a problem with the LTC1877 regulator used to generate 2.5V (PFR1007)
 - Part was over-stressed in screening
 - Some parts failed in circuit
 - The burn-in fixture used by the screening house was reworked and a new lot of parts was screened
 - All flight parts have been replaced with parts from this new lot and retested
- All IMPACT TiNi P5 Actuators (including SWEA door actuator) were returned to manufacturer for inspection after failure of SEPT door actuator die to assembly tolerance issue (PFR7003)
 - Passed, returned, re-integrated
- A thermistor failed during board-level tests (PFR1021)
 - Probably over-heated during installation; replaced
- These PFRs have been signed-off and closed (not "Red-Flag" PFRs).

SWEA/STE-D FM1 Problem/Failures applied to FM2

- **PFR1028**:
 - FM1 SWEA LVPS failed to start up properly below –16C
 - Fix applied to FM2 SWEA prior to the start of FM2 tests
- PFR1030:
 - FM1 SWEA was found to run too cold during Thermal Balance tests
 - Fix applied to FM2 SWEA prior to the start of FM2 tests
- PFR1033:
 - FM1 SWEA was found to have occasional interface errors with the IDPU (outside the chamber) during thermal balance tests
 - Fix applied to FM2 SWEA prior to the start of FM2 tests
- These PFRs have been signed-off and closed (not "Red-Flag" PFRs)

SWEA/STE-D FM2 Problem/Failures since PER

- PFR1035:
 - FM2 SWEA Anode 12 stopped counting during calibration
 - Prior to qualification tests
 - Problem found to be a damaged Actel I/O
 - Failure analysis found electrical over-stress
 - Actel replaced, no further problems during test (but see PFR 1037)
- PFR1037
 - FM2 SWEA Anode 11 stopped counting during calibration
 - Prior to qualification tests
 - Problem found to be a failed A111F
 - Failure analysis found electrical overstress of several transistors in hybrid
 - Part replaced, failed again
 - Discovered transients on MCP high voltage supply during ramp-up were stressing parts (maybe related to PFR1035)
 - Caused by broken HV filter capacitor; may have been broken during fix for PFR 6001
 - Capacitor, A111F replaced
 - Impedance measured on other A111F and Actel I/Os which may have been stressed; all OK. Spare preamp boards in fabrication, but currently do not plan to replace existing boards if there are no further problems.
 - Unit passed qualification tests with no problems.

SWEA/STE-D FM2 Problem/Failures since PER, Continued

- PFR1039:
 - The FM2 STE-D door failed to actuate during thermal vac
 - Trend data indicates erratic motion since vibration
 - It was found that a set-screw that holds a door adjustment was missing
 - Probably never installed
 - The adjustment was fixed and set-screw installed
 - FM2 STE-U door set screw was checked and is in place; FM1 doors need to be checked (non-invasive)
 - The door workmanship vibrated and tested OK, but failed in thermal vac
 - We believe that the door actuator wire had been partially over-heated during attempts to make it move in the first failure (protective time-outs had been increased in an attempt to make the door move); it worked OK at ambient but not under the stress of cold thermal vac
 - Door actuator wire was replaced and 4 more thermal vac cycles passed with 20 door motions during the first and last hot and cold soaks with no trend in door actuation time.

SWEA/STE-D FM2 Problem/Failures since PER, Continued

- **PFR1040**:
 - The FM2 SWEA LVPS failed after the workmanship vibration associated with PFR1039
 - A broken transformer wire was found
 - The bobbin was not glued to the core, potentially stressing the wire during vibration
 - The transformer was replaced (glued), re-shaken (workmanship), and returned to thermal vac. No subsequent problems.
 - The FM1 SWEA supply as well as the IDPU supplies potentially have this same problem
 - FM2 IDPU was checked; no problem
 - FM1 IDPU and SWEA transformers will be checked at APL by UCB personnel and staked if bobbins found loose.
- These PFRs have been signed-off and closed except 1040 (pending checking transformers in other units). PFR1037 is considered red-flag due to possible latent problems with other preamps

FM2 SWEA/STE-D Waivers

- Pre-environmental waivers related to the IDPU involve waivers to the EMC requirements, including:
 - CCR460-26 and CCR460-41 regarding single-ended interfaces to instruments
 - EMC committee approved IMPACT design
 - CCR460-42, use of combined signal and power harness
 - EMC committee approved IMPACT design
 - CCR463-131, SWEA door activation transient exceeds primary current transient spec (1 time)
 - EMC committee approved
- Also:
 - CCR463-130, vibrate SWEA off the IMPACT Boom
 - CCR463-135, no acoustics test for SWEA
 - CCR460-9, 19, 66, 134 regarding IMPACT Suite power consumption
- Waivers can be found at:
 - <u>http://sprg.ssl.berkeley.edu/impact/dwc/Waivers/</u>
- All Waivers approved by CCB

FM2 SWEA/STE-D Environmental Tests

- Test Plans/Procedures can be found at:
 - <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/</u>
 - EMC: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/IMPACT-BoomSuite-EMC-</u> <u>Acceptance_A.pdf</u>
 - CPT: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/IMPACT-SWEA-CPT_B.pdf</u>
 - Vibration: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/IMP-583-DOC--</u> %20SWEA%20Vibration%20Test%20Procedure.pdf
 - Tvac: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/SWEA%20and%20STE-</u> <u>D%20Test%20Plan.pdf</u>
- Test Reports can be found at:
 - <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestReports/</u>
 - Tvac: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestReports/IMPACT-SWEA-FM2-TVac-Report.pdf</u>
 - Magnetics: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestReports/IMPACT-SWEA-FM2-</u> <u>Magnetics-Report.pdf</u>
 - Vibration: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestReports/IMP-621-</u> DOC%20STEREO%20SWEA%20FM2%20Vibration%20Report%20R-1.pdf

FM2 SWEA/STE-D Vibration Testing – Results

- All axes performed
- No notching performed
- No structural degradation or loss of functionality
- Passed post-vib CPT
- 2 workmanship vibrations (PFR1039, PFR1040)
 - Failed first workmanship post-vib CPT see PFR 1040

FM2 SWEA/STE-D Thermal Vacuum Test Results

- Problems with STE-D door (PFR1039) caused an interruption in the test.
 - Door problem was ultimately fixed, passed final 4 cycles of CPT with extra door actuations.
- No significant trends in performance data (other than STE-D door problems in early cycles)
FM2 SWEA/STE-D Bakeout Results

- After thermal vac the unit was set baked out at +40C while monitoring the TQCM readings
- The unit settled out at ~160Hz/hour, significantly worse that FM1 readings, which was close to chamber background (~50Hz/hour)
- The unit was removed and the empty chamber tested, which measured 150Hz/hour, indicating the chamber has been contaminated
 - Probably due to ChoTherm material used in STE to cold plate heat strap
 - A foil from this second run was analyzed at GSFC and indicates hydrocarbons and silicone present
 - Instrument may have been contaminated, though small change in TQCM rate when instrument removed indicates not a lot of instrument contamination, and no instrument performance degradation was measured
- Plan to repeat outgassing test at GSFC to verify we meet the outgassing requirement

FM2 SWEA/STE-D Bakeout TQCM data



FM2 SWEA/STE-D TQCM without heat strap (22)



FM2 SWEA/STE-D Magnetics Test

- The FM2 SWEA/STE-D was rotated while monitoring the magnetic field 60cm away.
 - Repeated for each of 3 axes
 - Measured field was ~10nT peak to peak, corresponding to a magnetic moment of 2-5nT-m^3, and a worst case field at the Magnetometer sensor of ~1nT (full spacecraft objective is 1nT DC).
 - MAG Col finds the level acceptable.

Performance Data

- SWEA instrument calibrations at CESR prior to delivery to UCB
 - Geometric factor, FOV, energy resolution, background
- SWEA/STE-D system-level calibrations at UCB
 - SWEA Energy sweep calibration
 - STE-D Geometric factor, FOV, energy resolution, threshold, background
- SWEA, STE-D and Power Supply measurements were trended throughout testing
 - No significant trends were found see following charts
- All performance measurements met or exceeded the requirements

SWEA Trend Data

SWEA FM2 Performance Trend (incl SWEA/STE-D LVPS)

			SWEA	ISWEAM	ISWEAD	Bus	Primary					ISWEAS	ISWEAV0	ISWEANR	ISWEAAn	ISWEAD	ISWEADe	Open		
Date	File	Test	Temp	CPTemp	ACTemp	Voltage	Current	2.5V	5VD	5VA	12VA	EDCur	DAC=128	5V	al	ff1	f12	Door?	MCP On	?
4	B0604120510.tlm	D- il CDT				28	143	2.51	4,98	5.09	11.55	<u>-</u>	**************************************		111111					
Apr 11 2005	B0504122244.tlm	PTE-MD CP1		20.7	24.7	24	100	2.51	4.90	5.10	11.09	0.0	42.5	e 08	69.4	464.2	00.4	14.2	Mat	
				30.7	21.7	28	141	2.51	4.90	5.08	11.50	9.0	- 12.0	0.00	00.4	101.2	33.4	no	NO.	
Apr 14 2005	B0504142928.thm	Post-vib. pre-Tvac				24	153	2.51	4.98	5.08	11.53									
S. 6. 6 (1997)		· · · · · · · · · · · · · · · · · · ·	20.4	19.9	21.5	35	141	2.51	4.98	5.07	11.49	5.8	-12.5	6.03	68.4	162	99.4	No	No	
			220025	15222	0122742	28	149	2.51	4.98	5.14	11.66	-0787	0.0000	A350-	2020-0	\$708 E	1922	-0.025	2220	
Apr 19 2005	B0504190633.tlm	Tvac Hot #2				24	167	2.51	4.98	5.16	11.73									
			33.3	32	40	35	149	2.51	4.98	5.14	11.67	15	-12.5	62	68.4	160	98.6	Yes	Yes	
						28	127	2.50	4.98	4.88	11.02									
Apr 19 2005	B0504191813.tlm	Tvac Cold #2				24	132	2,60	4.98	4.89	11.04	1.000								
			-43	-37	-41	35	127	2.50	4.98	4.90	11.02	-18.4	-12.54	5.87	70.48	165.4	103.6	No	Yes	
Apr 20 2005	B0504200000.tlm	Tvac Hot #3	34.1	30.9	35.9	28	152	2.51	4.98	.5.17	11.70	11.4	-12.5	6.19	68.4	161.2	99.4	No	Yes	
Apr 20 2005	B0504200000.tlm	Tvac Cold #3	43.8	-35.8	-44.4	28	125	2.51	4.98	4.90	11.05	-20	-12.54	5.86	70.5	166.3	103.6	No	Yes	
Apr 21 2005	B0504210000.tlm	Tvac Hot #4 (FAIL) Pre-vib CPT (after door &	30.1	38.6	35.1	28	165	2.51	4.98	5.19	11.75	12	-12.5	6.19	68.4	161.2	99.4	No	No	STE-D door failure, P
Apr 27 2005	B0504280000.tlm	transformer fix)	27	28.3	28.8	28	143.8	2.51	4.98	5.08	11.58	9.6	-12.5	6.08	68.4	161.2	99.4	No	No	
874.848.838 8						28	141	2.51	4.98	5.08	11.55									
Apr 29 2005	B0504292057.tlm	Post-vib, pre-Tvac				24	165.5	2.51	4.98	.6.10	11.59									
			22.4	22.1	23.6	35	142.1	2.51	4.98	5.09	11.55	7.2	-12.5	6.04	68.4	161.2	99.4	No	No	
						28	147	2.51	4.98	5.14	11.67									
May 3 2006	B0604292057.thm	Tvac Hot #4				24	161	2.51	4.98	5.12	11.67	1000								
			30.3	34	34	35	149	2.51	4.98	5.10	11.62	10.8	-12.5	6.16	68.4	161.2	99.4	Yes	Yes	
		Trac Cold #4 (after door fix				28	128	2.60	4.98	4.90	11.08	All All All								
Mary 5 2005	B0605060000.thm	new wires)				24	134	2.60	4.98	4.90	11.07									20-motion
		new witch,	-37.4	-17.9	-34.2	35	127	2.50	4.98	4.90	11.06	-16.5	-12.54	5.94	70.1	165.4	102.8	Yes	Yes	door test
Construction and a		2020-0212-022-02				28	162	2.51	4.98	5.12	11.65									
May 5 2005	B0605060000.tlm	Tvac Hot #4	1223270	0.352	100000	- 24	174	2.61	4.98	5.19	11.82	0.575	1000	231	2812	122124	1022-215	121113	22,022	20-motion
			36.4	34.3	38.6	35	163	2.51	4.98	5.17	11.74	12.5	-12.5	6.21	68.4	161.1	98.6	No	Yes	door test
						28	127	2.60	4.98	4.88	10.99									
Mary 5 2005	B0605060000.thm	Tvac Cold #5	20.4			24	132	2.60	4.98	4.87	10.99			F 00	20.00	10000	400.0	200		20-motion
		100 C 100 C 100 C	-38.1	-35.3	-35.3	35	129	2.50	4.96	4.68	10.97	-16.7	-12.54	5.92	70.06	165.4	102.8	No	Yes	door test
May 6 2006	B0505060000.tlm	Ivac Hot #6	33.2	34.8	34.8	28	169	2.61	4.98	5.16	11.72	10.6	-12.5	5.3	68.37	161.2	98.6	No	Yes	MCPOn
Mary 6 2006	B0505060000.tim	Ivac Cold #6	-39.8	-18	-38.4	28	126	2.50	4.96	4.90	11.00	-17.6	-12.54	6.89	/0.48	165.4	102.8	No	Yes	
Mary 6 2006	B0505060000.tim	Ivac Hot #/	39.6	30.3	39.1	25	103	2.01	4.96	0.1/	11.75	13.2	-12.0	62	00	160.3	96.6	NO	res	
LL., 0 0005	DOCOLOGODO #	T				28	125	2.50	4.96	4.67	11.01	<u>.</u>								
may 6 2006	B000500000.00	Ivac Cold #/		24.5	07.0	24	101	2.00	4.90	4.00	44.00	100	45.64	5.00	70.5	405.4	400.0	3 1 22	10.0	20-motion
			-/.b	-34.5	-37.8	35	140	2.00	4.98	4.66	11.00	-16.5	-12.54	6.92	70.5	105.4	102.8	NO	res	door test
May 7 2005	D0605070000 4-	Turne List #8				20	198	2.01	4.90	5.13	11.04									20 meeting
may 7 2006	50000/0000.im	TVac Hot #0	24.2	22.2	95.4	24	14.8	2.51	4.90	5.15	11.09	44.4	13.5	C 10	69.4	100.2	09.6	Ma	Ver	deer test
			34.2	33.2	30.4	35	140	2.01	4.90	0.10	11.00	11.1	- 12.0	0.10	00.4	100.3	90.0	NO	res	door test

STE-D Trend Data

STERU HVIZ HI	POPTILISCE I SENS					Test Pulser Door Science							5	Long Inlegration Door Source (Door LUT)																	
Date	File	Text	Primary Current (mA)	STE-D Temp	STE-D DAC Term	втерол р (тА)	r Open (xec)	Close (terc)	Ras	Rt Rev	Det	Tàrean.	Official (cold)	Gain (keVillin)	Curv. (18x//)	Toot Gain	FWHII (ks//)	Offset (keV)	Gain (keWillinj	Curv. (Inte V)	Gial da	22k+V ch	FWHI	AccTime (2+4)	Offset (keV)	Gain Curv. (beVBinj (1/beV)	Glool / ch	22h+V ch	HIM/ cite	FWI-MI	
	10504120510.5m	Pre-sik CET	1.0		-		0.55 (0.5		387	470.000		D 1	0.00	0.3857	1265-04	12,8479 12,2467	0.812	-0.03	0.4006 6 0.4014 6	63 (F) 63 (F)	47.14	20.25	0.018	000	-0.03 0.00	0.4006 6e-5 (F) 0.4014 6e-5 (F)	48.03	20.05	1246-02	0.006	é.
pr 11 2005	10504122244 Sm	PTE-US CP1	145	21.0	20.4	aus	0.50 (0.5	50 0 507 0 50	190	4212005		2	0.00	0.3500	1.096-04	12,6242	0.854	-0.03	0.4012 6 0.4030 6	e-5 (F)	37.63	18.05	0.961	920	-0.01	0.4008 Se-5 (F) 0.4033 Se-5 (F)	35.25	17.85	3.706-03	0.975	
												D 10	-0.05	0.3501	8.33E-05	13,7273	0.792	0.00	0.4003 64	0-5 (F)	40.14	20.93	0.921		0.00	0.4005 Ee-5 (F)	49.29	20.63	2.046-02	0.623	
Apr 14 2005	105.04142928 \$m	Post-vib, pre-Tvac	141	10.7	19.7	5.1	0.82 /0.7	5 0.62/0.55	20	4212005		2 12	-0.07	0.3857	1.07E-04	12,0029	0.701	-0.00	0.4021 6	e-5 (F)	37.28	15.95	0.525	640	-0.07	0.4022 De-5 (F)	37.75	19.1.3	4.366-03	0.820	
											-	3 12 D 8	-0.05 Red FR	0.3857	9.455-05	13,6780	0.773	-0.02	0.4030 84	64 (F) 64 (F)	37.94	19.23	0.910	<u> </u>	-0.02	0.4030 Se-5 (F)	38.76	18.55	4.805-03	0.015	
Apr 10 2005	20504100033.5m	Type Hot #2	140	-29.4	34.4	10.9	0.38 (0.5	50 0 36/0.50	20	4210005		1 4	No Court				12.22	0.04	0.4032 64	-5 E	50.63	20.56	0,734	1370	D.04	0.4035 Ce-5 (F)	51.63	20.92		0.752	
												3 11	-0.00	0.3858	1.055-04	12,7942	0.000	0.01	D.4045 6	00 (F)	40.35	15.45	0.742		0.00	0.4046 Ce-5 (F)	39.97	18.30	1.096-042	0.784	
										39275		D 2	-0.20	0.3554	8.846-05	13,6521 12,3547	0.550	-0.07	0.4043 Ex 0.4006 Ex	5.5	48.65	10.90	0.712	10288	-0.08	0.4046 Se-5 (F) 0.4090 Se-5 (F)	49.25	20.29		0.706	
upr 19 2005	205041013131	Type Cold 42	127	-55.5	40.7	-18.3	1.12 / 1.1	2 125/1.35	20	5/3/2005		Z 15	-0.22	0.3505	1.045-04	12.8067	a 494	-0.12	0.4075 6	e-5 (F)	39.05	15.86	0.667	450	-0.1.3	0.4077 Ce-5 (F)	37.45	18.91		0.043	
												0 10	-0.22	0.3505	9.01E-05	13.5636	0.523	-0.12	0.4078 6	14 (F)	30.90	21.05	0.706		-0.10	0.4074 Se-5 (F) 0.4023 Se-5 (F)	38,55	21.31	2,675-02	0.664	
Apr 20 2005	0504200000 fm	Tyes Hot #3	152	-34.5	342	10.2	0.38 /0.5	0.5010.50	20	5/3/2005		1 1	No courts			-		0.05	0.4030 64	0-5 (F)	50.55	20.85	0.761	410	0.04	0.4040 Sec5 (F)	50.50	20.84	4.116-02	0.755	
		a morenera	11.000		1.1.1.1					5.100.0110		2 10	-0.04	0.3855	0.886-05	13.5743	0.540	0.02	0.4043 6	10.0	39.15	17.91	0.793		0.02	0.4042 08-5 (F	39.50	18.52	4416-02	0.500	
		11 30 -2013/03/2	19253	902-32	194.66	1250			1000	- waand		0 10	-0.17 No F#	0.3861	D.DEE-OS	12,8767	0.537	-0.00	0.4042 64	2.5	50.22 49.15	19.40	0.708	100000	-0.10	0.4051 De-5 (F) 0.4004 De-5 (F)	49.50	20.35	5.225-02	0.895	
pr 20 2005	20504200000 111	Type Cold #0	125	-88.5	-40	-21	1.12 (1.1	2.1.3671.88	150	5/3/2005	1 8	2 21	-0.19	0.3863	1.076-04	12,5960	0.513	-0.13	D.4050 E	=5 (F)	38.43	19.52	0.654	3330	-0.12	0.4070 Sei5 (F)	37.86	18.78		0.661	
				212-22			100.00					0 10	-0.20	0.3863	1.021-04	12.0160	0.504	-0.09	0.40/3 6	10.04	30.04	10.20	0.677		-0.11	0.4077 08-5 (F)	30.55	10.33		0.000	See PER 10
lçr 21 2005	0504210300 £m	Type Hot #4 [FAL]	145	-23.0	42.4	14.8	FAIL	FAL				1 10 Z 17	5																		
			3								-	3 12 D 11	-0.00	0.3504	9.05E-05	137144	0.619	0.03	0.326 6	e-5 (F)	40.97	20.00	0.964		0.00	0.3900 Ce-5 (F)	45.61	20.15	1246-02	0.963	
pr 27 2005 1	0504250000 5m	Pre-vib CPT (offer doo	143.8	22.5	28.6	9.1	0.50 (0.5	0 0.367 0.75	20	5/3/2005	1	1 10	0.02	0.3854	1235-04	12,5696	0.747	0.02	0.4010 64	-4 (E)	48.29	20.31	0.866	54540	0.01	0.4013 Ge-5 (F)	48.67	20.22	1.075-02	0.550	
A		a contact for the	98979	1000000	11.200		10.1. N. 10. 11		a	5.050.000		2 14	-0.04	0.3859	8,705-05	13.6763	0.807	-0.02	0.4024 6	0-5 (F)	37.40	15.13	0.071		-0.02	0.4025 8e-5 (F)	38.00	18.01	1.005-02	0.040	
			2020	1000	19294	12.2.4				and		D 10	-0.00	0.3500	1,205-04	13,6261	0.770	-0.01	0.4011 6 0.4015 6	14 A	48,04	20.28	0.200	10000	-0.01	0.4011 De-5 (F) 0.4024 De-5 (F)	45.21	18.36	2,265-02	0.014	
pr 29 2005	0504292057.5m	Post-vib, pre-Tvisc	141	15.6	22.3	6.5	0.02 10.0	2 0 50r1.00	20	5/3/2005	1	2 19	-0.09	0.3800	1.055-04	12.8414	0.892	-0.08	0.4025 6	+5 (F)	37.92	15.97	0.526	700	-0.07	0.4023 Re-5 (F)	33.90	17.46	1.678-02	0.815	
												3 12 D 1	-0.05 Nofil	0.3450	9.546-05	13,5718	0.745	-0.04	0.4020 8	64 (F) 64 (F)	30.30	20.00	0.806		-0.04	0.4026 6e-5 (F) 0.4021 6e-5 (F)	25.11 50.28	16.72	7.362-02	0.504	
Very 3 2005	10504030000 5m	Type Hot#4	147	-23.5	337	11.23	0.35 (0.5	0.5010.50	20	5/3/2005		1 1	No dala		- Internet	120440	0.011	D.05	0.4036 54	0-5 (E)	50.49	20.21	0.778	1350	0.03	0.4037 de-5 (F)	50.56	20.55	2 805-03	0.754	
1000000	25-22/2017	31 - 49 GL 54 GL	242430	2000	245335	22/00/2	0934046	Y 1887 B 899	2 32	222,2334		3 12	-0.04	0.3855	9.046-05	13,5163	0.054	D.00	0.4045 6	-10	40.24	18.17	0.505	0.175800.0	0.00	0.4045 De-5 (F)	39.52	18.21	3.436-02	0.807	
		Type Cott #4 /after										0 10	-0.17	0.3563	9.00E-05 1.18E-04	13,5001	0.536	-0.06	0.4052 64 0.4094 64	14 (F)	49.54	19.77	0.727		-0.08	0.4054 6e-5 (F) 0.4094 6e-5 (F)	45.49	18.97	2.216-02	0.750	
Very 5 2005	mt 0003333333333	doorfix, sev vireal	1.28	-89.1	-33.5	-15.4	1.12 (11	2 1.12/1.12	20	5/3/2005		2 10	-0.19	0.3504	1.055-04	12,7130	0.996	-0.14	0.4055 64	e-5 (F)	37.42	18.14	0.719	690	-0.1.3	0.4082 6e-5 (F)	35.08	17.05	1121,5425	0.702	
		61 22										D 10	-0.12	0.3863	9,915-05	13,4562	0.569	-D.09	0.4078 6	60 (F) 60 (F)	50.32	20.35	0.071	-	0.11	0.4031 Ge-5 (F)	50.39	20.26	1576-02	0.576	
Ary 5 2005	105050503033	Type Hot #4	152	-36	35	12.3	0.38 /0.5	10 0.36/0.36	20	5/32005		1 7	0.00	0.3854	1,215-04	12,3569	0.041	0.05	0.4043 64	-4 (F)	48.55	10.90	0.756	1200	0.04	0.4045 6e-5 (F)	49.22	20.02	1.525-02	0.797	
10												3 12	-0.02	0.3502	9.87E-05	13,4487	0.679	0.03	0.4052 6	64.6	40.03	19.02	0.554		0.02	0.4058 Se-5 (F)	39.64	17.97		0.635	
1981189	2020202	1 0001100	(6.25)	- 2022	- 28	123	0.512624	2012/02	1.12	sereni		0 10	-0.15	0.3500	1,235-04	13,5082	0.591	-0.08	0.4024 64	65 (F) 65 (F)	50.08	10.55	0.053	223	-0.07	0.4050 Se-5 (F) 0.4092 Se-5 (F)	49.30	10.92	2.116-02	0.749	
who were a	100000000000000000000000000000000000000	Traic Caid #5	120	-00 /	-30	-1/2	1.12/11	12 1.1211.25	20	5432005		2 10	-0.10	0.3501	1.005-04	12,7155	0.505	-0,13	0.4083 64	=5 (F	35.36	17.60	0.710	610	-0.13	0.4083 Ce-5 (F	35.95	17.75		0.715	
										-		0 1	-1.04	0.3859	0.725-05	13.4619	0.009	0.04	0.4027 64	-3 (F)	50.10	10.00	0.832		0.03	0.4028 6e-5 (F)	51.66	20.14	1.806-02	0.876	
Ary 6 2005	0505060000 \$1	Tyse Hot #6	159	-36	33.4	10	0.50 (0.5	50 0.367 0.50	20	5(32005		1 7	-0.04	0.3854	1245-04	12,3570	0.644	-0.04	0.4044 64 0.4040 64	e-5 (F)	50.00	20.47	0.795	870	-0.04	0.4042 Se-5 (F) 0.4040 Se-5 (F)	49.14	18.73	0.0000000	0.791	
												3 11	-0.02	0.3854	1.015-04	13,4187	0.653	0.00	0.4053 6	64 (F	40.53	15.07	0.837		0.01	0.4053 6e-5 (F	39.75	17.84		0.824	
		The Cold St.	1.10	00 T		40.4	1.17.47.1		-	1.00001		1 7	-0.17	0.3804	1.196-04	12,3173	0.541	-0.07	0.4082 6	e0 (F) e6 (F)	43,44	16.93	0.546	1.000	-0.05	0.4004 Cer.5 (F)	41.42	10.00	1.116-02	0.678	rectob pound
who were i	10000000031	Telic Cold Pa	1.40	961.2	0910	-10.4	1.12(11)	14211420	- 20	5632005	1.1	2 12	-0.20	0.3502	1.055-04	12,7165	0.957	-0.11	0.4078 84	e-5 (F)	35.94	17.91	0.975	01160	-0.13	0.4055 Se-5 (F)	37,03	17.83		0.667	
	Distant America	n and a second second	112.47		- name		and an international of			- name of		D 10	-0.03	0.3855	0.435-05	13.4647	0.090	0.03	D.4029 6	=4 (F)	51.00	20.22	0.549		0.03	D.4029 Re-5 (F)	50.39	19.63	1.055-02	0.855	
Very 6 2005	10505060000 5m	Type Hot#7	153	-32	38.9	12.6	0.35 (0.2	95 0.50 / 0.50	20	5(32005		1 8	-0.00	0.3855	1.085-04	12.5535	0.636	-0.03	0.4045 E	e-5 (F) e-5 (F)	40.44	20.36	0.759	630	-0.03	0.4040 6e-5 (F) 0.4050 6e-5 (F)	49.34	18.74	4216-03	0.792	
- unanos o	210022041010	20 - 300 State Sec.	A5320	5.000	- 10 (M)	0.00			2 - 19 A			3 12	-0.02	0.3457	1.005-04	134124	0.672	0.01	0.4227 6	0.5 (F)	30.36	17.92	0.834	1000	0.01	0.425 (e-5 (F)	40.09	17.80		0.630	
and 2005	0505050000 5=	Trac Fold #	170	202.011	1.74.8	246.62	100/11	2 1 12/1 12	- 30	5/3/2005		1 7	-0.11	0.3500	1215-04	12,3305	0.719	-0.05	0.4052 6	e-5 (F)	48.76	10.48	0.687		-0.05	0.4004 Se-5 (F)	42.10	19.53		0.664	and of some
what we are a		The cost of			1.000	-16.4	120111					2 10	-0.15	0.3500	1.105-04	127243	0.576	-0.13	0.4082 64 0.4076 64	-5 E	36.29	17.81	0.588		-0.13	0.4082 6e-5 (F) 0.4075 6e-5 (F)	30.55	17.49		0.700	
												0	-0.04	0.3804	9.36E-05	13.5002	0.092	0.03	0.4030 6	-5 (F)	50.77	10.90	0.244		0.03	0.4330 Se-5 (F)	50.07	10.82	1.176-02	0.635	
May 7 2005	0505070000 \$1	Type Hot #8	148	-35	33.9	°0	0.38 /0.5	50 0.367 0.50	20	5/32005	1	2 12	s -0.04	0.3455	1.076-04	12.0004	0.664	-0.03	0.4041 0	eG (F) eG (F)	38.26	18.84	0.201	580	-0.03	0.4051 Re-5 (F)	37.54	18.14	3.046-02	0.765	
52										_		3 11	0.00	0.3962	1.015-04	13,4400	0.677	0.01	0.4055 64	0-5 (F)	40.65	18.05	0.826		0.02	0.4056 Re-5 (F)	39.26	17.81		0.624	
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													19					10					- 3								

FM2 SWEA/STE-D Operating Hours

- Most of the FM2 SWEA/STE-D has operated for over 500 hours trouble free
- Since the last change (PFR1039, STE-D door failure)
 - Thermal Vac: 44.1 Hours
 - Boom Suite I&T, EMC: 152.3 Hours
 - Total: 196.4 Hours

Quality Assurance

- Parts Lists
 - All SWEA/STE-D Parts Lists approved
 - Parts qualification, screening (including radiation) completed
- SWEA (CESR) and UCB Materials Lists Approved
- SWEA/STE-D FM2 PFRs Closed
 - except PFR1040 (pending inspection of other units)
 - PFRs can be found at: <u>http://sprg.ssl.berkeley.edu/impact/dwc/Problems/</u>
- SWEA/STE-D-related Waivers Closed
 - Except possible EMC Waiver
 - Waivers can be found at: <u>http://sprg.ssl.berkeley.edu/impact/dwc/Waivers/</u>
- Acceptance Data Package Prepared

SWEA/STE-D Outstanding Issues

- SWEA Transformer failure still open (PFR1040).
 - Pending inspection of other units for loose bobbins
- SWEA Bakeout to be repeated at GSFC
 - after delivery to APL, but prior to installation of boom onto spacecraft
- FM1 STE Doors to be checked to verify door adjustment set-screw in place (PFR1039)

FM2 Boom Suite Pre Ship Review 2005 May 23

IMPACT FM2 STE-U



FM2 STE-U Test History

- 6/15 7/13 First assembly, test
- 7/7 8/13 Calibrations
- 8/2 8/13 Thermal Vac
 - STE-D door position sense switch failed cycle 4 (PFR1013); fixed
 - STE-D door failed during post PFR1013 100 cycle test cold (PFR1014); fixed
 - No problem in final 4 cycles
- 8/16 8/19 Mated with FM2 boom, tests OK
- 8/26 FM2 boom vibration (with STE-U and MAG instruments)
 - STE-U removed after vib for boom thermal vac to avoid contaminating STE
- 9/18 STE-U re-integrated with FM2 boom (final)
- 12/14 5/20 Support FM2 IDPU Environmental Tests, Boom Suite I&T

STE-U Verification Matrix

Level of Assembly	ltem	Elect. test, rm. Temp	Bench Calibration	Elect. Test, ho	Elect. Test, cold	Vibration, Sinusoidal	Vibration, Random	Self Shock	Acoustics	Thermal Vacuum	Voltage margins	Thermal cycle	Thermal balance	Life Test	EMC/EMI	Magnetics	Beam Calibration	Bakeout	Contamination Inspection	Comments
С	Detector, EM	C		_					,											
С	Detector, F	С																	С	
С	Preamp, BB	С	С																	
I	Instrument, ETU	С	С	С	С				Α		С			С			С			
I	Instrument, PF (FM1)	С	С			С	С	С		С	С		С		С	С	С	С	С	
I	Instrument, PF (FM2)	С	С			С	С	С		С	С				С		С	С	С	
Legen	d:																			
	Level of Assembly	Uni	t Typ	ре						X =	Tes	st ree	quire	d						
										A =	Ana	alysi	s							
	C = Component	BB	Bre	adb	oarc	ł				H =	Tes	st at	high	er le	vel c	of as	sem	bly		
	I = Instrument	EM	Eng	ginee	ering	g Mo	del			C =	: Tes	st C	omp	lete	d					
		PF	Pro	tofliq	ght															
		F =	Flig	ht																

Full IMPACT Verification Matrix at:

http://sprg.ssl.berkeley.edu/impact/dwc/Verification/IMPACTVerificationMatrix_2005-3-25.pdf

FM1 STE-U Problem/Failures, applied to FM2 prior to Qualification

- **PFR1008**:
 - FM1 STE-U door failed to actuate properly when cold (-100C)
 - Caused by mechanical part out of tolerance (few thousandths)
 - Build special tooling to ensure tolerance, rework all STE door parts
 - Test all doors at ambient in an LN2 bath, plus 100 motion burn-in
- PFR1009:
 - Busts of noise in FM1 STE-U detectors when warm
 - Problem identified as oscillations in the preamp
 - Adjusted preamp compensation in all STE units
- **PFR1011**:
 - FM1 STE-U door failure after boom suite vibration
 - Caused by a pulley in the door mechanism hung up on a screw
 - Screw was missing its washer, and so extended into the pulley
 - Washer installed, fixed problem
 - Verified on all other STE units

FM2 STE-U Problem/Failures

- PFR1013
 - STE-D door position sense switch failed (closed) in thermal vac cycle 4
 - Door sense switch dimension out of tolerance, making intermittent contact with cam
 - Switch adjusted, perform 100-cycle test (ambient), return to thermal vac
 - Inspect all other STE door sense switches (no problems found)
- PFR1014
 - STE-D door failed during door cycle test in thermal vac following PFR1013 fix
 - Door was actuated too soon after previous actuation; actuator wires had not cooled and de-tensioned (takes much longer in vacuum).
 - Actuator wires replaced, tested ambient and cold
 - Minimum time between actuations enforced in IDPU software
 - It was subsequently determined that FM1 STE-U door had also been overheated during post-qualification calibrations. Wires were replaced and unit requalified (see FM1 PSR for details)
- These PFRs have been signed-off and closed (not "Red-Flag" PFRs)

FM2 STE-U Related Waivers

- Pre-environmental waivers related to STE-U involve waivers to the EMC requirements, including:
 - CCR460-40 and CCR460-41 regarding single-ended interfaces to IDPU and secondary power distribution
 - EMC committee approved IMPACT design
 - CCR463-37, STE door actuator wire exposed voltage
 - EMC committee approved IMPACT design
- Also:
 - CCR463-133, STE-U thermal balance off boom
 - CCR463-135, no acoustics test for STE-U
 - CCR460-9, 19, 66, 134 regarding IMPACT Suite power consumption
- Waivers can be found at:
 - <u>http://sprg.ssl.berkeley.edu/impact/dwc/Waivers/</u>
- All Waivers approved by CCB

FM2 STE-U Environmental Tests

- Test Plans/Procedures can be found at:
 - <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/</u>
 - CPT: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/IMPACT-IDPU-</u> <u>CPT_H.pdf</u>
 - Vibration: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/IMP-562-DOC-</u> <u>A%20Vibration%20Test%20Procedure.pdf</u>
 - Tvac: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/IMPACT%20STE-U%20TVac%20Test%20Plan.pdf</u>
 - EMC: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/IMPACT-BoomSuite-</u> <u>EMC-Acceptance_A.pdf</u>
- Test Reports can be found at:
 - <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestReports/</u>
 - Tvac: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestReports/IMPACT-STEU-</u> <u>FM2-TVac-ReportB.pdf</u>
 - Vibration: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestReports/IMP-582-DOC%20STEREO%20Boom%20FM2%20Vibration%20Report%20R-1.pdf</u>

FM2 STE-U Thermal Vacuum Test Results

- Problems with FM2 STE-D door actuation during 4th cycle (PFR 1013, 1014)
 - Fixed, cycling resumed at cycle 4, 4 more cycles.
- No significant trends or adverse temperature dependencies were seen

FM2 STE-U Bakeout Results

- After the last cycle of thermal vac the unit was baked out at +40C while monitoring outgassing with a TQCM at -20C.
- Rates seen were 47Hz/hour, close to chamber background.
 - Considered acceptable by Project Contamination Control

FM2 STE-U Vibration Testing

- Vibrated on FM2 Boom
 - Described in Boom section.
 - No problems

FM2 STE-U Performance Data

- FM2 STE-U calibrations at UCB
 - Geometric factor, FOV, energy resolution, threshold, background
- Key measurements were trended throughout testing (IDPU and Sensor)
 - No significant trends were found see following charts
- All performance measurements met or exceeded the requirements

FM2 STE-U Trend Data

Date File Bec 14/2004 0412121011 Bec 17/2004 041217112 Bec 27/2004 0412217010 Bec 30/2004 041220300 Bec 30/2004 041220300		Fast Falser Door Source Long Misgration Door Source (Door LUT)													10														
Dec 14/2004 04/1215/01 Dec 17/2004 04/1217/12 Dec 27/2004 04/1227003 Dec 20/2004 04/1227003 Dec 20/2004 04/1220300	Test	5	TE-U Promap orap Torap	DPU Temp	STRUCE ONA	Open	Close (nec)	Rim	Fit Rev	Det.	Threats	Offset (beV)	Gain JeoWiller	Carv.	Teat Gain	FWHM #xeV)	Othet (JavV)	Gain Ca JosVEiro (18	rv. Wj GlaeV cha	22 w V ch	FWHN	AccTinue (sec)	Offset (kw)	Gain Curv. (In//The) (Ifko/)	Gew ci	a 13koV d	a SilleV da	FW-BI	
Dec 17/2004 04/22/7012 Dec 27/2004 04/22/7012 Dec 20/2004 04/22/7012 Dec 20/2004 04/22/2020	alm IDPU Pro Vib	GP1	22	253	16.5	0.38 (0.50	4E01850	150	2/14/2006	1	1	a 10 a 05 a 05	0.385	5 106E-04 9 120E-04 5 117E-04	13.2248	1 302 1 290 1 105	0.07 0.01 0.09	0.3054 Ee-5 0.3774 Ee-5 0.3701 Ee-5	F) 40.00 F) 44.54 F) 35.65	22.21 21.34 10.94	1.216 1.123 1.050	8/0	-0.40 -0.07 -0.07	0.3877 Ge-5 JF) 0.3775 Ge-5 JF) 0.3772 5.046-05	\$1.65 \$1.60 \$1.22	20.90 19.43 18.52	5.38E-00 2.94E-00 5.97E-00	1.215 1.138 1.080	
Enc 27 2004 04 1227083 Enc 20 2004 04 1227083 Doc 20 2004 04 1220300	din 10PUPod W	OPT .	22.6	27.2	46.7	0.38 (0.50	0.2510.36	150	2/18/2006	1	1	0.11 0.05 0.05	0.3054	9 10/E-04 2 10/E-04 5 19/E-04 5 19/E-04	13.3958	1.002	0.13 0.06 0.05	0.3045 Ee-5 0.3023 Ee-5 0.3772 Ee-5 0.3772 Ee-5	E 2159 E 4244 E 4254	20.35 21.95 20.89 19.97	1.001 1.92 1.94 1.94 1.051	780	-0.15 -0.01 -0.07 -0.09	0.3855 3.88E-05 0.3855 4.90E-05 0.3972 6e-5 (F) 0.3977 6e-5 (F)	31.51 39.24 40.71 33.22	18.45 20.24 19.40 18.31	7.50E-00 1.53E-02 1.11E-02 1.10E-02	1.922	•
Dec 30 2004 04 1230000	des IDPU Track	1.82	155	15.4	14	0.50 10.50	03811050	150	2/18/2006	3	1	0.14	0.395	0 1035-04	13.3974 12.0259 12.5907	1.051	-0.13 0.00 0.01	0.3545 Ep-5 0.3521 Ep-5 0.3752 Ep-5	F) <u>321.08</u> F) 40.20 F) 40.24	193.86 22.08 20.01	1.08 0.950 0.912	863	-0.15 -0.02 -0.01	0.3850 4546-05 0.3853 3.466-05 0.3701 6e-5 (F)	\$2.02 40.35 41.60	18.39 19.50 16.64	9.325-00 7.526-00 6.24E-00	0.955	2
Dec 20 2004 04 1220300	ules IOPUTrack	4.402,	(Å	ma	16.6	0.40 (0.50	aw(050	490	2002006	1	-	4.05	0.354	5 12E-04 5 12E-04 5 12E-04 5 14E-04	12,0030	0.512	4.04	0.3044 (a-5 0.3020 (a-5 0.3020 (a-5	P) 36.31 P) 34.82 P) 40.14 P) 44.01	2022 2125 2049	0.043	750	-0.02 -0.02 -0.01	0.366 (es.s.p.) 0.3840 7.546-05 0.3855 (e-5.jF) 0.3763 (e-5.jF)	1010 4103 4172	18.39	1.34E-02 1.77E-00 9-0E-00	0.451 0.477 0.946 0.4925	
Doc 30 2004 04 1230000	at at at a state.	i Sekati ne	10. 	1000	1/20			100		3		0.04	0.394	5 13E-04 3 13E-04 5 4.0E-05	127802 13.0464 13.1521	0.772 0.810 1.000	4.01	0.3/6/ Ee-5 0.3/5/ Ee-5 0.3945 Ee-5	F) 36.49 F) 35.57 F) 44.03	19.07 19.53 21.20	0.854	1774	0.01	0.3365 Ge-5 F) 0.3845 5.47E-05 0.3852 3.70E-05	34.19 32.25 34.85	17.86 18.23 19.83	1 506-02	0.836	•
	Ofm IDPU Trac D	ki #2	14.8	21.1	15	0.50 10.50	0.38110.38	150	2158(2006)	23		0.14 0.21 0.01	0.3%	3 9 DEL-08 3 4 STE-08 7 140E-04	12.0390	0.545	0.12	0.37/1 5e-5 0.3709 5e-5 0.3824 5e-5	6 34.50 6 34.50 6 34.50	1916 1916 1915	0.923	9800	415 417 402	0.3776 6e-5 F) 0.3844 4.00E-05 0.3856 5.23E-05	3199 32.14 40.91	18.14 18.00 19.03	7.066-00 8.556-00 9.758-00	0.924	•
Jag 3 2005 050103000	din IDPU Tracili	± #3,	12.1	12.1	16.6	0.50 (0.50	0301050	150	2/18/2006	12		0.05	0.394 0.394 0.395	2 143E-04 1 136E-04 4 123E-04	12.0120 12.7801 13.0401	0780 0735 0794	0.01 0.01 0.08	0.3763 Ee-5 0.3764 Ee-5 0.3542 Ee-5	F) 46.18 F) 36.12 F) 35.05	20.54 20.05 20.04	0.848 0.790 0.855	1570	-0.01 -0.03 -0.05	0.3N64 Ge-5 JF) 0.3N65 Ge-5 JF) 0.3M45 5.20E-05	41.47 3193 32.76	10.04 17.77 16.34	1.025-02 1.105-02 5.271-00	0.845 0.807 0.865	
Jun 3 2005 080103000	alim IDPU Teac Co	ыю	14.4	-149	20.8	0.50 10.42	0301038	150	2/18/2005	1 2 3		0 017 017 017 019	0.3%	7 A D/E-05 1 10/E-04 4 10/E-04 4 A D/E-05	13.1543 12.2790 12.096 13.208	1.005 0.000 0.042 0.042	0.13 0.11 0.13 0.16	0.3120 Ee-5 0.3771 Ee-5 0.3777 Ee-5 0.3538 Ee-5	P) 44.14 P) 46.27 P) 35.36 P) 34.10	21.02 20.30 19.02 19.00	1.055 0.041 0.041 0.041	2230	015	0.3854 3.45E-05 0.3770 6e-5 (F) 0.3774 6e-5 (F) 0.3845 4.37E-05	40.35 4150 33.76 32.25	19.84 18.85 18.22 16.14	7.754-00 1.384-02 1.394-02 4.324-05	1.042 0.942 0.892 0.892	
Jun 4 2005 050104000	den IDPU Tueck	4.84	122	85.5	14.4	0.50 10.50	0.3010.38	150	2/18/2005	1		0.00	0.354	D 130E-04 3 143E-04 1 144E-04	12,0010 12,0100 12,7807	0.847 0.747 0.741	0.01 0.02	0.3126 Se-5 0.3100 Se-5 0.3109 Se-5	F) 44.16 F) 46.41 F) 35.30	20185 20167 19181	0.897 0.857 0.790	1800	-0.01 -0.01	0.3857 5.558-05 0.3764 6e-5 (F) 0.3764 6e-5 (F)	40.77 4195 33.67	19.41 18.92 17.93	1.17E-02 1.17E-02 1.12E-02	0.921 0.436 0.796	1
Jun 4 2005 050104000	den IDPU Trac D	ын	15.3	-13.6	20.5	0.50 10.50	0.387/0.38	150	2/18/2005	1		0.00	0.3985 0.3985 0.3985	2 138-04 8 8 998-05 2 1038-04 3 1038-04	13.062	0.946	0.13 0.13 0.10 0.13	0.3656 Ee-5 0.3765 Ee-5 0.3765 Ee-5	P) 25.46 P) 40.55 P) 44.41 P) 35.90	20.58 20.53 19.65	1.001 0.942 0.840	35210	-0.05 -0.15 -0.11 -0.12	0.3850 4.97E-05 0.3770 6e-5 (F) 0.3776 6e-5 (F)	40.33 4145 3365	12.04 19.65 18.96 18.20	1.235-02 1.235-02 9.464-00	0.450	•
Jun 5 2005 000100000	den IDPU Tuacili	4.85	125	15.5	14.4	0.50 / 0.75	0.387/050	150	2182005	3		0.19	0.395	7 A BAE-08 0 128E-04 3 145E-04	13.2208	0.832	0.15 0.01 0.00	0.3027 Se-5 0.3026 Se-5 0.3763 Se-5	F) 54.00 F) 44.10 F) 44.95	11.92 21.72 19.67	0.80	2210	0.17	0.3842 4.845-05 0.3851 7.268-05 0.3742 6e-5 (F)	\$2.07 40.85 41.85	17.52 19.43 18.60	1.006-02	468.0 116.0 523.0	-8
	10 - 51,1976720 			19400	1350		000042546	1.0		3	1	0.00	0.3993	5 1.38E-04 5 1.27E-04 5 8 85E-05 3 1.07E-04	13.0390	0,799	0.00	0.3009 Se-5 0.3044 Se-5 0.3044 Se-5	F) 25.08 F) 25.49 F) 42.53 F) 45.15	21.05	1.01	2000	0.07	0.3%6 Ge-5 (F) 0.3%6 5.15E-05 0.3%6 6.30E-05 0.3%6 6e-5 (F)	32.40 40.00 41.34	17.60 (8.07 (9.20 (8.24	12/1-02	0.458	3
Jaar 5 3005 Deb 106000	Dina IDPU Trac D	ki/S	142	-15.3	20.7	0.50 10.62	0.3010.38	150	21462005	23	1	0.16	0.395	6 9726-05 8 8 875-05 4 1266-04	12,0025 13,2180 12,0244	1.107	0.11 0.15 0.01	0.37/4 Ee-5 0.3038 Ee-5 0.3824 Ee-5	P) 32.N P) 34.00 P) 42.70	19.61 19.55 21.58	0.845	2570	0.15	0.3777 Ge-5 (F) 0.3841 5.01E-05 0.3854 5.73E-05	33.59 32.37 40.52	18.05 17.85 19.42	1.054-02 1.415-02 1.554-02	0.802	
Jan 6 3008, 080108000	der IDPU Track	A FD	12.2	86.7	34	0.50 10.65	0.381(0.3%	150	2182005	2		0.05 0.07	0.325	2 13E-04 9 13E-04 7 12E-04	12:5899	1.099	401	0.3712 Ee-5 0.3705 Ee-5 0.3943 Ee-5	F) 45.14 F) 32.63 F) 34.26	20.14 19.67 19.44	0.810	50.0	0.03 -0.02 -0.05	0.3762 Ge-5 JF) 0.3768 Ge-5 JF) 0.3588 7 2966-05	4164 3151 3245	15.85	1.306-02 1.106-02 7.706-03	0.429	
Jan 6 2005 020108000	alim IDPU Teac D	el Mi	15.5	-15.6	21	0.50 10.63	0.381 0.50	150	2/18/2005	3		012	0.3988	0 10/E-04 2 10/E-04 7 A ME-05	12,7802 12,0418 13,2240	0.853 0.852 0.857	012 012 017	0.3771 Be-5 0.3775 Be-5 0.3039 Be-5	F) 44.08 F) 35.54 F) 34.86	20.59 20.20 19.44	0.921	1500	012	0.3771 Ge-5 F) 0.3776 Ge-5 F) 0.3846 2.626-05	41,25 33,90 32,02	18-82 17-92 17-92	9.87E-00 1.08E-02 1.53E-02	0.9321	
Jun 7 2005 02010/000	alen ISPA Tancili	4.67	127	80	4.8F	0.50 10.63	0.381 0.50	150	2/18/2005	0.0.2			0.354	5 130E-04 2 141E-04 2 130E-04	12,000/ 12,0101 12,7778	0.625	0.0	0.3824 6e-5 0.3764 6e-5 0.3766 6e-5	F) 40.94	10.67 10.41 10.50	0.825	1530	0.01	0.3%2 Ge-5 (F) 0.3%7 Ge-5 (F) 0.3%7 Ge-5 (F)	40.50 41.96 33.52 73.60	10.61 16.60 17.76	1.125-02 1.475-02 1.066-02	0.897	
Feb 2 2005 000200000	ilm IDPU Tax21	bi <i>i</i> H	15.1	826	17	0.50 (0.75	0.751050	450	2/14/2/006	1		0.01 0.03 0.03	0.385	1 1292-04 5 1425-04 4 1335-04	12.9757 12.0044 12.7730	0.854 0.799 0.764	0.01 0.03 0.01	0.3026 Ee-5 0.3702 Ee-5 0.3704 Ee-5	F) 40.18 F) 44.46 F) 35.36	20.75 19.23 19.20	0.001	610	0.01 -0.01 -0.02	0.3%7 5.57E-05 0.3%75 6e-5 (F) 0.3%55 6e-5 (F)	\$9.71 40.78 \$2.97	18.57 17.90 17.00	1.408-02 1.408-02 3.528-00	0.946 0.546 0.520	Note: During EPU FMC Thermal rac: STE-U decrements to have been breaking been long during schedure causing scheduling and
Feb 2 2005 050202172	alm 1020 hac20	6.01	207	22.9	208	0.50 (0.75	0.751050	150	2/14/2006	1		0.00	0.394	5 130E-04 5 3 44E-05 3 107E-04 7 107E-04	12,7713	1.047	0.10	0.3047 Ee-5 0.3025 Ee-5 0.3725 Ee-5 0.3725 Ee-5	P) 30.20 P) 40.92 P) 40.92 P) 40.38 P) 40.38	20.15 10.04	1.057	180	0.10	0.3852 5.16E-05 0.3854 5.27E-05 0.3770 6e-5 F) 0.3775 6e-5 F)	31.86 31.97 31.92 77.95	17.32 18.00 17.25 10.04	7.528-02 1.538-02	0.475	times between coming of one switch and maching the slop
Lab 1 2005 Detailed an	the DBU back	-	16.0	. 113		0.00.00.00	075 (050	00	2014/2019	1		0.02	0.3%	4 A NE-06 3 1 ME-04 5 1 45E-04	12,2131	0.855	0.1/ 0.01 0.01	0.303 Ee-5 0.3023 Ee-5 0.3703 Ee-5	E) 32.00 F) 41.44 F) 40.27	17.85 20.95 19.20	DBZ	1000	4.15	0.3MS 4.20E-05 0.3MS 5.0M-05 0.3MS 6e-5 F)	3106 30.53 40.84	12.17 18.51 18.00	1.206-02	0.921	• 2
			100		1944		0.2010.00			23		0.05	0.394	5 1 0E-04 9 1 2E-04 3 9 2E-05	12,7762 13,0068 13,1103	0.749	0.00	0.3705 Ee-5 0.3522 Ee-5 0.3541 Ee-5	F) 3493 F) 3330 F) 4336	17.61 15.00 20.45	0.8%		-0.01 -0.10	0.3762 Ge-5 (F) 0.3846 5.28E-05 0.3848 5.45E-05	32.79 51.58 31.90	17.15 17.20 18.00	5.508-00 8.584-00 1.138-02	0.425	•
Feb 3 2005 050203000	olen i DPU friedzic	st /0	20.7	48	20.2	0.50 10.75	0.2510.50	150	21582005	2	_	4.10 4.10 4.17 4.17	0.385	5 105-04 5 9405-05 4 135-04	12,9002 12,9002 13,2071 12,8603	0.535	0.10 0.12 0.14 0.01	0.3777 Ee-5 0.3777 Ee-5 0.3943 Ee-5 0.3157 Ee-5	F) 40.42 F) 34.92 F) 30.02 F) 41.91	194 194 195	0.015	460	-0.11 -0.11 -0.17 -0.00	0.3771 Ge-3 (F) 0.3773 Ge-3 (F) 0.3845 4.516-05 0.3845 9.716-05	40.30 52.55 3123 51.53	17.00	1106-02 1.064-02 4.728-00	0.904	
Feb 4 2005 050204000	olen ICPU Taac2)	D1/0	16.5	211	14.1	0.50 10.75	0.2510.50	150	2/18/2005	123		0.04	0.354	5 14E-04 5 13E-04 0 130E-04	12,8911 12,7983 13,0022	0.764 0.744 0.809	0.02 0.02 0.03	0.3750 Ee-5 0.3755 Ee-5 0.3540 Ee-5	F) 42.89 F) 34.04 F) 33.99	18.73 18.84 17.94	0.633	10210	0.00 -0.02 -0.09	0.3759 Ge-5 (F) 0.3765 Ge-5 (F) 0.3845 5.836-05	40.41 32.95 31.17	18.05 17.01 17.36	1 625-62 7.64E-60 1 38E-62	0.455 0.422 0.475	
Feb 4 2005 050204000	dim (DPU Trac210	14/6	10.1	6.0	10.6	0.50 (0.75	0.25/0.50	110	2/18/2006	1 2 3		0 11 0 11 0 17	0.38%	9 34E-05 1 108E-04 7 104E-04 5 9 30E-05	13,1467 12,7705 12,0048 13,2083	0.850 0.855 0.815	4 10 4 11 4 11 4 15	0.3043 Ee-5 0.3772 Ee-5 0.3779 Ee-5 0.3259 Ee-5	F) 41.28 F) 40.15 F) 34.37 F) 34.00	19.72 19.05 19.12 19.12	0.040	3000	-0.11 -0.10 -0.11 -0.17	0.3847 5.534-05 0.3749 6e-5 (F) 0.3775 6e-5 (F) 0.3845 4.506-05	\$0.03 \$0.40 \$2.55 \$126	16.71 17.97 16.97 17.11	1.458-02 1.458-02 1.068-02 1.058-02	0.927	
80. 								20	2158(2006)	12		0.05	0.354	1 12E-04 1 14E-04 1 12E-04	12.1163 12.6362 13.0200	1 135 1 153 1 075	0.02	0.3549 Ep-5 0.3752 Ep-5 0.3757 Ep-5	F) 42.02 F) 40.53 F) 32.17	20.04 18.83 17.74	1.1543	2510	0.01	0.3856 5.062-05 0.3N22 Ge-5 (F) 0.3N22 Ge-5 (F)	39.45 39.15 31.23	16.02 16.02	9.971-00 5.506-00 6.006-00	1 190 1 104 1.075	
Feb/7 2005 05020/000	lin IDPU Taic21	Hild	14.0	20.8	14.1	0.50 10.63	0.381050-	150	2/14/2005	0		4.01	0.3546	5 130E-04	12.1301	0.010	0.04	0.3941 Ee-5	D <u>3349</u>	31.10	0.051	1520	0.02	0.3852 7.57E-05 0.3855 5.96E-05 0.3822 6e-5 F) 0.3825 6e-5 F)	30.93 30.61 40.45	15.04 15.04 15.05	137E-02 137E-02 136E-02	0.912	-
<u>.</u>								20	24422005	3	5	0.15 0.12	0.395	9.045-05 1.1045-04	13,0001	1.525	-0.10 -0.09	0.3546 Ee-5 0.3765 Ee-5	F) 40.40 F) 41.72	19.57 19.72	1321	100	-0.08 -0.08 -0.10	0.3844 5.78E-05 0.3832 9.43E-05 0.3770 Ge-5 F)	31.75 37.89 39.15	17.22 18.95 18.32	1 154-02 7 134-00 8 194-00	0.852 1.326 1.247	•
Feb 7 2005 050207000	ulm 1090 Trac210	et #1	16.3	-11.6	20.8	0.50 (0.75	0.251050-	<i>"</i>		3		0.13	0.3989	5 9 10E-04	13.3002	1.093	012	0.379 Ee-5 0.3103 Ee-5	P) 32.65 P) 32.46	10.50	1.021		-0.11 -0.15 -0.14 -0.12	0.3776 de-5 (F) 0.3837 4.00E-05 0.3856 2.06E-05 0.3856 2.06E-05	3129 30.69 31.60 40.75	16.07 17.36 18.77	6.225-00 7806-00 4976-00	1.098	-
2								150	2/18/2006	2		0.07	0.392	1 1105-04	15,2951	0.634	0.07	0.325 5e-5	P) 40.90	10	0.941	1300	0.13	0.3772 9853 (F) 0.3779 665 (F) 0.3844 4175-05 0.3858 4132-05	\$2.75 31.32 34.05	17.02 17.02 17.22 18.04	7.158-00 6.488-00 1.148-02	1.048	-
Feb 14/2005 000214154	liten IDPU post-	ф	22.5	317	18.5	0.50 10.50	0.25/0.38	150	2/18/2005	2	1	0 00 0 00 0 11	0.354	1 124E-04 9 117E-04 5 108E-04	12,0127 13,0127 13,2678	0.527	-0.05 -0.07 -0.16	0.3757 Be-5 0.3772 Be-5 0.3051 Be-5	F) 41.44 F) 34.96 F) 32.26	17.71 17.71 19.05	0.850	130	-0.05 -0.05 -0.14	0.3771 Ge-5 (F) 0.3775 Ge-5 (F) 0.3845 B20E-05	40.52 52.41 51.15	16.04	4054-00 7/03E-00 7/50E-00	0.894 0.917 0.94E	

FM2 STE-U Trouble-Free Operating Hours

- Since the last STE-U change (PFR1014, STE-U door failure)
 - Thermal Vac cycles 4-7 111.1 Hours
 - Boom, Suite I&T
 4.5 Hours
 - FM2 IDPU Thermal Vac 297.5 Hours
 - FM2 IDPU Post-vib CPT 2.5 Hours
 - FM2 Boom Suite I&T 167.0 Hours

Total: 582.6 Hours

Quality Assurance

- Parts Lists
 - All STE-U Parts Lists approved
 - Parts qualification, screening (including radiation) completed
- UCB Materials Lists Approved
- STE-U FM2 PFRs Closed
 - PFRs can be found at: <u>http://sprg.ssl.berkeley.edu/impact/dwc/Problems/</u>
- STE-U-related Waivers Closed
 - Waivers can be found at: <u>http://sprg.ssl.berkeley.edu/impact/dwc/Waivers/</u>
- Acceptance Data Package Prepared



FM2 STE-U Outstanding Issues

• None

FM2 Boom Suite Pre Ship Review 2005 May 23

IMPACT FM2 MAG Sensor



FM2 MAG Test History

- 5/18/04 FM1 MAG Sensor and electronics delivered to UCB
 - Calibrated at GSFC using IDPU simulator GSE
 - FM2 MAG Electronics integrated into FM2 IDPU, goes through qualification testing with IDPU (see IDPU part of this PSR)
 - FM2 MAG Sensor integrated with FM2 Boom, goes through qualification testing with Boom (see Boom part of this PSR)

MAG Test Matrix

	Verification Matrix for STEREO/IMPACT/MAG																Revision Date: 2005-3-27		
																Revision Number: 3			
	Hardware Description									Tes	t								
Level of Assembly	ltem	Elect. test, rm. Temp	Bench Calibration	Elect. Test, hot	Elect. Test, cold	Vibration, Sinusoidal	Vibration, Random	Shock	Acoustics	Thermal Vacuum	Voltage margins	Thermal cycle	Thermal balance	>100 hours Operation	EMC/EMI	Magnetics	Bakeout	Contamination	Comments
С	Sensor, EM	Sensor, EM C C																	
С	Sensor, F	С	С	С	С	С	С	С		С		С	С	С	С		С	С	Sensor thermal balance by heritage
С	Electronics, EM	С	С	С	С									С					
С	Electronics,F	С	С	С	С	С	С			С	С	С		С	С		С	С	
Legen	d:																		
	Level of Assembly	Uni	t Ty	ре						X =	Tes	st red	quire	d					
										A =	Ana	alysi	s						
	C = Component BB Breadboard H = Test at higher level of assembl												bly						
	I = Instrument EM Engineering Model (Boom for sensor, IDPU for e												elec	tronics)					
	PT Prototype C = Test Completed																		
		PF	Pro	toflig	ght														
	F = Flight																		

Full IMPACT Verification Matrix at:

http://sprg.ssl.berkeley.edu/impact/dwc/Verification/IMPACTVerificationMatrix_2005-3-25.pdf

FM2 MAG Problem / Failures / Waivers

• No MAG specific PFRs or Waivers

FM2 MAG Qualification Tests

- FM2 MAG Electronics tested with FM2 IDPU
 - See FM2 IDPU section of this PSR
- FM2 MAG Sensor tested with FM2 Boom
 - See Boom section of this PSR
- Trouble-Free Operating Hours (prior to delivery to APL)
 - Same as FM2 IDPU, 433 Hours
 - longer if you add hours accumulated prior to latest IDPU fix, which did not effect MAG sensor or electronics; ~1000 hours.

FM2 MAG Performance

- FM2 MAG meets Performance Requirements as certified by MAG team prior to delivery
- FM2 MAG performance parameters tended through IDPU and Boom Qualification Tests – see next chart
 - No significant trends

FM2 MAG Trending

MAG FM2 Performance Trend

											IFC X			IFC Y			IFC Z		1
Data	File	Tart	MAG	IDPU	Heater	DMC	DMS	DMC-	IFC Fit	Sample	Amulituda	Pata	Sample	Amplitude	Pata	Sample	Amplituda	Pata	
Date	File 01101c100cm.il	I est	remp	remp	UITHEP	RMSX	Rinay	RING2	nev orderooos	time .	Ampintude	Rate	nine	Ampinude	Rate	04.0	Ampirtude	Nate	Class Base
Dec 14 2004	0412151207.0m	IDPU Previb CPT	24	26.3	10.4	6.0	2.0	9.0	2/18/2005	-22.4	8901	9.3	-22.6	8868	9.6	-21.3	9306	8.7	Clean Roo
Dec 17 2004	0412171124.tim	IDPU Post vib CP1	23.3	27.2	10.3	8.0	5.0	9.0	2/18/2005	-22.0	8908	9.7	-23.8	88/0	10.4	-21.5	9299	8.9	Clean Roo
Dec 27 2004	0412270938.tlm	IDPU I vac Hot #2	17.6	65.8	14.5	1.4	1.4	1.2	2/18/2005	-21.5	8883	9.4	-18.9	8849	10.0	-23.1	9387	10.0	Shout
Dec 30 2004	0412300000.tlm	IDPU Tvac Hot #2	14.8	60.6	11.8	1.6	1.8	1.1	2/18/2005	-21.1	8883	9.3	-20.9	8852	9.6	-21.9	9383	9.5	Shout
Dec 30 2004	0412300000.tlm	IDPU Tvac Cold #2	15.1	-21.1	8.7	1.5	1.6	1.3	2/18/2005	-22.6	8858	10.8	-20.5	8826	10.1	-22.4	9372	10.3	Shout
Jan 3 2005	0501030000.tlm	IDPU Tvac Hot #3	13.9	62.7	15.1	1.3	3.4	1.8	2/18/2005	-19.1	8879	8.2	-20.5	8849	9.3	-22.3	9382	9.5	Shout
Jan 3 2005	0501030000.tlm	IDPU Tvac Cold #3	14.7	-14.9	9.2	1.5	4.6	1.2	2/18/2005	-22.3	8856	10.7	-20.9	8828	10.4	-22.5	9372	10.4	Snout
Jan 4 2005	0501040000.tlm	IDPU Tvac Hot #4	14.2	65.5	15.2	1.6	5.3	1.8	2/18/2005	-20.6	8881	9.0	-20.9	8850	9.5	-22.8	9384	9.8	Snout
Jan 4 2005	0501040000.tlm	IDPU Tvac Cold #4	16.4	-13.6	9.7	1.5	2.1	1.7	2/18/2005	-21.5	8854	10.3	-20.3	8826	10.1	-22.6	9370	10.5	Snout
Jan 5 2005	0501050000.tlm	IDPU Tvac Hot #5	16.2	66.5	16.1	2.0	2.3	1.5	2/18/2005	-18.2	8879	7.8	-20.6	8851	9.4	-23.0	9383	9.9	Snout
Jan 5 2005	0501050000.tlm	IDPU Tvac Cold #5	15.9	-15.3	9.6	2.0	1.7	1.5	2/18/2005	-21.7	8853	10.4	-21.1	8822	10.5	-21.9	9368	10.1	Snout
Jan 6 2005	0501060000.tlm	IDPU Tvac Hot #6	15.3	66.7	15.4	1.7	2.6	2.2	2/18/2005	-21.7	8879	9.5	-21.4	8848	9.8	-22.0	9385	9.5	Snout
Jan 6 2005	0501060000.tlm	IDPU Tvac Cold #6	16.6	-15.6	9.4	1.4	4.2	1.0	2/18/2005	-22.3	8855	10.7	-20.0	8822	9.9	-22.0	9366	10.2	Snout
Jan 7 2005	0501070000.tlm	IDPU Tvac Hot #7	14.5	60	14.7	1.9	1.8	1.3	2/18/2005	-20.0	8880	8.8	-20.5	8853	9.4	-22.1	9380	9.6	Snout
Feb 2 2006	0502020906.tlm	IDPU Tvac2 Hot #1	17.1	63.6	14.9	2.1	2.5	1.4	2/18/2005	-20.6	8882	9.0	-21.3	8849	9.7	-23.4	9386	10.1	Snout
Feb 2 2005	0502021725.tlm	IDPU Tyac2 Cold #1	21.2	-22.9	8.3	2.1	4.5	2.6	2/18/2005	-21.0	8852	9.8	-21.0	8818	10.3	-23.6	9370	10.9	Snout
Feb 3 2006	0502030000.tlm	IDPU TVac2 Hot #2	20.5	71.2	15.2	1.5	4.1	2.5	2/18/2005	-19.7	8880	8.5	-20.1	8849	9.1	-22.0	9383	9.4	Snout
Feb 3 2006	0502030000.tlm	IDPU TVac2 Cold #2	22.1	-4.8	10	2.0	5.4	1.7	2/18/2005	-21.7	8855	10.3	-20.4	8831	10.0	-22.2	9371	10.2	Snout
Feb 4 2006	0502040000.tlm	IDPU TVac2 Hot #3	20.1	71.1	15.2	1.4	5.5	2.6	2/18/2005	-20.5	8879	8.9	-20.4	8848	9.2	-21.9	9386	9.4	Snout
Feb 4 2006	0502040000.tlm	IDPU TVac2 Cold #3	20.3	-6.8	10	1.7	3.4	1.6	2/18/2005	-22.0	8858	10.4	-20.5	8825	10.1	-23.1	9371	10.7	Snout
Feb 7 2006	0502070000.tlm	IDPU TVac2 Hot #4	17.8	70.8	15.2	1.6	4.8	3.8	2/18/2005	-21.8	8879	9.5	-20.2	8848	9.1	-21.9	9383	9.4	Snout
Feb 7 2005	0502070000 tim	IDPU TVac2 Cold #4	18.7	-11.6	93	14	3.5	17	2/18/2005	-22.3	8858	10.7	-207	8823	10.3	-22.8	9370	10.6	Spout
Feb 14 2005	0502141544.tlm	IDPU post-vib	23.3	31.7	8.7	6.5	8.1	7.3	2/18/2005	-20.6	8901	8.6	-152	8881	6.4	-23.0	9327	9.7	Clean Roo
1 00 14 2000		inter post the	20.0		0.1	0.0			2.10.2000			0.0					5521		Gicannico
													1						

MAG Open Issues

- MAG needs thermal blankets installed
 - Flight blankets in fabrication
 - Must remove MAG sensor from boom to install blankets



FM2 Boom Suite Pre Ship Review 2005 May 23

IMPACT FM1 BOOM



FM2 Boom Test History

- 09 Jan 2004 Assembly Begins.
- 26 Aug 2004 Assembly Completed.
- 26 Aug 2004 Magnetometer Installed.
- 26 Aug 2004 STE-U Installed.
- 27 Aug 2004 Vibration Test. Completed.
- 27 Aug 2004 STE-U Uninstalled. Removed before Boom TV to prevent
- contamination of the STE detectors.
- 27 Aug 2004 14 Sept 2004
- Thermal Vacuum Test. Completed.
- 09 Sept 2004 Boom Primary Actuator Harness Failure (PFR-1020).
- 14 Sept 2004 Bakeout Qualification. Completed.
- Sept 2004 STE-U Installed.
- 12 May 2005 SWEA Final Integration. Boom Complete.

Verification Matrix for STEREO/IMPACT/Boom Re	Verification Matrix for STEREO/IMPACT/Boom Revision Date: 5/22/2004													
	evision Date: 5/22/2005													
	Revision Number: 7													
Hardware Description Test														
Deployment Contamination Bakeout Bakeout Magnetics EMC/EMI End-to-End Conductance Test Thermal Balance Thermal Vacuum Force Margin Deployment Acoustics Self Shock Vibration, Random Vibration, Sinusoidal Stiffness, Proof Load Deploy Test, Thermal Vac Deploy Test, Room Temperature E	Contamination Inspection													
C Proto P P P														
C EM P P I I P P	Qual levels													
C PF/FS P P P P P P P P P P P	Protoflight levels													
C FM1 P	P Protoflight levels													
C FM2 P	P Protoflight levels													
S FM1 P	Protoflight levels													
S FM2 P P P P P P	Protoflight levels													
Legend:														
Level of Assembly Unit Type Status														
C = Component PT = Prototype X = Test required														
S1 = with MAG, STE-U PF/FS Protoflight / Flight Spare A = Analysis														
S = with all instruments FM1 = Flight unit #1 P = Performed														
FM2 = Flight unit #2														

Boom Verification Matrix

Curtis

Boom FM2 Problem/Failures

- PFR1016, Boom Lock Pins
 - Glue residue from the assembly of the tubes was found in several Lock Pin bores.
 - The Boom was disassembled and all bores were cleaned.
 - No additional locking problems.



- PFR1020, FM2 Actuator Harness Fault
 - FM2 Hot Vacuum deployment failed on the primary circuit
 - Harness checked and fault localized.
 - Harness corrected and verified in Cold deployment.
 - This PFR has been signed-off and closed
FM2 Boom Suite Pre Ship Review 2005 May 23

FM2 Boom Related Waivers

- 460-42, Combined Signal and Power Harness
 - Closed 2002
- 463-116, Cork Brake Pad Contamination Waiver
 - Closed 03 FEB 2004
 - Complete Material List approved



FM2 Boom Test Procedures

- Test Plans/Procedures can be found at:
 - <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/</u>
 - EMC: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/IMPACT-EMC_C.pdf</u>
 - CPT: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/IMPACT-IDPU-CPT_H.pdf</u>
 - Vibration: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/IMP-562-DOC-</u> <u>A%20Vibration%20Test%20Procedure.pdf</u>
 - Tvac: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/IMP-563-DOC-</u> <u>A%20Thermal%20Vac%20Cycliing%20Test%20Plan.pdf</u>
 - <u>TBal:</u>

http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/BOOMTBTESTPLANFINAL. pdf

FM2 Boom Test Reports

- Test Reports can be found at:
 - <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestReports/</u>
 - EMC: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestReports/02-15-05%20UCBerkeley%20Stereo%20Impact%20Prep%20TR.pdf</u>
 - Tvac: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestReports/IMP-591-DOC-RB%20STEREO%20Boom%20FM2%20Thermal%20Cycling%20Report.pdf</u>
 - Tbal: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestReports/BOOMThermalTestandAn</u> <u>alysisReport.pdf</u>
 - Magnetics: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestReports/IMPACT-BOOM-Magnetics-Report.pdf</u>
 - Vibration: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestReports/IMP-582-DOC%20STEREO%20Boom%20FM2%20Vibration%20Report%20RA.pdf</u>
 - Alignement: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestReports/IMP-592-</u> DOC-R-%20STEREO%20Boom%20FM%20Alignment%20Test%20Report.pdf
 - Stiffness: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestReports/IMP-614-DOC-</u> <u>R-%20STEREO%20Boom%20FM%20Stiffness%20Test%20Report.pdf</u>
 - Mass Properties: <u>http://sprg.ssl.berkeley.edu/impact/dwc/TestReports/IMP-624-DOC%20STEREO%20Boom%20FM2%20Mass%20Properties%20R-1.pdf</u>

FM2 Boom Mass Properties Testing

- Mass: 13.98 kg
- CG: X, Y, Z =
 -455 mm, -123 mm, -113 mm
- MOI: (by similarity)
 - Ixx = 0.130 kg m²
 - lyy = 4.668 kg m^2
 - Izz = 4.852 kg m^2



FM2 Boom Magnetic Testing

- Part level magnetic survey was conducted for the Boom. The two "hot" items are:
 - Flyweight Brake Mechanism: ~100 nT @ 5" (1.2 m from Magnetometer when stowed, 4.4 m from Magnetometer when deployed resulting in 0.003 nT field at Magnetometer)
 - Preload Spring: ~100 nT @ 5" (1.1 m from Magnetometer when stowed, 4.3 m from Magnetometer when deployed resulting in 0.003 nT field at Magnetometer)

Boom Functional Test

- Boom functional testing
 - Deployments were performed to ensure proper functionality
 - Full deployment is defined as:
 - actuation via powering the SMAR (Shape Memory Alloy Release) pin puller,
 - Stacer initiation via Deployment Assist Device (DAD),
 - full deployment via Stacer,
 - extension of all Tubes
 - and locking of all Lock Pins
 - A total of four (4) full deployments will be made to verify the functionality of the Boom
 - One deployment remains TBC at Spacecraft EMC

FM2 Boom Deployment Test History

STERE	0 800	M Dep	loyment	Log			1	1
FM2 Boo	m	1	12	3	la ner-		3	
Number	Date	Time	Deploy	Actuation	Mass Dummies	Test Purpose:	Time	Comments:
Τ1	8/2/2 004	12:14 PM	FULL	Actuated	Yes	Tuning - Cable length, harness braid		Force Margin met, Alignment met, Stiffness File: ImpBoomFM2Deploy1_XYPI ane,XZPJane, 3 Look Pins did not extend (See PR1016)
1	87257 2004	12:07 PM	FULL	Actuated	SWEA MD	Functionality Test	6.3+ s	FM2 Mag installed, Harness installed, Force Margin met, Alignment met, Stiffness File: ImpBoomFM2 Deploy2_XYPlane, XZPlane
2	9/8/2 004	10:32 AM	FULL	Actuated	SWEA MD	Thermal Vacuum Hot, Post- vibration	5.9 s	FM2 Mag installed, Force Margin met, Alignment met, Stiffness File: ImpBoomFM2 Deploy8_XZPlane, XYPlane, Primary Actution circuit migwired, Secondary circuit fired normally (See PR1020)
3	97137 200 4	3:37 PM	FULL	Actuated	SWEA MD	Thermal Vacuum Cold	5.9 s	FM2 Mag installed, Force Margin met, Alignment met, Stiffness File: ImpBoomFM2 Deploy4_XZPlane, XYPlane
4				Actuated	FM2 Instruments	EMC Deployment		Integrated with S/C, Blankets Installed

FM2 Boom Suite Pre Ship Review 2005 May 23

Boom Alignment Test

- Alignment
 - Alignment was verified on Flight Model Booms after each deployment using a digital inclinometer with resolution of 0.01 degree
 - Requirement: 52.5 arcmin
 - FM2 maximum: 13.6 arcmin



FM2 Boom Suite Pre Ship Review 2005 May 23

Boom Stiffness Test

- Stiffness
 - Stiffness was verified for each Flight Model Boom.
 - Requirement: > 0.5 Hz and not coincident with another device (i.e., solar cells, SWAVES antennas)
 - Fundamental Frequency: ~1.9 Hertz





STEREO Boom FM1 Hot Deploy XZ

STEREO Boom FM1 Cold Deploy XZ



FM2 Boom Vibration Test

- Vibration
 - Boom was vibrated to levels specified in Environmental Spec (Sine Sweep, Random) at Quanta Laboratories, Santa Clara, CA
 - Vibration spectra are notched per the PF Control Envelopes (next slides, approved by T. Betenbaugh, 08 March 2004)
 - Boom was vibrated powered as in launch: survival heaters on
 - Boom was vibrated with FM2 STE-U and FM2 MAG installed
 - An instrument CPT was performed before and after vibration
 - A harness connectivity test was conducted before and after vibration
 - A full deployment was conducted to verify functionality after vibration. This deployment occurred as the hot deployment of thermal vacuum cycling, thus following the "test as you fly" philosophy.

Boom Random Vibration Test, Notched Spectra, Example



Curtis

Boom Thermal Vacuum Test

- Test Plan:
 - Preliminary bakeout, up to 48 hours at +40C
 - Thermal vac
 - 7+ survival cycles: +40C to -33C
 - One hour soak minimum
 - Flight thermistor used as reference
 - Temperatures from verified thermal model, with at least 10C margins.
 - MAG CPT on each operational cycle
 - Deployment on seventh hot soak and seventh cold soak
 - Qualification bake-out

Anawin2 - [Ra	amp Soak Eo	dit]						
e System Ch	annel Setup	Recipe Log	s Trend Plot	View Help				
ast Recipe Dov	wnloaded						Login	
						ſ	Logout	
ave Ready			P	rofile : STER	EO TV 3.0			
Spin	40-				1			7.9
Left Bight								1
Show Seas	0				11			<u>_</u>
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First 1 Last 6 Segment # Name Seg Time Total Time Setpoint Tolerance	-40- 00:0 startup 00:00 00:00 27 0	00 01:05 0 2 r_rt>hot 00:04 00:04 40 0)2:10 03:14 3 hot soak 05:00 05:04 40 0	4 04:19 0: 4 04:19 0: 1 19 0:24 00:24 05:28 -33 0	5:24 06:29 5:24 06:29 cold soak 05:00 10:28 -33 0	6 10:20 10:48 27 0	, 1 138 09:43 7	3 10:48 8
First 1 Last 6 Segment # Name Seg Time Total Time Setpoint Tolerance Trigger #1	-40- 00:0 1 startup 00:00 00:00 27 0 NONE	0 01:05 0 2 r_rt>hot 00:04 00:04 40 0 NONE	12:10 03:14 3 hot soak 05:00 05:04 40 0 NONE	4 04:19 0: 4 04:19 0: 1 hot>cold 00:24 05:28 -33 0 NONE	5:24 06:29 5:24 06:29 cold soak 05:00 10:28 -33 0 NONE	6 r_cold>rt 00:20 10:48 27 0 NONE	1 :38 09:43 7	<u>)</u> 3 10:48 8
First 1 Last 6 Segment # Name Seg Time Total Time Setpoint Tolerance Trigger #1 Trigger #2	-40- 00:0 1 startup 00:00 00:00 27 0 NONE NONE	0 01:05 0 2 r_rt>hot 00:04 00:04 40 0 NONE NONE	12:10 03:1 3 hot soak 05:00 05:04 40 0 NONE NONE	4 04:19 0: 4 04:19 0: 1 hot>cold 00:24 05:28 -33 0 NONE NONE	5:24 06:29 5:24 06:29 cold soak 05:00 10:28 -33 0 NONE NONE	6 r_cold>rt 00:20 10:48 27 0 NONE NONE	;38 09:43 7	3 10:48 8
First 1 Last 6 Segment # Name Seg Time Total Time Setpoint Tolerance Trigger #1 Trigger #2 Event #1	-40 00:0 1 startup 00:00 00:00 27 0 NONE NONE NONE	0 01:05 0 2 r_rt>hot 00:04 00:04 40 0 NONE NONE NONE	12:10 03:14 3 hot soak 05:00 05:04 40 0 NONE NONE NONE	4 04:19 0: 4 04:19 0: 1 10:24 00:24 05:28 -33 0 NONE NONE NONE	5:24 06:29 5:24 06:29 cold soak 05:00 10:28 -33 0 NONE NONE NONE	6 107:34 08 6 10:20 10:48 27 0 NONE NONE NONE	1 38 09:43 7	3 10:48 8 8
First 1 Last 6 Segment # Name Seg Time Total Time Setpoint Tolerance Trigger #1 Trigger #2 Event #1 Event #2	-40- 00:0 1 startup 00:00 00:00 27 0 NONE NONE NONE	0 01:05 0 2 r_rt>hot 00:04 00:04 40 0 NONE NONE NONE NONE	2:10 03:1- 3 hot soak 05:00 05:04 40 0 NONE NONE NONE NONE	4 04:19 0: 4 04:19 0: 1 hot>cold 00:24 05:28 -33 0 NONE NONE NONE NONE	5:24 06:29 5:24 06:29 cold soak 05:00 10:28 -33 0 NONE NONE NONE NONE	6 r_cold>rt 00:20 10:48 27 0 NONE NONE NONE NONE	7 7	3 10.48 8
First 1 Last 6 Segment # Name Seg Time Total Time Setpoint Tolerance Trigger #1 Trigger #2 Event #1 Event #2 Event #3	-40- 00:0 1 startup 00:00 00:00 27 0 NONE NONE NONE NONE	0 01:05 0 2 r_rt>hot 00:04 00:04 40 0 NONE NONE NONE NONE NONE	2:10 03:14 3 hot soak 05:00 05:04 40 0 NONE NONE NONE NONE NONE	4 04:19 0: 4 04:19 0: 1 hot>cold 00:24 05:28 -33 0 NONE NONE NONE NONE NONE NONE NONE	5:24 06:29 5:24 06:29 cold soak 05:00 10:28 -33 0 NONE NONE NONE NONE NONE NONE	F_cold>rt 07:34 08 F_cold>rt 00:20 10:48 27 0 NONE NONE NONE NONE NONE NONE	1 :38 09:43 7	3 10:48 8
First 1 Last 6 Segment # Name Seg Time Total Time Setpoint Tolerance Trigger #1 Trigger #2 Event #1 Event #2 Event #3 Event #4	-40- 00:0 1 startup 00:00 00:00 27 0 NONE NONE NONE NONE NONE NONE	0 01:05 0 r_rt>hot 00:04 00:04 40 0 NONE NONE NONE NONE NONE NONE NONE	2:10 03:1 3 hot soak 05:00 05:04 40 0 NONE NONE NONE NONE NONE NONE NONE	4 04:19 0: 4 04:19 0: 1 hot>cold 00:24 05:28 -33 0 NONE NONE NONE NONE NONE NONE NONE NONE NONE	5:24 06:29 5:24 06:29 cold soak 05:00 10:28 -33 0 NONE NONE NONE NONE NONE NONE NONE NONE	6 1	1 1 38 09:43 7	3 10:48 8

Boom Thermal Vacuum Test, Actuator Current

- SMAR deploy voltage was monitored for thermal dependence
- Voltage:
 - 28V is armed
 - ~17V is firing
 - 0V is fired
- Actuation time:
 - 30ms hot
 - 60ms cold



Boom Qualification Bake-out Test

TQCM data taken for 8 consecutive hours with the chamber at 40C and the TQCM at -20C

Final Rate: 50 Hz/hr



Other Boom Environmental Tests

- Thermal Balance
 - Thermal balance was completed for Protoflight and was not repeated for the Flight Models (Waiver submitted)

- EMC with the suite
 - Described in IDPU section
- Acoustic Testing
 - No foils or other acoustic sensitivities
 - Built into the vibration spec (APL 9003)



FM2 Boom Test Results

- The FM2 Boom has been deployed 4 times. 3 were full deployments (all subsystems were included)
- The structure has been shown repeatedly to have a first frequency of ~1.9 Hz.
- The structure is stable in thermal cycling.
- The actuation and deployment systems function at survival temperatures.
- The structure, actuation and deployment systems function after sinusoidal and random vibration.
- Vibration levels were determined for all attached instruments.
- The Boom has been found to align the Magnetometer to within 13.6 arcmin (root of sum of squares) in the XY and XZ spacecraft planes. (The requirement is 52.5 arcmin.)
- The deployment system functions with adequate force margin.

Boom Handling

- The Flight Model Booms must be stored in a Class 10,000 cleanroom at all times.
 - The Flight Hardware shall be doublebagged with Llumalloy bagging material or equivalent whenever outside a Class 10,000 clean room following thermal vacuum bakeout.
- The Boom Stowing Procedure, IMP-449-DOC, has been designated a hazardous procedure due to physical contact with the stacer.
 - Basic precautions are required, i.e., experienced personnel must complete this operation and stowing GSE should be utilized.





Quality Assurance

- IMPACT Suite QA Issues worked through Ron Jackson at UCB
 - UCB Independent Inspections by Jeremiah Tolbert,
 - Supported by GSFC QA
 - Signs off on work orders, inspections, parts & materials lists, etc.
- Parts Lists
 - All Boom Parts Lists approved
 - Parts qualification, screening (including radiation) completed
- UCB Materials Lists Approved
- Boom FM2 PFRs Closed
 - PFRs can be found at: <u>http://sprg.ssl.berkeley.edu/impact/dwc/Problems/</u>
- Boom related Waivers Closed
 - Waivers can be found at: <u>http://sprg.ssl.berkeley.edu/impact/dwc/Waivers/</u>
- Acceptance Data Package Prepared and reviewed



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FM2 Boom Outstanding Issues

- Thermal Blankets and Taping to be applied after Spacecraft EMC
 - Including STE Silver-Teflon
- Cut Retraction Tool as Red Tag item.



FM2 Boom Suite Pre Ship Review 2005 May 23

Boom Suite



FM2 Flight Harness

- UCB-provided flight harness includes harnesses between IDPU and boom, SEP
- The FM2 flight harnesses passed:
 - Continuity test
 - Mass properties (just mass)
 - Hi-Pot test
 - Suite EMC Test
 - Outgassing test
 - Requirement <5E-11g/cm²/sec, Measured = 1.1E-12 g/cm²/sec
- There have been no PFRs or other issues with the flight harness
- The only open issue with the harness is that the part of the harness that is inside the spacecraft needs a non-conductive over-wrap to avoid shorting the harness ground to spacecraft chassis ground in an unpredictable manner
 - To be performed at APL
- Harness is currently wrapped in lumalloy to keep it clean.

FM2 Boom Suite Limited Life Items

•	Boom Deployments:	
	 Qual boom deployments: 	28
	 FM2 boom deployments to date: 	4
	 Anticipated boom deployment in spacecraft I&T: 	1
	 Anticipated boom deployments on orbit: 	1
•	SWEA Door Actuations	
	 Actuator life (manufacturer): 	100
	 FM2 door actuations to date: 	13
	 Anticipated actuations in spacecraft I&T: 	2
	 Anticipated actuations in orbit: 	1
•	STE Door Actuations (count motions)	
	 ETU Life test, (ambient / cold vacuum): 	18,000 / 1,100
	 STE-U FM1 door actuations to date: 	210 / 202
	 STE-D FM1 door actuations to date: 	214 / 118
	 Anticipated actuations in spacecraft I&T (2 per Cl 	PT): ~20
	 Anticipated actuations on-orbit: 	~58
	 2-year mission 	

Boom Suite Safety

- Premature boom deployment
 - Possible personnel hazard, probably damage to unit
 - APL actuation safeing plug
 - Deployment prevention pin will remain in place most of the time
- Radiation sources
 - STE units have very weak calibration radiation sources in their doors
 - Radiation Safety paperwork has been submitted
- SWEA High Voltage
 - No personnel hazard completely contained, but can damage instrument if powered on except in vacuum
 - Enable plug will not be installed except for thermal vac and launch
 - Delivered with test plug installed in place of flight plug

FM2 Boom Suite Delivery

- FM1 Boom Suite integrated, tested, ready to ship
 - Unit will go a radiation safety wipe-test prior to shipping (today)
- Deliver to APL May 24
 - Shipped on same flight we are taking (IDPU hand-carried)
 - Double-bagged in lumalloy
 - Bags are sealed, dry N2 back-filled.
 - Shock-mounted inside the boom shipping coffin
 - Shock and humidity monitors will be included
 - Project to provide paperwork and advance warning to TSA, Airlines
 - Unit will be driven directly from the airport to APL
 - Arrangements have been made for late arrival at APL





Delivery Plans

- Unit will go a radiation safety wipe-test prior to shipping (today)
- Deliver to APL April 24
 - IDPU Hand-carried
 - Double-bagged in lumalloy, sealed, dry N2 back-filled.
 - All inside an Aluminum briefcase packed with bubble-wrap
 - Shock and humidity monitors will be included
 - Project to provide paperwork and advance warning to TSA, Airlines

Post-Delivery Plans

- On arrival at APL, FM2 Boom Suite will go through a radiation safety wipe-test, contamination inspection, and bench CPT
- APL is ready to install the FM2 IDPU, but not the FM2 boom suite
 - FM2 boom suite shall be stored at APL in its shipping container, purged.
 - FM2 SWEA will be removed and sent to GSFC for repeat bakeout test
- An APL procedure will be used for spacecraft mating of the IDPU
- A safe-to-mate will be performed prior to electrical mating
- The usual Conducted Emissions testing will be performed on the IDPU power converter harness after mating
 - If this fails, the IDPU shall be removed and returned to UCB for rework.
- A post-mating functional will be run using the POC/MOC/Spacecraft/IDPU
- Other outstanding issues are:
 - Final IDPU software loading
 - Thermal blanketing, taping
- The boom will be deployed for spacecraft-level EMC tests
 - UCB to provide off-load fixture
 - Verifies no interference to deployment from spacecraft
 - Boom will be removed for stowing after EMC

Summary of FM2 Boom Suite Liens

- SWEA Outgassing
 - UCB Test inconclusive (chamber contaminated)
 - To be repeated at GSFC after delivery to APL, prior to installation on spacecraft
- IDPU EMC
 - Measurement to be repeated on spacecraft
 - If not acceptable, unit to be returned to UCB for repair
- SWEA Transformer (PFR1040) FM1 Units checked at APL
- STE Door (PFR1039) FM1 Units need to be checked at APL
- Thermal blankets and taping
- Final flight harness kapton tape over-wrap for internal part