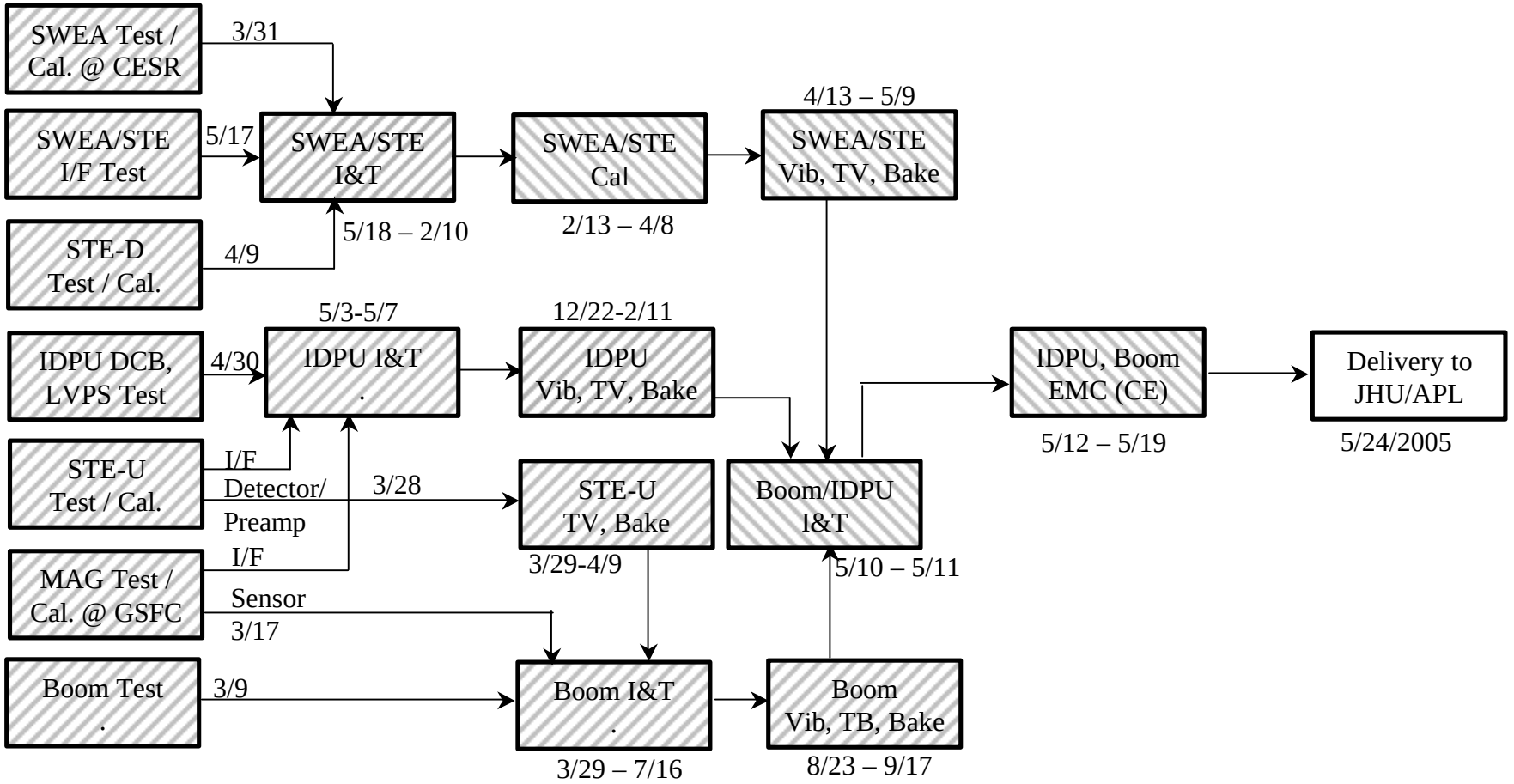

STEREO
IMPACT
UCB - NASA/GSFC- Caltech - U of MD - LANL - JPL - UCLA - SAIC - NOAA/SEC
U of MI - JHU/APL - MPAe - U of Kiel - CESR/CNRS - ESA/ESTEC -
DESPA/OBSPM - KFKI/RMKI

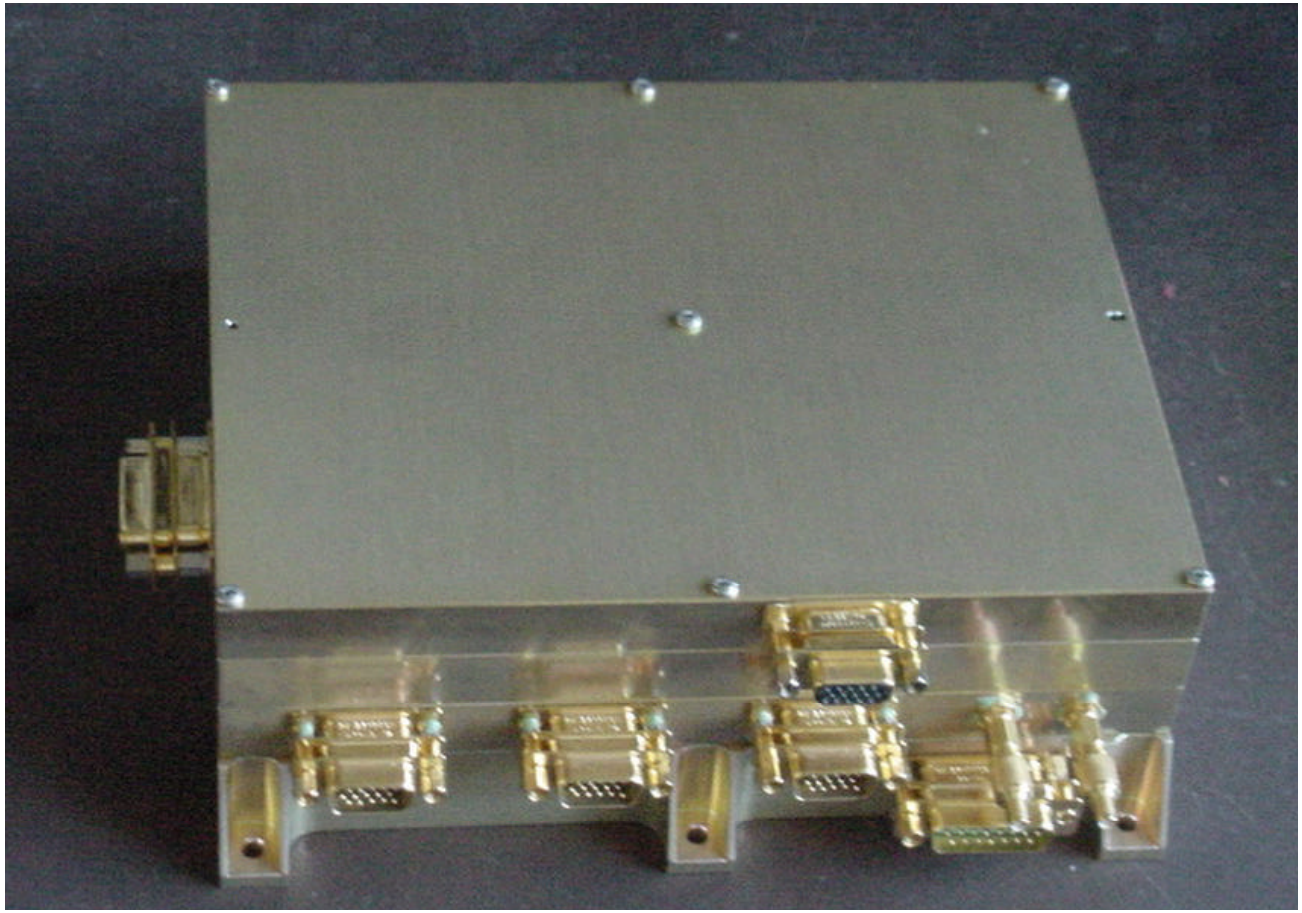
Review History

- 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

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



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	Item	Elect. test, rm. Temp	Elect. Test, hot	Elect. Test, cold	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
C	PWB, EM	C	C	C						C			C							
I	IDPU EM	C								C			C	C						
C	PWB, F	C	C	C						C			C							
I	IDPU, FM1	C	C	C	C	C			A	C	C		C	C	C		C	C	C	C
I	IDPU, FM2	C	C	C	C	C			A	C	C		C	C	C		C	C	C	C

Legend:

Level of Assembly	Unit Type		X = Test required
			A = Analysis
C = Component	BB =	Breadboard	H = at higher level of assembly
I = Instrument	EM =	Engineering Model	**C = Test Completed**
	PT =	Prototype	
	PF =	Protoflight	
	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:
  - http://sprg.ssl.berkeley.edu/impact/dwc/Waivers/
- All Waivers approved by CCB

Environmental Tests

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

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/cm^2/sec (per unit), compared to a requirement of < 5e-11.

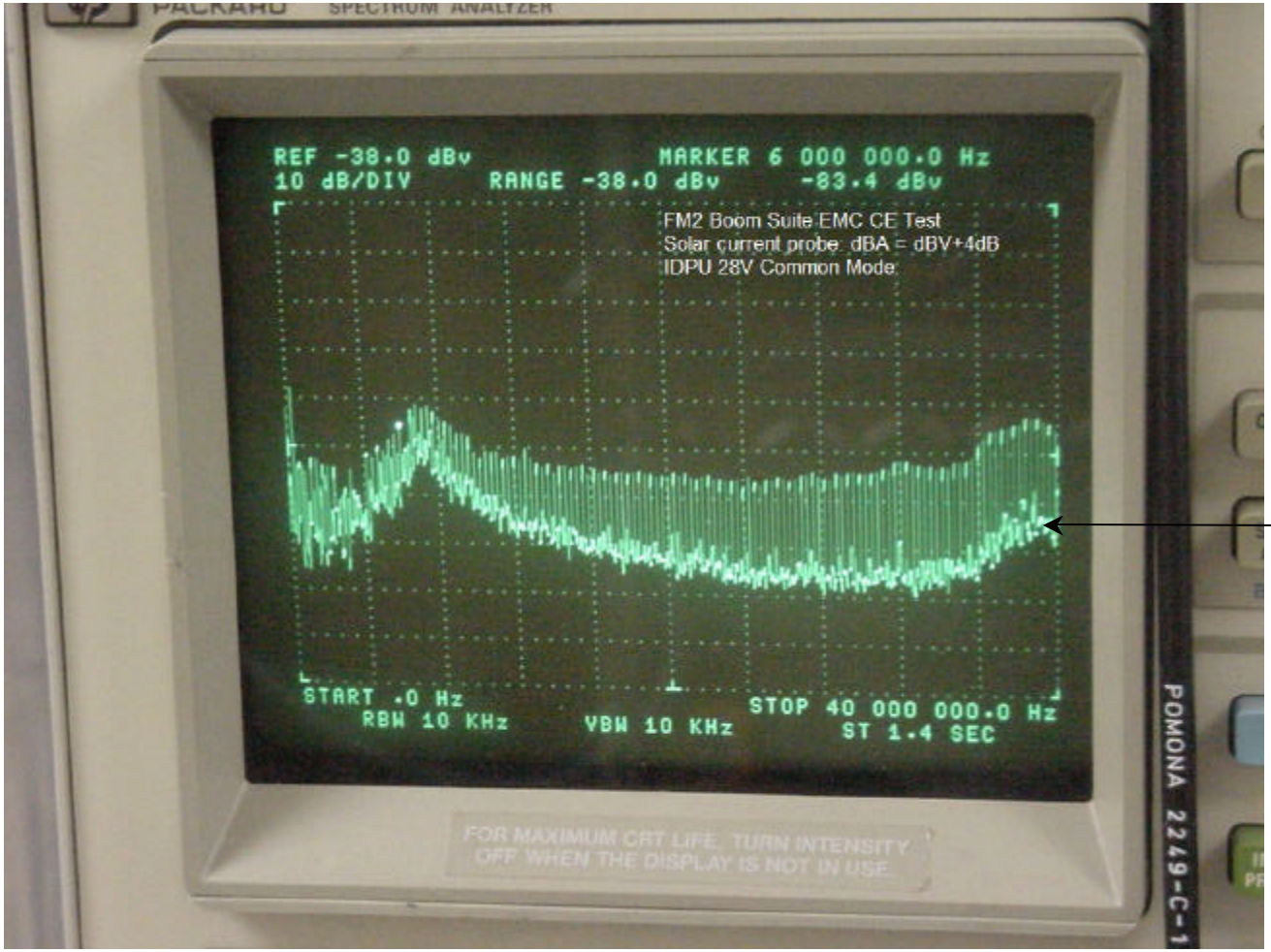
FM2 IDPU Magnetics Test

- **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 CoI 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

Sample Trend Data

IDPU FM2 Performance Trend

Date	File	Test	S/W Version	IDPU Temp	Primary Current, mA	Bus Voltage	2.5V	5VD	5VA	12VA	STE-U?
Dec 14 2004	0412151207.tlm	Pre vib CPT	24	26.3	201	28	2.49	4.98	4.87	12.86	FM2
Dec 17 2004	0412171124.tlm	Post vib CPT	24	27.2	199	28	2.49	4.98	4.88	12.86	FM2
					200.5	28	2.48	4.98	4.84	12.97	
Dec 27 2004	0412270938.tlm	Tvac Hot #2	24	65.8	240.5	24	2.48	4.98	4.84	12.88	FM2
					162.7	35	2.48	4.98	4.84	12.97	
					199	28	2.49	4.97	4.83	12.94	
Dec 30 2004	0412300000.tlm	Tvac Hot #2, again	24	60.6	240	24	2.49	4.97	4.83	12.89	FM2
					164	35	2.49	4.97	4.83	12.98	
					198	28	2.51	5.00	4.92	12.86	
Dec 30 2004	0412300000.tlm	Tvac Cold #2	24	-21.1	246	24	2.50	5.00	4.92	12.80	FM2
					162	35	2.51	5.00	4.93	12.87	
Jan 3 2005	0501030000.tlm	Tvac Hot #3	24	62.7	201	28	2.49	4.97	4.84	12.95	FM2
Jan 3 2005	0501030000.tlm	Tvac Cold #3	24	-14.9	197	28	2.50	5.00	4.92	12.86	FM2
Jan 4 2005	0501040000.tlm	Tvac Hot #4	24	65.5	201	28	2.49	4.97	4.83	12.95	FM2
Jan 4 2005	0501040000.tlm	Tvac Cold #4	24	-13.6	197	28	2.50	5.00	4.92	12.87	FM2
Jan 5 2005	0501050000.tlm	Tvac Hot #5	24	66.5	201	28	2.49	4.97	4.83	12.95	FM2
Jan 5 2005	0501050000.tlm	Tvac Cold #5	24	-15.3	202	28	2.50	5.00	4.92	12.86	FM2
Jan 6 2005	0501060000.tlm	Tvac Hot #6	24	66.7	202	28	2.49	4.97	4.83	12.95	FM2
Jan 6 2005	0501060000.tlm	Tvac Cold #6	24	-15.6	199	28	2.51	5.00	4.92	12.86	FM2
					200	28	2.49	4.97	4.84	12.95	
Jan 7 2005	0501070000.tlm	Tvac Hot #7	24	60	240	24	2.48	4.98	4.84	12.87	FM2
					160	35	2.48	4.98	4.84	12.96	
					207	28	2.49	4.97	4.83	12.95	
Feb 2 2005	0502020906.tlm	TVac2 Hot #1	24	63.6	242	24	2.48	4.98	4.84	12.87	FM2
					162	35	2.49	4.98	4.84	12.96	
					200	28	2.51	5.00	4.92	12.87	
Feb 2 2005	0502021725.tlm	TVac2 Cold #1	24	-22.9	242	24	2.51	5.00	4.93	12.80	FM2
					167	35	2.51	5.00	4.93	12.86	
Feb 3 2005	0502030000.tlm	TVac2 Hot #2	24	71.2	203	28	2.49	4.97	4.83	12.94	FM2
Feb 3 2005	0502030000.tlm	TVac2 Cold #2	24	-4.8	199	28	2.50	4.99	4.90	12.89	FM2
Feb 4 2005	0502040000.tlm	TVac2 Hot #3	24	71.1	204	28	2.49	4.97	4.83	12.95	FM2
Feb 4 2005	0502040000.tlm	TVac2 Cold #3	24	-6.8	197.5	28	2.50	4.99	4.90	12.89	FM2
					200	28	2.49	4.97	4.83	12.95	
Feb 7 2005	0502070000.tlm	TVac2 Hot #4	24	70.8	243	24	2.49	4.97	4.83	12.89	FM2
					164	35	2.49	4.97	4.83	12.97	
					197	28	2.50	5.00	4.91	12.88	
Feb 7 2005	0502070000.tlm	TVac2 Cold #4	24	-11.6	239	24	2.50	5.00	4.91	12.79	FM2
					165	35	2.50	5.00	4.91	12.87	
					193	28	2.49	4.98	4.87	12.93	
Feb 14 2005	0502141544.tlm	Post-vib CPT	24	31.7	229	24	2.50	4.98	4.88	12.86	FM2
					160	35	2.49	4.98	4.88	12.86	

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 Hours
  - Post 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

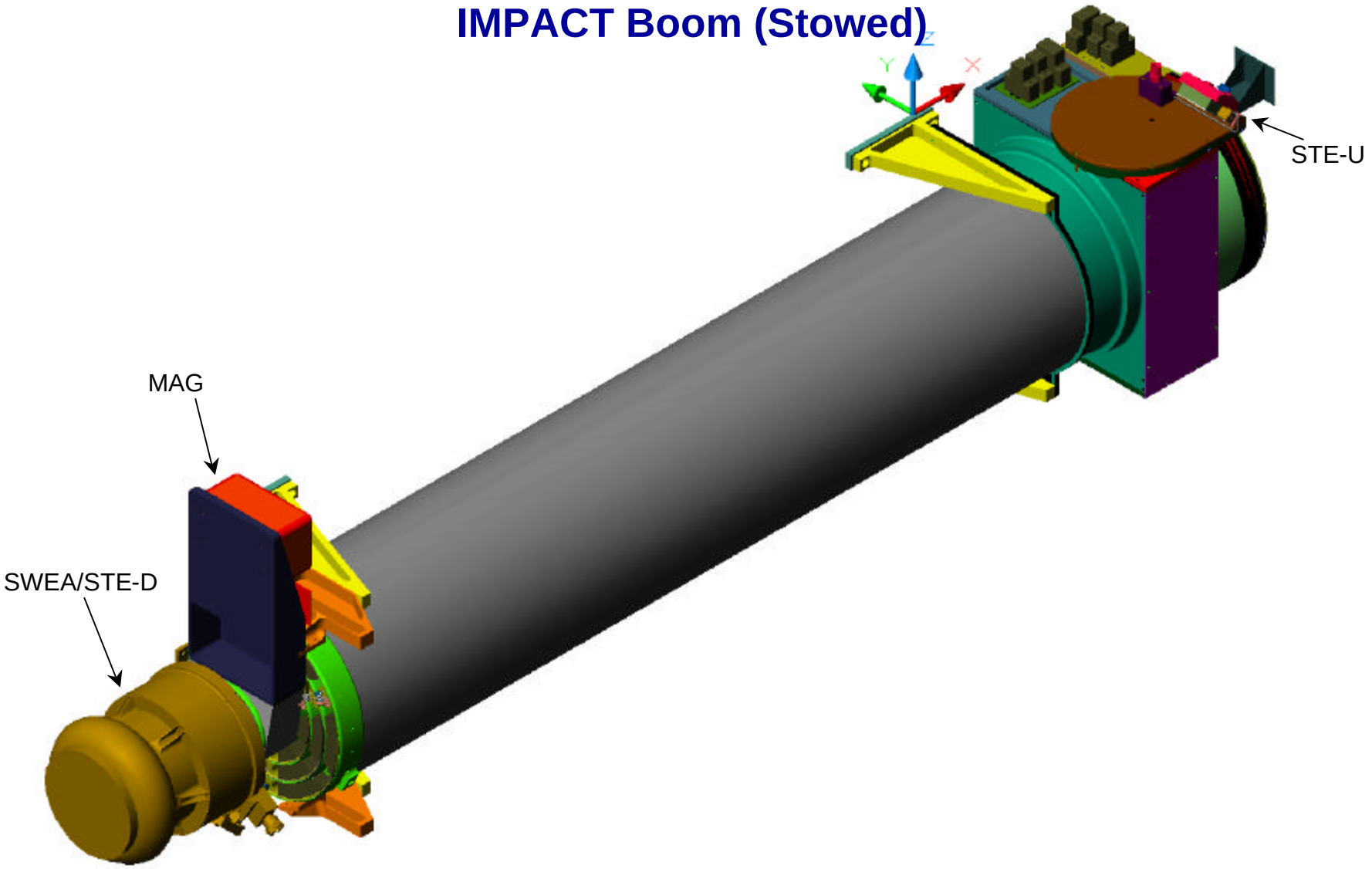
Quality Assurance

- **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: http://sprg.ssl.berkeley.edu/impact/dwc/Problems/**
- **IDPU-related Waivers Closed**
  - **Except possible FM2 IDPU EMC Test Results waiver**
  - **Waivers can be found at: http://sprg.ssl.berkeley.edu/impact/dwc/Waivers/**

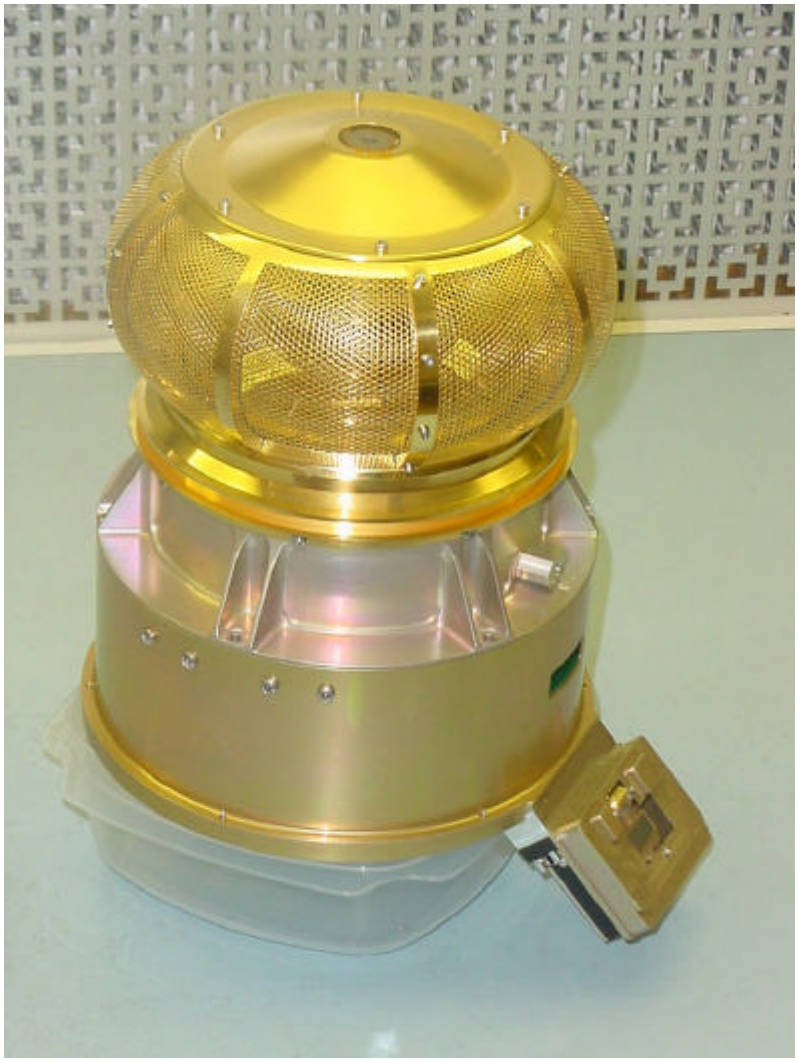
Outstanding Issues

- **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**

IMPACT Boom (Stowed)



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

			Verification Matrix for STEREO/IMPACT/SWEA																	Revision Date: 3/22/2005
																				Revision Number: 4
	Hardware Description		Test																	
Level of Assembly	Item	Pedestal Interface Tes	Elect. test, rm. Temp	Voltage margins	Bench Calibration	Beam Calibration	Elect. Test, hot	Elect. Test, cold	Vibration, Sinusoidal	Vibration, Random	Self Shock	Acoustics	Thermal Vacuum	Thermal cycle	Thermal balance	Life Test	EMC/EMI	Magnetics	Bakeout	Contamination Inspection	Comments
C	MCP, F		C			C															
C	Preamp, F		C		C																
C	Optocouplers, F		C		C																
S	Electronics, EM		C	C	C		C	C													
S	Electronics, F		C	C	C		C	C											C		
I	Instrument, EM1	C	C	C		C												C			UCB test unit
I	Instrument, EM2		C	C		C						A									CESR test unit
I	Instrument, PF (FM1)	C	C	C		C			C	C	C		C	C	C	C	C	C	C	C	
I	Instrument, PF (FM2)	C	C	C		C			C	C	C		C	C		C	C	C	C	C	
Legend:																					
	Level of Assembly		Unit Type										X = Test required								
													A = Analysis								
	C = Component		BB =		Breadboard								H = Test at higher level of assembly (at UCB)								
	S = subsystem		EM =		Engineering Model								**C = Test Completed**								
	I = Instrument		PF =		Protoflight																
			F =		Flight																

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 on-orbit 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:
  - http://sprg.ssl.berkeley.edu/impact/dwc/Waivers/
- All Waivers approved by CCB

FM2 SWEA/STE-D Environmental Tests

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

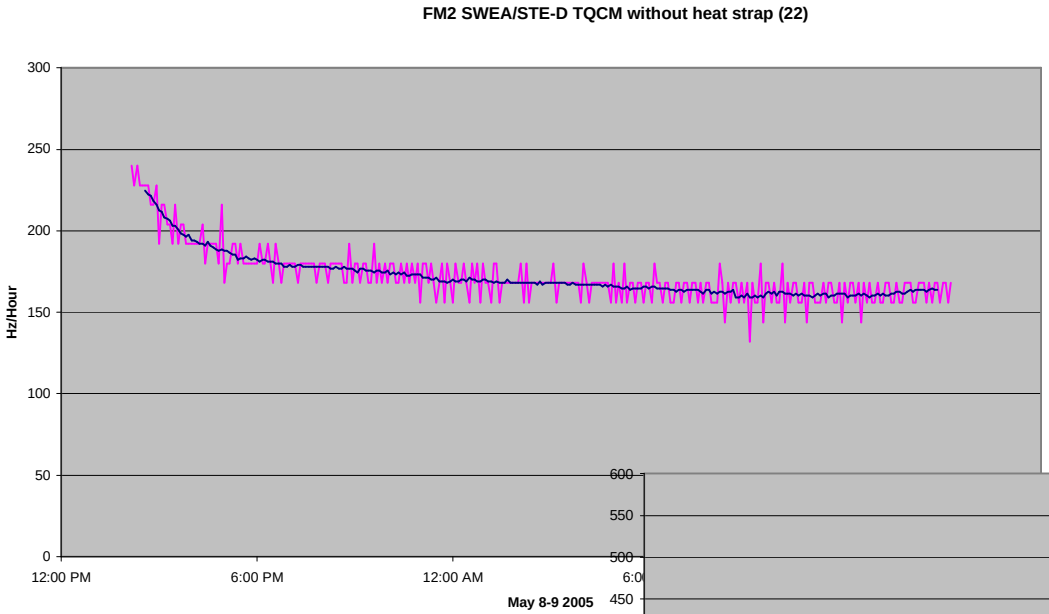
FM2 SWEA/STE-D Thermal Vacuum Test Results

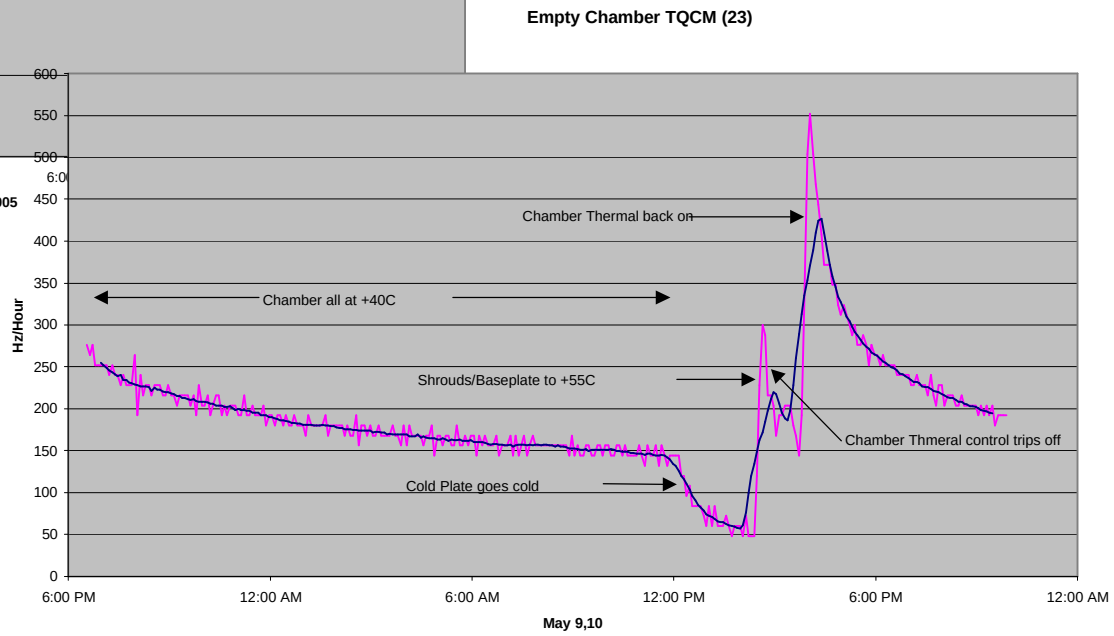
- **Problems with STE-D door (PFR1039) caused an interruption in the test.**
  - **Door problem was ultimately fixed, passed final 4 cycles of CPT with extra door actuations.**
- **No significant trends in performance data (other than STE-D door problems in early cycles)**

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 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 CoI 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)

Date	File	Test	SWEA Temp	ISWEAM CPTemp	ISWEAD ACTemp	Bus Voltage	Primary Current	2.5V	5VD	5VA	12VA	ISWEAST EDCur	ISWEAV0 @ DAC=128	ISWEANR 5V	ISWEAAn al	ISWEADe fl1	ISWEADe fl2	Open Door?	MCP On?	
						28	143	2.51	4.96	5.09	11.55									
Apr 11 2005	B0504120510.tlm, B0504122244.tlm	Pre-vib CPT				24	155	2.51	4.96	5.10	11.59									
				30.7	31.7	35	143	2.51	4.96	5.11	11.53	9.8	-12.5	6.08	68.4	161.2	99.4	No	No	
						28	141	2.51	4.96	5.08	11.50									
Apr 14 2005	B0504142928.tlm	Post-vib, pre-Tvac				24	153	2.51	4.96	5.08	11.53									
			20.4	19.9	21.5	35	141	2.51	4.96	5.07	11.49	5.8	-12.5	6.03	68.4	162	99.4	No	No	
						28	149	2.51	4.96	5.14	11.66									
Apr 19 2005	B0504190633.tlm	Tvac Hot #2				24	167	2.51	4.96	5.16	11.73									
			33.3	32	40	35	149	2.51	4.96	5.14	11.67	15	-12.5	6.2	68.4	160	98.6	Yes	Yes	
						28	127	2.50	4.96	4.88	11.02									
Apr 19 2005	B0504191813.tlm	Tvac Cold #2				24	132	2.50	4.96	4.89	11.04									
			-43	-37	-41	35	127	2.50	4.96	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	4.96	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	4.96	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)	30.1	38.6	35.1	28	165	2.51	4.96	5.19	11.75	12	-12.5	6.19	68.4	161.2	99.4	No	No	STE-D door failure, PI
Apr 27 2005	B0504280000.tlm	Pre-vib CPT (after door & transformer fix)	27	28.3	28.8	28	143.8	2.51	4.96	5.08	11.58	9.6	-12.5	6.08	68.4	161.2	99.4	No	No	
						28	141	2.51	4.96	5.08	11.55									
Apr 29 2005	B0504292057.tlm	Post-vib, pre-Tvac				24	155.5	2.51	4.96	5.10	11.59									
			22.4	22.1	23.6	35	142.1	2.51	4.96	5.09	11.55	7.2	-12.5	6.04	68.4	161.2	99.4	No	No	
						28	147	2.51	4.96	5.14	11.67									
May 3 2005	B0504292057.tlm	Tvac Hot #4				24	161	2.51	4.96	5.12	11.67									
			30.3	34	34	35	149	2.51	4.96	5.10	11.62	10.8	-12.5	6.16	68.4	161.2	99.4	Yes	Yes	
						28	128	2.50	4.96	4.90	11.08									
May 5 2005	B0505050000.tlm	Tvac Cold #4 (after door fix, new wires)				24	134	2.50	4.96	4.90	11.07									20-motion
			-37.4	-17.9	-34.2	35	127	2.50	4.96	4.90	11.06	-16.5	-12.54	5.94	70.1	165.4	102.8	Yes	Yes	door test
						28	152	2.51	4.96	5.12	11.65									
May 5 2005	B0505050000.tlm	Tvac Hot #4				24	174	2.51	4.96	5.19	11.82									20-motion
			36.4	34.3	38.6	35	153	2.51	4.96	5.17	11.74	12.5	-12.5	6.21	68.4	161.1	98.6	No	Yes	door test
						28	127	2.50	4.96	4.88	10.99									
May 5 2005	B0505050000.tlm	Tvac Cold #5				24	132	2.50	4.96	4.87	10.99									20-motion
			-38.1	-35.3	-35.3	35	129	2.50	4.96	4.88	10.97	-16.7	-12.54	5.92	70.06	165.4	102.8	No	Yes	door test
May 6 2005	B0505060000.tlm	Tvac Hot #6	33.2	34.8	34.8	28	159	2.51	4.96	5.16	11.72	10.6	-12.5	5.3	68.37	161.2	98.6	No	Yes	MCP On
May 6 2005	B0505060000.tlm	Tvac Cold #6	-39.8	-18	-38.4	28	126	2.50	4.96	4.90	11.00	-17.6	-12.54	5.89	70.48	165.4	102.8	No	Yes	
May 6 2005	B0505060000.tlm	Tvac Hot #7	36.8	35.3	39.1	28	153	2.51	4.96	5.17	11.75	13.2	-12.5	6.2	68	160.3	98.6	No	Yes	
						28	126	2.50	4.96	4.87	11.01									
May 6 2005	B0505060000.tlm	Tvac Cold #7				24	131	2.50	4.96	4.88	11.00									20-motion
			-7.5	-34.5	-37.8	35	126	2.50	4.96	4.88	11.00	-16.5	-12.54	5.92	70.5	165.4	102.8	No	Yes	door test
						28	148	2.51	4.96	5.13	11.64									
May 7 2005	B0505070000.tlm	Tvac Hot #8				24	166	2.51	4.96	5.17	11.73									20-motion
			34.2	33.2	35.4	35	148	2.51	4.96	5.15	11.68	11.1	-12.5	6.18	68.4	160.3	98.6	No	Yes	door test

STE-D Trend Data

STE-D FM2 Performance Trend

Date	File	Test	SWEA/STE-D Primary Current (mA)	STE-D Temp	SWEA/STE-D DAC Temp	ISTED Curr (mA)	Door Open (sec)	Door Close (sec)	Bins	Rt Rev	Det	Thresh	Test Pulser: Offset (keV)	Gain (keV/Bin)	Curv. (1/keV)	Test Gain	FWHM (keV)	Door Source: Offset (keV)	Gain (keV/Bin)	Curv. (1/keV)	GeV/ c/s	22keV c/s	FWHM	Long Integration Door Source (Door LUT): AccTime (sec)	Offset (keV)	Gain (keV/Bin)	Curv. (1/keV)	GeV/ c/s	22keV c/s	11keV c/s	FWHM	
Apr 11 2005	B0504123510.tlm B0504122244.tlm	Pre-vib CPT	143	21.6	25.2	8.05	0.50 / 0.50	0.50 / 0.50	150	4/21/2005	0		0.03	0.3857	1.04E-04	12.8479	0.812	-0.03	0.4006	6e-5 (F)	47.14	20.28	0.916		-0.03	0.4006	6e-5 (F)	48.03	20.05	1.24E-02	0.906	
											1		0.07	0.3892	1.26E-04	12.2467	0.759	0.00	0.4014	6e-5 (F)	48.88	19.15	0.872	920	0.00	0.4014	6e-5 (F)	48.02	20.25	1.57E-02	0.859	
											2		0.03	0.3900	1.09E-04	12.6242	0.854	-0.03	0.4012	6e-5 (F)	37.63	19.05	0.961		-0.01	0.4008	6e-5 (F)	38.28	17.85	8.70E-03	0.975	
											3		0.01	0.3862	1.03E-04	12.8214	0.792	-0.06	0.4030	6e-5 (F)	37.10	17.69	0.906		-0.07	0.4033	6e-5 (F)	37.89	18.03	1.21E-02	0.908	
Apr 14 2005	B0504142928.tlm	Post-vib, pre-Tvac	141	16.7	19.7	5.1	0.62 / 0.75	0.62 / 0.88	20	4/21/2005	0	10	-0.05	0.3861	9.33E-05	13.7273	0.792	0.00	0.4003	6e-5 (F)	49.14	20.93	0.921		0.00	0.4005	6e-5 (F)	49.29	20.63	2.04E-02	0.923	
											1	10	-0.01	0.3855	1.17E-04	12.5656	0.725	0.02	0.4018	6e-5 (F)	50.34	20.83	0.868	640	0.02	0.4019	6e-5 (F)	49.22	20.81	5.96E-03	0.852	
											2	10	-0.07	0.3857	1.07E-04	12.6029	0.701	-0.06	0.4021	6e-5 (F)	37.28	18.95	0.825		-0.07	0.4022	6e-5 (F)	37.75	18.13	8.36E-03	0.820	
											3	12	-0.06	0.3857	9.45E-05	13.6780	0.773	-0.02	0.4030	6e-5 (F)	37.94	19.23	0.910		-0.02	0.4030	6e-5 (F)	38.76	18.59	4.80E-03	0.915	
Apr 19 2005	B0504190833.tlm	Tvac Hot #2	149	-29.4	34.4	10.9	0.38 / 0.50	0.38 / 0.50	20	4/21/2005	0		Failed Fit					0.01	0.4021	6e-5 (F)	51.84	21.32	0.764		0.02	0.4021	6e-5 (F)	50.73	20.49	1.33E-02	0.768	
											1		No Counts					0.04	0.4032	6e-5 (F)	50.63	20.56	0.734	1370	0.04	0.4035	6e-5 (F)	50.63	20.92		0.752	
											2	10	-0.07	0.3864	1.07E-04	12.7709	0.551	-0.04	0.4044	6e-5 (F)	40.12	19.42	0.758		-0.02	0.4038	6e-5 (F)	38.64	18.90	1.06E-02	0.754	
											3	11	-0.03	0.3858	1.05E-04	12.7842	0.600	0.01	0.4045	6e-5 (F)	40.35	19.45	0.742		0.00	0.4046	6e-5 (F)	39.97	18.30		0.784	
Apr 19 2005	B0504191813.tlm	Tvac Cold #2	127	-68.5	-40.7	-18.3	1.12 / 1.12	1.25 / 1.38	20	5/3/2005	0	8	-0.20	0.3864	8.64E-05	13.6521	0.550	-0.07	0.4043	6e-5 (F)	48.66	19.99	0.712		-0.05	0.4046	6e-5 (F)	49.25	20.29		0.706	
											1	7	-0.15	0.3858	1.15E-04	12.3847	0.475	-0.05	0.4036	6e-5 (F)	49.21	20.68	0.640	450	-0.05	0.4040	6e-5 (F)	48.57	20.33		0.625	
											2	15	-0.22	0.3865	1.04E-04	12.8097	0.494	-0.12	0.4075	6e-5 (F)	39.08	18.86	0.667		-0.13	0.4077	6e-5 (F)	37.48	18.01		0.643	
											3	8	-0.22	0.3865	9.26E-05	13.5835	0.623	-0.12	0.4078	6e-5 (F)	39.93	19.04	0.706		-0.10	0.4074	6e-5 (F)	38.58	18.77		0.664	
Apr 20 2005	B0504200000.tlm	Tvac Hot #3	152	-34.5	34.2	10.2	0.38 / 0.50	0.50 / 0.50	20	5/3/2005	0	10	-0.05	0.3864	8.01E-05	13.8286	0.669	0.03	0.4028	6e-5 (F)	50.74	21.00	0.810		0.03	0.4023	6e-5 (F)	50.99	21.31	2.01E-02	0.826	
											1		No counts					0.05	0.4036	6e-5 (F)	50.56	20.83	0.761	410	0.04	0.4040	6e-5 (F)	50.50	20.84	4.11E-02	0.756	
											2	10	-0.07	0.3857	1.04E-04	12.9528	0.580	-0.02	0.4044	6e-5 (F)	40.21	18.83	0.722		-0.02	0.4042	6e-5 (F)	38.93	19.34		0.728	
											3	13	-0.04	0.3858	9.88E-05	13.5743	0.646	0.03	0.4043	6e-5 (F)	39.15	17.91	0.793		0.02	0.4048	6e-5 (F)	39.50	18.52	4.41E-02	0.800	
Apr 20 2005	B0504200000.tlm	Tvac Cold #3	125	-68.5	-46	-21	1.12 / 1.12	1.38 / 1.88	150	5/3/2005	0	10	-0.17	0.3861	9.66E-05	12.8767	0.637	-0.06	0.4042	6e-5 (F)	50.22	19.46	0.708		-0.10	0.4051	6e-5 (F)	49.36	20.35	9.22E-02	0.668	
											1		No Fit					-0.04	0.4049	6e-5 (F)	49.15	19.86	0.658	3330	-0.05	0.4054	6e-5 (F)	49.59	20.46		0.618	
											2	21	-0.19	0.3863	1.07E-04	12.5960	0.513	-0.13	0.4060	6e-5 (F)	38.43	19.52	0.654		-0.12	0.4079	6e-5 (F)	37.86	18.78		0.661	
											3	13	-0.20	0.3863	1.02E-04	12.8160	0.534	-0.09	0.4073	6e-5 (F)	38.59	18.55	0.677		-0.11	0.4077	6e-5 (F)	38.55	18.33		0.655	
Apr 21 2005	B0504210000.tlm	Tvac Hot #4 (FAIL)	165	-23.9	42.4	14.8	FAIL	FAIL			0	10																				See PFR 1039
											1	10																				
											2	10																				
											3	13																				
Apr 27 2005	B0504280000.tlm	Pre-vib CPT (after door & transformer fix)	143.8	22.5	28.6	9.1	0.50 / 0.50	0.38 / 0.75	20	5/3/2005	0	11	-0.05	0.3864	9.66E-05	13.7144	0.619	0.03	0.3966	6e-5 (F)	49.97	20.00	0.864		0.00	0.3969	6e-5 (F)	48.61	20.15	1.24E-02	0.863	
											1	10	0.02	0.3854	1.23E-04	12.5696	0.747	0.02	0.4010	6e-5 (F)	48.29	20.31	0.866	54540	0.01	0.4013	6e-5 (F)	48.67	20.22	1.07E-02	0.869	
											2	21	-0.04	0.3857	1.09E-04	12.8967	0.721	-0.05	0.4009	6e-5 (F)	36.74	18.91	0.823		-0.07	0.4015	6e-5 (F)	37.51	18.71	1.26E-02	0.845	
											3	14	-0.04	0.3859	9.70E-05	13.6763	0.807	-0.02	0.4024	6e-5 (F)	37.40	18.13	0.971		-0.02	0.4025	6e-5 (F)	38.00	18.01	1.06E-02	0.956	
Apr 29 2005	B0504290357.tlm	Post-vib, pre-Tvac	141	18.6	22.3	6.5	0.62 / 0.62	0.50 / 1.00	20	5/3/2005	0	10	-0.03	0.3860	9.49E-05	13.6261	0.770	-0.01	0.4011	6e-5 (F)	48.04	20.28	0.866		-0.01	0.4011	6e-5 (F)	45.21	18.36	2.26E-02	0.914	
											1	9	-0.01	0.3857	1.20E-04	12.5564	0.705	0.02	0.4015	6e-5 (F)	49.64	19.86	0.845	700	0.00	0.4024	6e-5 (F)	44.53	18.67	1.02E-02	0.852	
											2	19	-0.09	0.3860	1.05E-04	12.8414	0.662	-0.08	0.4025	6e-5 (F)	37.92	18.97	0.828		-0.07	0.4023	6e-5 (F)	33.96	17.46	1.67E-02	0.815	
											3	12	-0.09	0.3859	9.54E-05	13.5718	0.748	-0.04	0.4036	6e-5 (F)	39.30	19.16	0.906		-0.04	0.4036	6e-5 (F)	35.11	16.72	2.30E-02	0.884	
May 3 2005	B0504030000.tlm	Tvac Hot #4	147	-23.8	33.7	11.23	0.38 / 0.50	0.50 / 0.50	20	5/3/2005	0	8	Failed Fit					0.03	0.4026	6e-5 (F)	50.74	20.06	0.810		0.02	0.4027	6e-5 (F)	50.24	20.43	1.36E-02	0.821	
											1	8	No data					0.05	0.4036	6e-5 (F)	50.49	20.21	0.778	1350	0.03	0.4037	6e-5 (F)	50.56	20.55		0.754	
											2	19	-0.07	0.3862	1.07E-04	12.8449	0.611	-0.04	0.4042	6e-5 (F)	40.02	18.94	0.775		-0.04	0.4041	6e-5 (F)	39.77	18.83	2.86E-03	0.752	
											3	12	-0.04	0.3858	9.94E-05	13.5163	0.664	0.00	0.4045	6e-5 (F)	40.24	18.17	0.808		0.00	0.4045	6e-5 (F)	39.52	18.21	3.43E-03	0.807	
May 5 2005	B0505050000.tlm	Tvac Cold #4 (after door fix, new wires)	128	-69.1	-33.5	-15.4	1.12 / 1.12	1.12 / 1.12	20	5/3/2005	0	10	-0.17	0.3863	9.06E-05	13.5001	0.556	-0.06	0.4052	6e-5 (F)	49.54	19.77	0.727		-0.08	0.4054	6e-5 (F)	46.90	18.97	2.21E-02	0.750	
											1	8	-0.11	0.3866	1.18E-04	12.3109	0.546	-0.03	0.4064	6e-5 (F)	49.05	19.56	0.701	690	-0.05	0.4064	6e-5 (F)	45.49	18.70	1.42E-02	0.686	
											2	19	-0.19	0.3864	1.06E-04	12.7130	0.566	-0.14	0.4068	6e-5 (F)	37.42	18.14	0.718		-0.13	0.4062	6e-5 (F)	35.08	17.05		0.702	
											3	12	-0.15	0.3863	9.42E-05	13.4370	0.599	-0.09	0.4078	6e-5 (F)	38.99	18.00	0.763		-0.11	0.4081	6e-5 (F)	37.87	17.18		0.749	
May 5 2005	B0505050000.tlm	Tvac Hot #4	152	-36	38	12.3	0.38 / 0.50	0.38 / 0.38	20	5/3/2005	0	10	-0.02	0.3864	9.61E-05	13.4952	0.664	0.03	0.4032	6e-5 (F)	50.32	20.35	0.871		0.03	0.4031	6e-5 (F)	50.39	20.26	1.57E-02	0.876	
											1	8	0.03	0.3854	1.21E-04	12.3569	0.641	0.05	0.4043	6e-5 (F)	48.55	19.99	0.796	1200	0.04	0.4045	6e-5 (F)	49.22	20.02	1.52E-02	0.797	
											2	20	-0.05	0.3857	1.07E-04	12.6840	0.666	-0.04	0.4053	6e-5 (F)	38.58	18.64	0.797		-0.03	0.4050	6e-5 (F)	37.38	18.16		0.785	
											3	13	-0.02	0.3862	9.87E-05	13.4467	0.679	0.03	0.4052	6e-5 (F)	40.03	19.02	0.854		0.02	0.4056	6e-5 (F)	39.64	17.97		0.836	
May 5 2005	B0505050000.tlm	Tvac Cold #5	127	-68.7	-36	-17.2	1.12 / 1.12	1.12 / 1.25	20	5/3/2005	0	10	-0.15	0.3860	9.46E-05	13.5082	0.591	-0.08	0.4054	6e-5 (F)	50.08	19.98	0.776		-0.07	0.4056	6e-5 (F)	49.30	19.92	2.11E-02	0.749	
											1	9	-0.10	0.3862	1.23E-04	12.3166	0.533	-0.05	0.4060	6e-5 (F)	47.90	19.01	0.683	610	-0.05	0.4062	6e-5 (F)	47.67	19.41		0.691	
											2	19	-0.10	0.3861	1.09E-04	12.7155	0.595	-0.13	0.4063	6e-5 (F)	38.36	17.60	0.719		-0.13	0.4063	6e-5 (F)	36.95	17.75		0.715	
											3	12	-0.17	0.3861	9.56E-05	13.4405	0.573	-0.10	0.4077	6e-5 (F)	38.97	18.13	0.747		-0.10	0.4078	6e-5 (F)	39.09	18.07		0.750	
May 6 2005	B0505060000.tlm	Tvac Hot #6	159	-35	33.4	10	0.50 / 0.50	0.38 / 0.50	20	5/3/2005	0	10	-0.04	0.3859	9.72E-05	13.4619	0.669	0.04	0.4027	6e-5 (F)	50.10	19.95	0.839		0.03	0.4025	6e-5 (F)	50.06	20.14	1.56E-02	0.850	
											1	8	0.02	0.3854	1.24E-04	12.3570	0.644	0.04	0.4044	6e-5 (F)	50.00	20.47	0.796	570	0.04	0.4042	6e-5 (F)	49.14	19.73		0.791	
											2	17	-0.04	0.3855	1.11E-04	12.6872	0.650	-0.04	0.4049	6e-5 (F)	38.69	18.01	0.809		-0.03	0.4046	6e-5 (F)	38.22	18.39		0.797	
											3	11	-0.02	0.3854	1.01E-04	13.4167	0.653	0.00	0.4053	6e-5 (F)	40.53	18.07	0.837		0.01	0.4053	6e-5 (F)	39.75	17.84		0.824	
May 6 2005	B0505060000.tlm	Tvac Cold #6	126	-90.7	-41.1	-19.4	1.12 / 1.12	1.25 / 1.25	20	5/3/2005	0	8	-0.17	0.3864	9.66E-05	13.5820	0.745	-0.07	0.4049	6e-5 (F)	49.01	19.45	0.748		-0.08	0.4052	6e-5 (F)	49.06	19.93	1.11E-02	0.744	Microphonics
											1	7	-0.13	0.3861	1.19E-04	12.3173	0.541	-0.06	0.4052	6e-5 (F)	43.44	16.93	0.810	1150	-0.05	0.4064	6e-5 (F)	48.42	19.67		0.678	
											2	13	-0.20	0.3862	1.05E-04	12.7165	0.557	-0.11	0.4078	6e-5 (F)	35.94	17.91	0.978		-0.13	0.4065	6e-5 (F)	37.03	17.83		0.667	
											3	9	-0.19	0.3861	9.58E-05	13.4461	0.573	-0.10	0.4079	6e-5 (F)	37.61	17.97	0.754		-0.10	0.4080	6e-5 (F)	39.38	18.00		0.731	
May 6 2005	B0505060000.tlm	Tvac Hot #7	153	-32	38.9	12.6	0.38 / 0.38	0.50 / 0.50	20	5/3/2005	0	10	-0.03	0.3858	9.43E-05	13.4647	0.668	0.03	0.4029	6e-5 (F)	51.00	20.22	0.849		0.03	0.4029	6e-5 (F)	50.39	19.83	1.66E-02	0.855	
											1	8	0.03	0.3855	1.20E-04	12.3535	0.635	0.04	0.4045	6e-5 (F)	48.44	20.36	0.788	630	0.05	0.4040	6e-5 (F)	49.34	19.74	8.21E-03	0.792	
											2	20	-0.03	0.3858	1.08E-04	12.6777	0.634	-0.03	0.4050	6e-5 (F)	38.10	18.51	0.781		-0.03	0.4050	6e-5 (F)	38.13	18.48		0.791	
											3	13	-0.02	0.3857	1.00E-04	13.4124	0.672	0.01	0.4057	6e-5 (F)	39.26	17.92	0.834		0.01	0.4056	6e-5 (F)	40.09	17.80		0.826	
May 6 2005	B0505060000.tlm	Tvac Cold #7	126	-89.3	-34.5	-16.5	1.00 / 1.12	1.12 / 1.12	20	5/3/2005	0	10	-0.15	0.3859	9.56E-05	13.5150	1.002	-0.08	0.4054	6e-5 (F)	49.65	20.24	0.756		-0.08	0.4052	6e-5 (F)	49.31	19.90		0.752	Microphonics
											1	8	-0.11	0.3866	1.21E-04	12.3305	0.719	-0.05	0.4062	6e-5 (F)	48.76	19.48	0.687	600	-0.05	0.4064	6e-5 (F)	48.16	19.53		0.684	
											2	19	-0.15	0.3860	1.10E-04	12.7243	0.576	-0.13	0.4062	6e-5 (F)	38.29	17.81	0.688		-0.13	0.4062	6e-5 (F)	36.58	17.49		0.700	
											3	12	-0.17	0.3860	9.67E-05	13.4468	0.575	-0.09	0.4076	6e-5 (F)	38.52	17.98	0.744		-0.10	0.4078	6e-5 (F)	39.33	17.41		0.731	
May 7 2005	B0505070000.tlm	Tvac Hot #8	148	-36	33.9	10	0.38 / 0.50	0.38 / 0.50	20	5/3/2005	0	9	-0.04	0.3864	9.36E-05	13.5002	0.662	0.03	0.4030	6e-5 (F)	50.77	19.96	0.844		0.03	0.4030	6e-5 (F)	50.07	19.82	1.71E-02	0.838	
											1	8	0.02	0.3853	1.21E-04	12.3584	0.634	0.05	0.4041	6e-5 (F)	50.59	19.84	0.801	580	0.04	0.4043	6e-5 (F)	49.70	19.83	3.04E-02	0.793	
											2	18	-0.04	0.3855	1.07E-04	12.6853	0.644	-0.03	0.4052	6e-5 (F)	38.26	18.40	0.792		-0.03	0.4051	6e-5 (F)	37.54	18.14		0.784	
											3	11	0.03	0.3862	1.01E-04	13.4469	0.677	0.01	0.4055	6e-5 (F)	40.65	18.08	0.826		0.02	0.4056	6e-5 (F)	39.26	17.81		0.824	

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

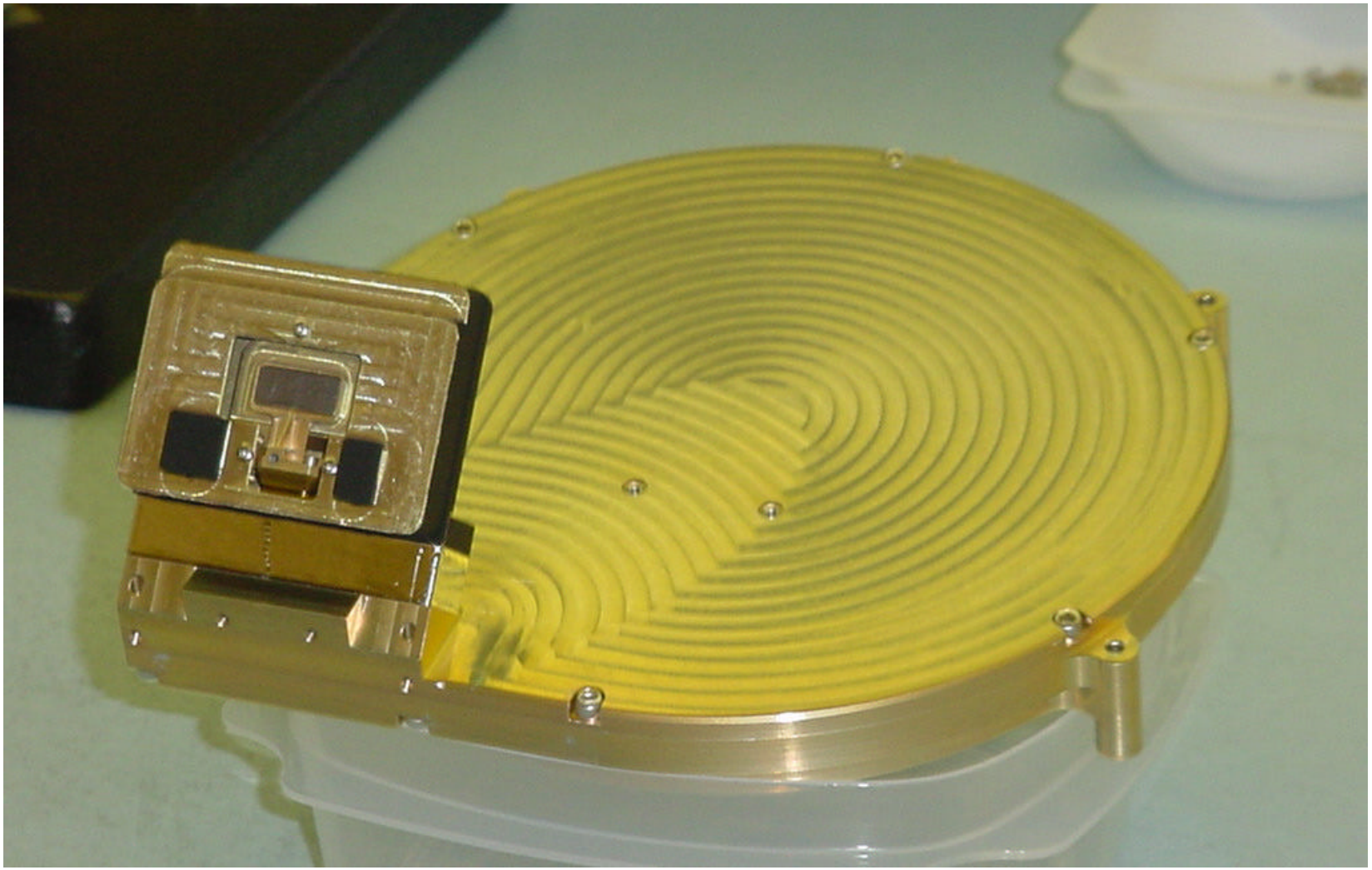
Quality Assurance

- **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: http://sprg.ssl.berkeley.edu/impact/dwc/Problems/**
- **SWEA/STE-D-related Waivers Closed**
  - **Except possible EMC Waiver**
  - **Waivers can be found at: http://sprg.ssl.berkeley.edu/impact/dwc/Waivers/**
- **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)

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	Item	Elect. test, rm. Temp	Bench Calibration	Elect. Test, hot	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
C	Detector, EM	C																		
C	Detector, F	C																	C	
C	Preamp, BB	C	C																	
I	Instrument, ETU	C	C	C	C				A		C			C			C			
I	Instrument, PF (FM1)	C	C			C	C	C		C	C		C		C	C	C	C	C	
I	Instrument, PF (FM2)	C	C			C	C	C		C	C				C		C	C	C	

Legend:

Level of Assembly	Unit Type	X = Test required	
		A = Analysis	
C = Component	BB Breadboard	H = Test at higher level of assembly	
I = Instrument	EM Engineering Model	**C = Test Completed**	
	PF Protoflight		
	F = Flight		

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 over-heated during post-qualification calibrations. Wires were replaced and unit re-qualified (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:**
  - **http://sprg.ssl.berkeley.edu/impact/dwc/Waivers/**
- **All Waivers approved by CCB**

FM2 STE-U Environmental Tests

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

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

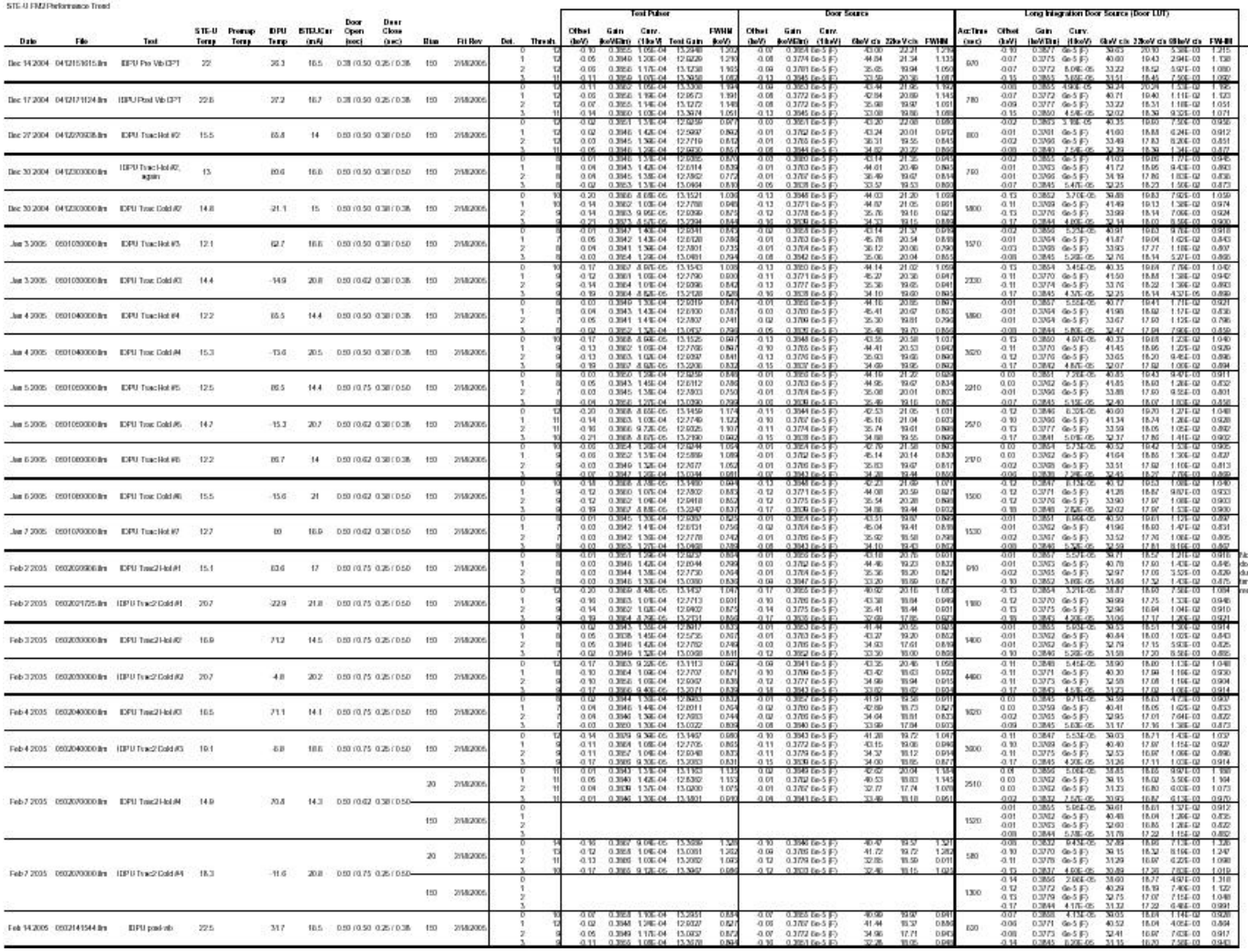


Table: During IDPU FM2 Thermal vac, STE-U door seems to have been brushing boom bag during actuation causing somewhat longer times between coming off cas switch and reaching the stop

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

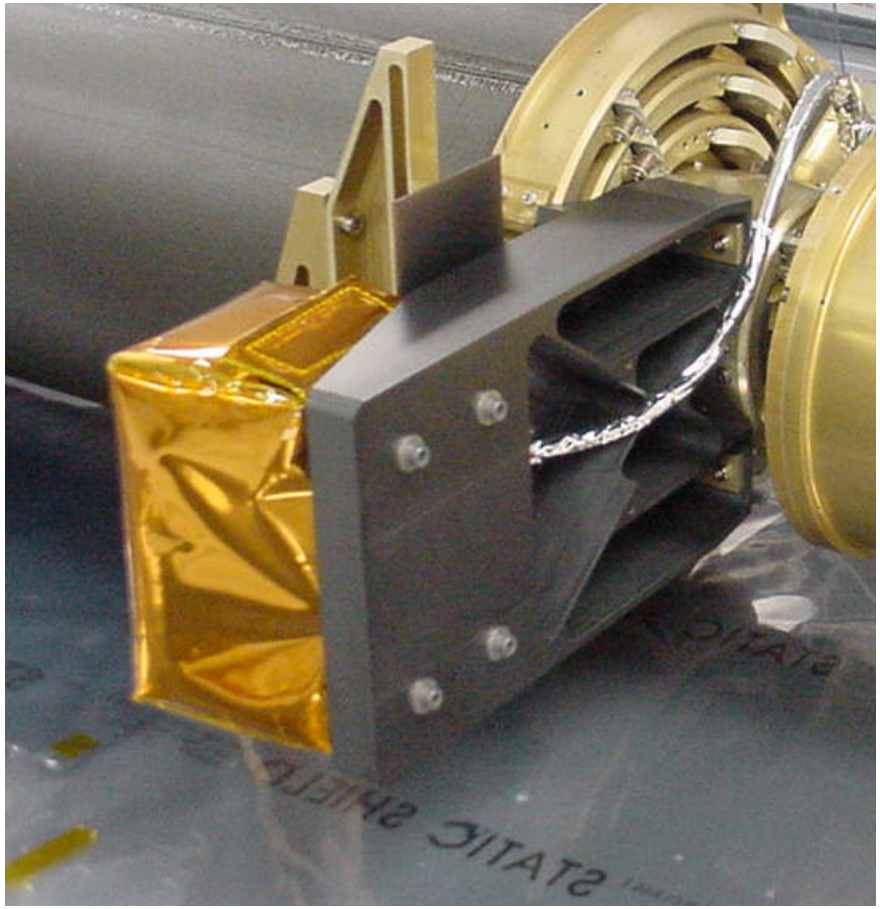
Quality Assurance

- **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: http://sprg.ssl.berkeley.edu/impact/dwc/Problems/**
- **STE-U-related Waivers Closed**
  - **Waivers can be found at: http://sprg.ssl.berkeley.edu/impact/dwc/Waivers/**
- **Acceptance Data Package Prepared**

FM2 STE-U Outstanding Issues

- **None**

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	Test																	
Level of Assembly	Item	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
C	Sensor, EM	C	C																
C	Sensor, F	C	C	C	C	C	C	C		C		C	C	C	C		C	C	Sensor thermal balance by heritage
C	Electronics, EM	C	C	C	C									C					
C	Electronics,F	C	C	C	C	C	C			C	C	C		C	C		C	C	
Legend:																			
	Level of Assembly	Unit Type								X = Test required									
										A = Analysis									
	C = Component	BB Breadboard								H = Test at higher level of assembly									
	I = Instrument	EM Engineering Model								(Boom for sensor, IDPU for electronics)									
		PT Prototype								C = Test Completed									
		PF Protoflight																	
		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

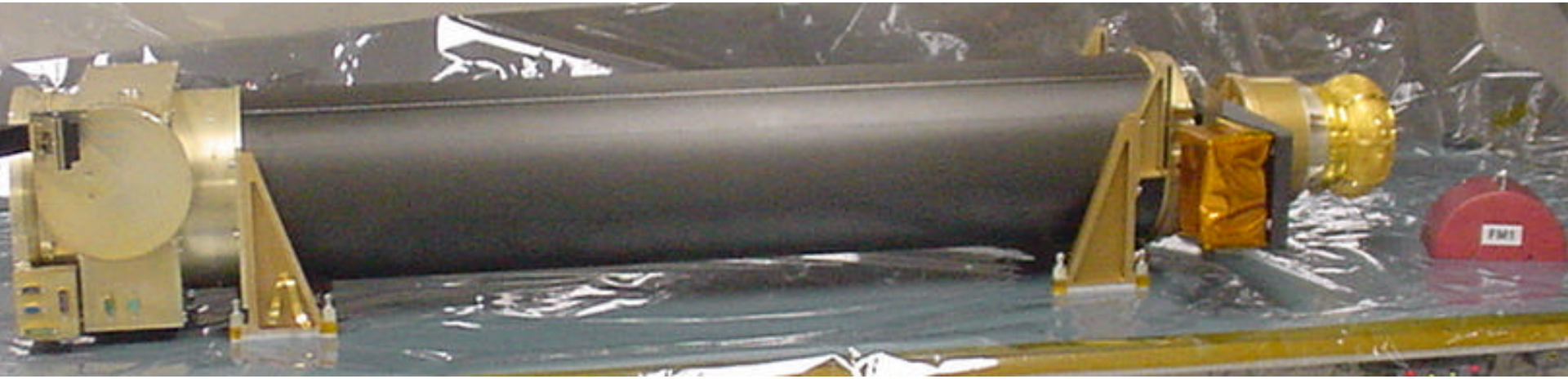
MAG FM2 Performance Trend

Date	File	Test	MAG Temp	IDPU Temp	Heater On HKP	RMSx	RMSy	RMSz	IFC Fit Rev	IFC X Sample Time	IFC X Amplitude	IFC X Rate	IFC Y Sample Time	IFC Y Amplitude	IFC Y Rate	IFC Z Sample Time	IFC Z Amplitude	IFC Z Rate	
Dec 14 2004	0412151207.tlm	IDPU Pre vib CPT	24	26.3	10.4	6.0	2.0	9.0	2/18/2005	-22.4	8901	9.3	-22.6	8858	9.6	-21.3	9306	8.7	Clean Roo
Dec 17 2004	0412171124.tlm	IDPU Post vib CPT	23.3	27.2	10.3	8.0	5.0	9.0	2/18/2005	-22.6	8908	9.7	-23.8	8870	10.4	-21.5	9299	8.9	Clean Roo
Dec 27 2004	0412270938.tlm	IDPU Tvac 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	Snout
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	Snout
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	Snout
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	Snout
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	8866	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 2005	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 Tvac2 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 2005	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 2005	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 2005	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 2005	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 2005	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.tlm	IDPU TVac2 Cold #4	18.7	-11.6	9.3	1.4	3.5	1.7	2/18/2005	-22.3	8858	10.7	-20.7	8823	10.3	-22.8	9370	10.6	Snout
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	-15.2	8881	6.4	-23.0	9327	9.7	Clean Roo

MAG Open Issues

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

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.

Boom Verification Matrix

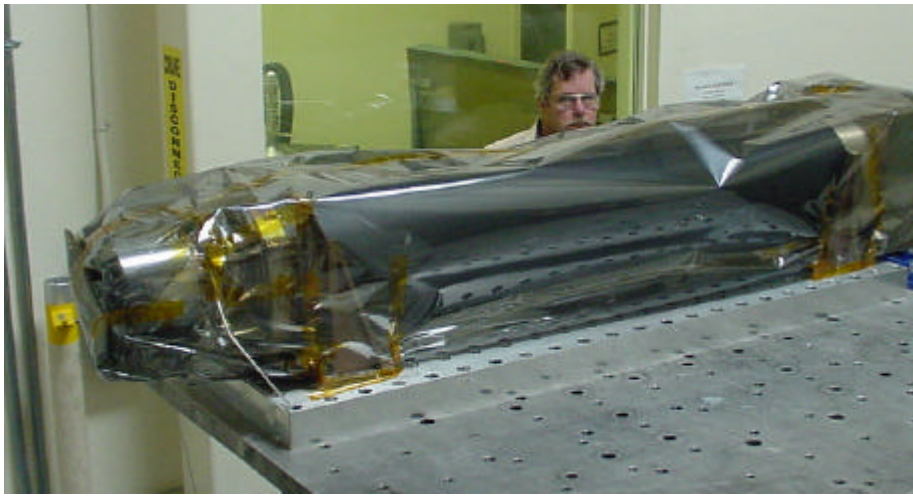
		Verification Matrix for STEREO/IMPACT/Boom																Revision Date: 5/22/2005
																		Revision Number: 7
Hardware Description		Test																
Level of Assembly	Item	Deploy Test, Room Temperature	Deploy Test, Thermal Vac	Stiffness, Proof Load	Vibration, Sinusoidal	Vibration, Random	Self Shock	Acoustics	Alignment	Force Margin Deployment	Thermal Vacuum	Thermal Cycle	Thermal Balance	End-to-End Conductance Test	EMC/EMI	Magnetics	Bakeout	Deployment Contamination	Contamination Inspection	Comments
C	Proto	P		P																
C	EM	P		P														P		Qual levels
C	PF/FS	P	P	P	P	P	P		P	P	P	P	P	P		P				Protoflight levels
C	FM1	P		P					P			P		P		P			P	Protoflight levels
C	FM2	P		P					P			P		P		P			P	Protoflight levels
S	FM1		P		P	P	S			P	P	P			P		P			Protoflight levels
S	FM2		P		P	P	S			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 FM2 Problem/Failures

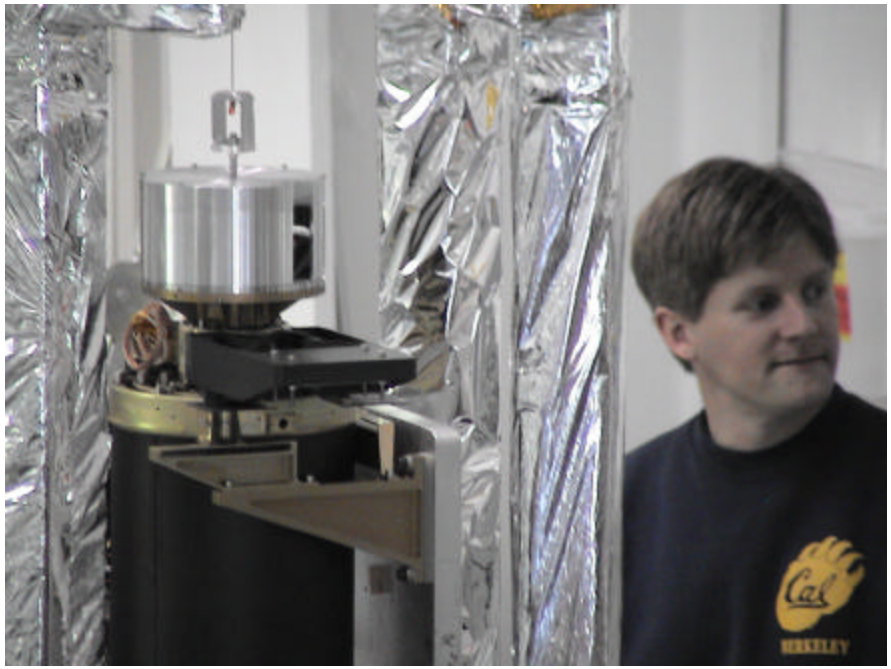
- **PFR1016, Boom Lock Pins**
  - **Glue residue from the assembly of the tubes was found in several Lock Pin bores.**
  - **The Boom was disassembled and all bores were cleaned.**
  - **No additional locking problems.**



- **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 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

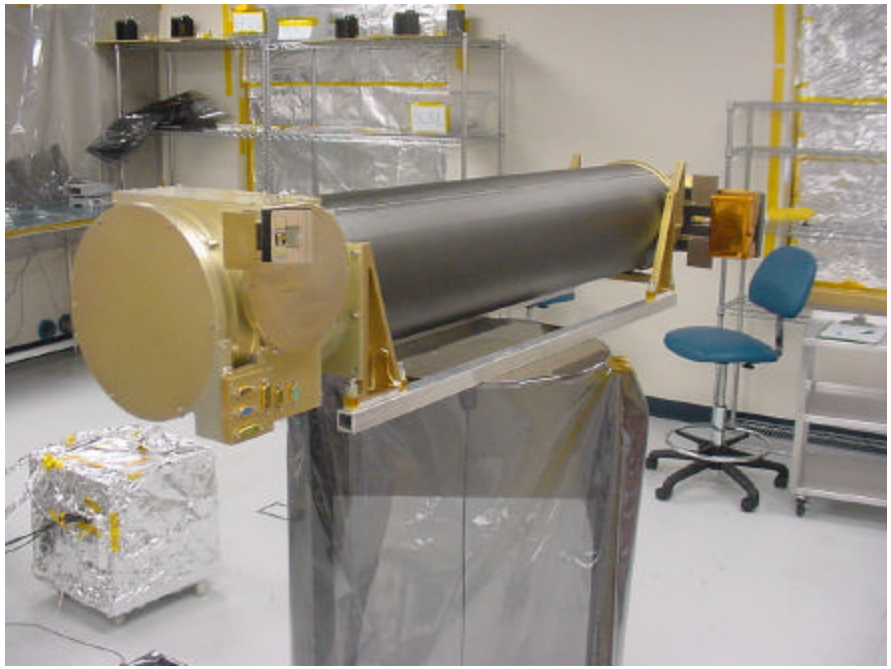
- **Test Plans/Procedures can be found at:**
  - http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/
    - **EMC:** http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/IMPACT-EMC_C.pdf
    - **CPT:** http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/IMPACT-IDPU-CPT_H.pdf
    - **Vibration:** http://sprg.ssl.berkeley.edu/impact/dwc/TestProcs/IMP-562-DOC-A%20Vibratio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

FM2 Boom Test Reports

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

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 m^2**
  - **Iyy = 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

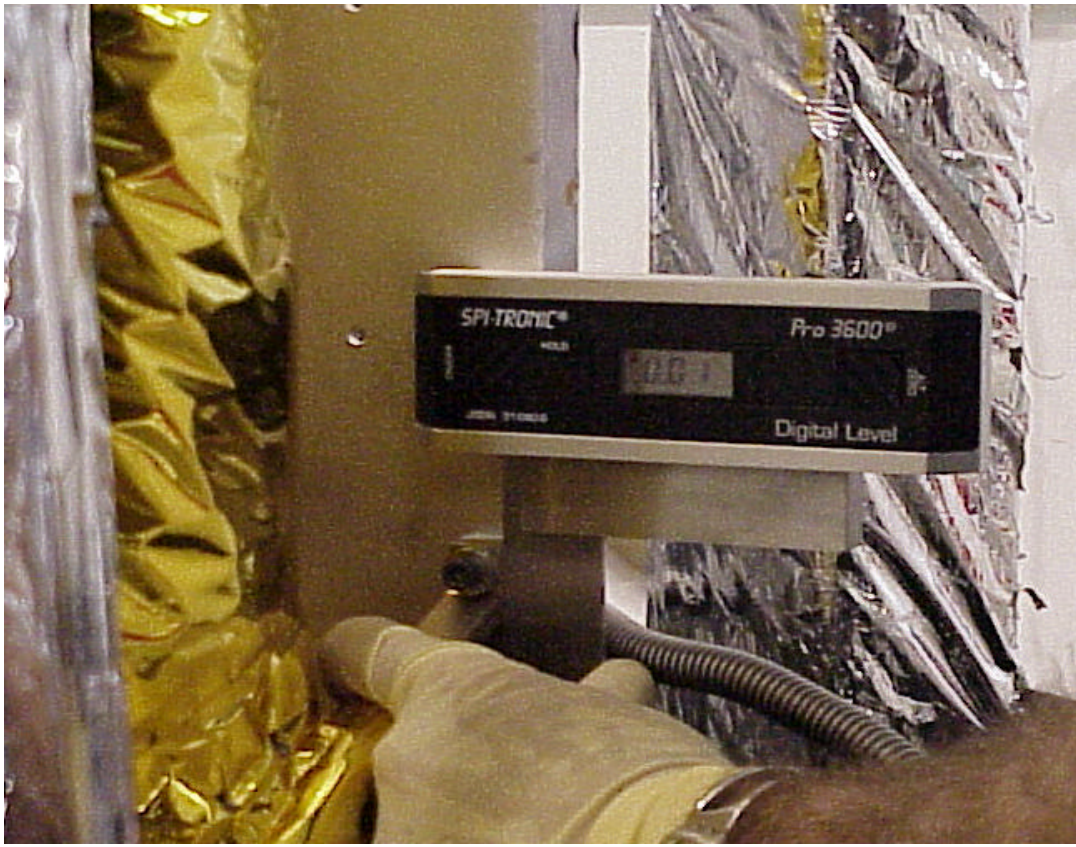
- **Boom functional testing**
  - **Deployments were performed to ensure proper functionality**
  - **Full deployment is defined as:**
    - **actuation via powering the SMAR (Shape Memory Alloy Release) pin puller,**
    - **Stacer initiation via Deployment Assist Device (DAD),**
    - **full deployment 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

STEREO BOOM Deployment Log								
FM2 Boom								
Number	Date	Time	Deploy	Actuation	Mass Dummies	Test Purpose:	Time	Comments:
T1	8/2/2004	12:14 PM	FULL	Actuated	Yes	Tuning - Cable length, harness braid	--	Force Margin met, Alignment met, Stiffness File: ImpBoomFM2Deploy1_XYPlane, ...XZPlane, 3 Lock Pins did not extend (See PR1016)
1	8/25/2004	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	9/8/2004	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 Deploy3_XZPlane, ...XYPlane, Primary Actution circuit miswired, Secondary circuit fired normally (See PR1020)
3	9/13/2004	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

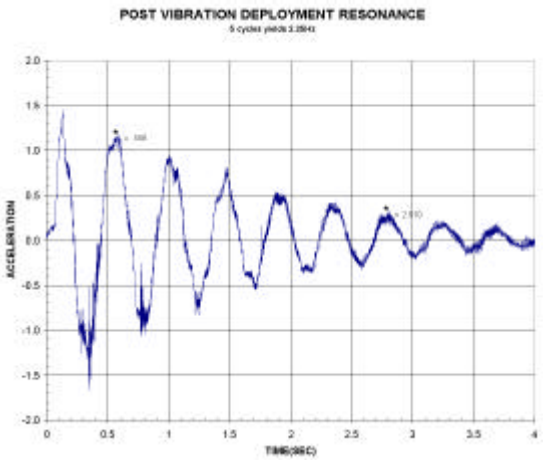
Boom Alignment Test

- 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

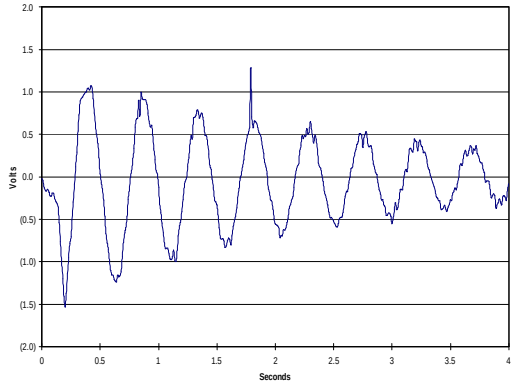


Boom Stiffness Test

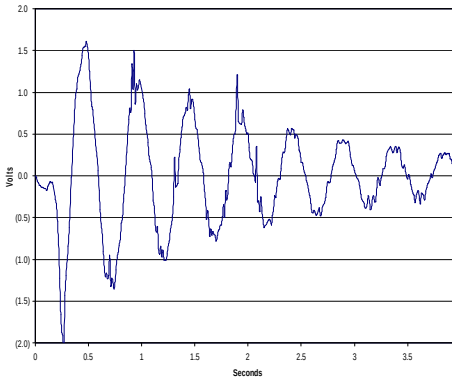
- **Stiffness**
  - **Stiffness was verified for each Flight Model Boom.**
  - **Requirement: > 0.5 Hz and not coincident with another device (i.e., solar cells, SWAVES antennas)**
  - **Fundamental Frequency: ~1.9 Hertz**



STEREO Boom FM1 Hot Deploy XZ



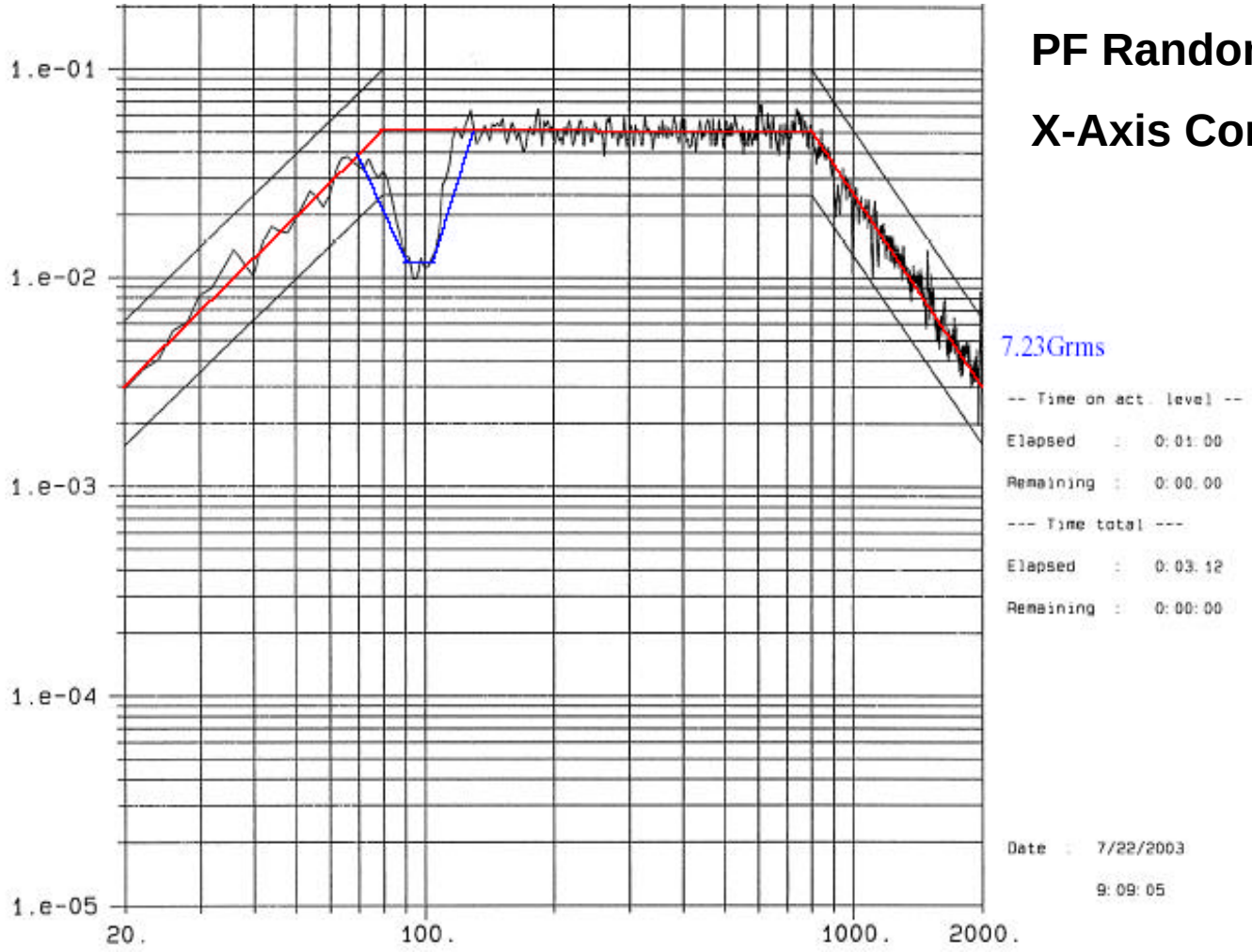
STEREO Boom FM1 Cold Deploy XZ



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

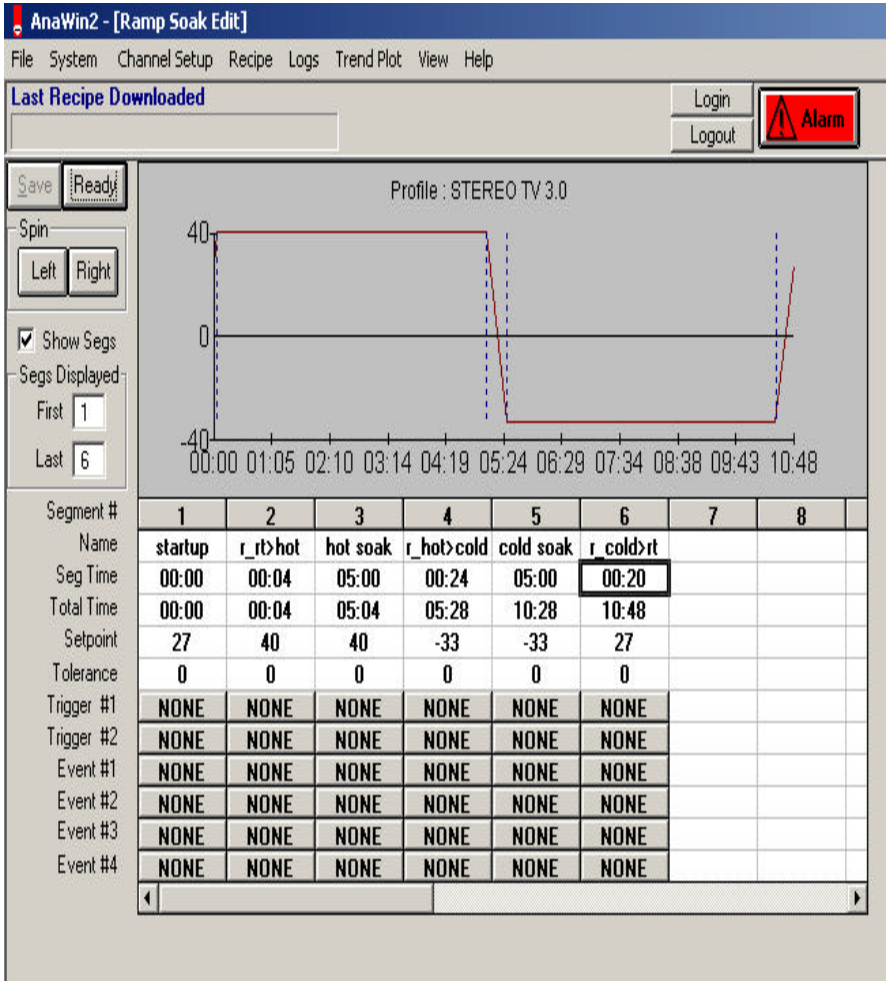


PF Random

X-Axis Control

Boom Thermal Vacuum Test

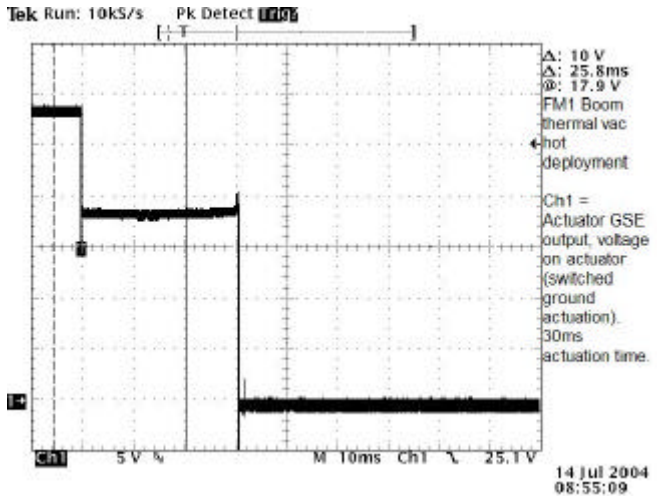
- **Test Plan:**
  - **Preliminary bakeout, up to 48 hours at +40C**
  - **Thermal vac**
    - **7+ survival cycles: +40C to –33C**
    - **One hour soak minimum**
    - **Flight thermistor used as reference**
    - **Temperatures from verified thermal model, with at least 10C margins.**
  - **MAG CPT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

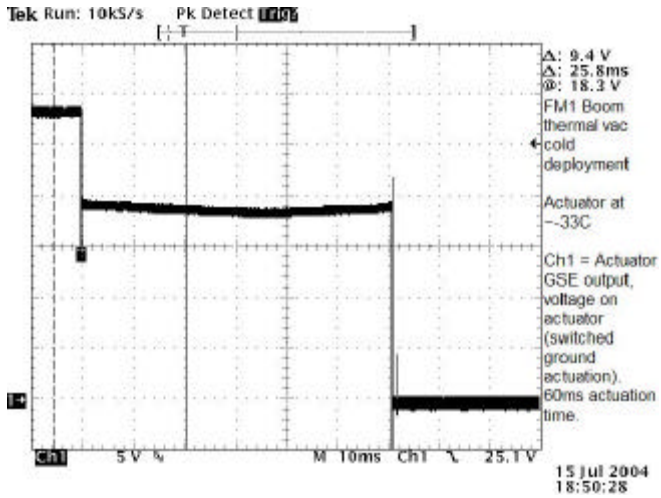


Boom Thermal Vacuum Test, Actuator Current

- SMAR deploy voltage was monitored for thermal dependence

- Voltage:
  - 28V is armed
  - ~17V is firing
  - 0V is fired
- Actuation time:
  - 30ms hot
  - 60ms cold

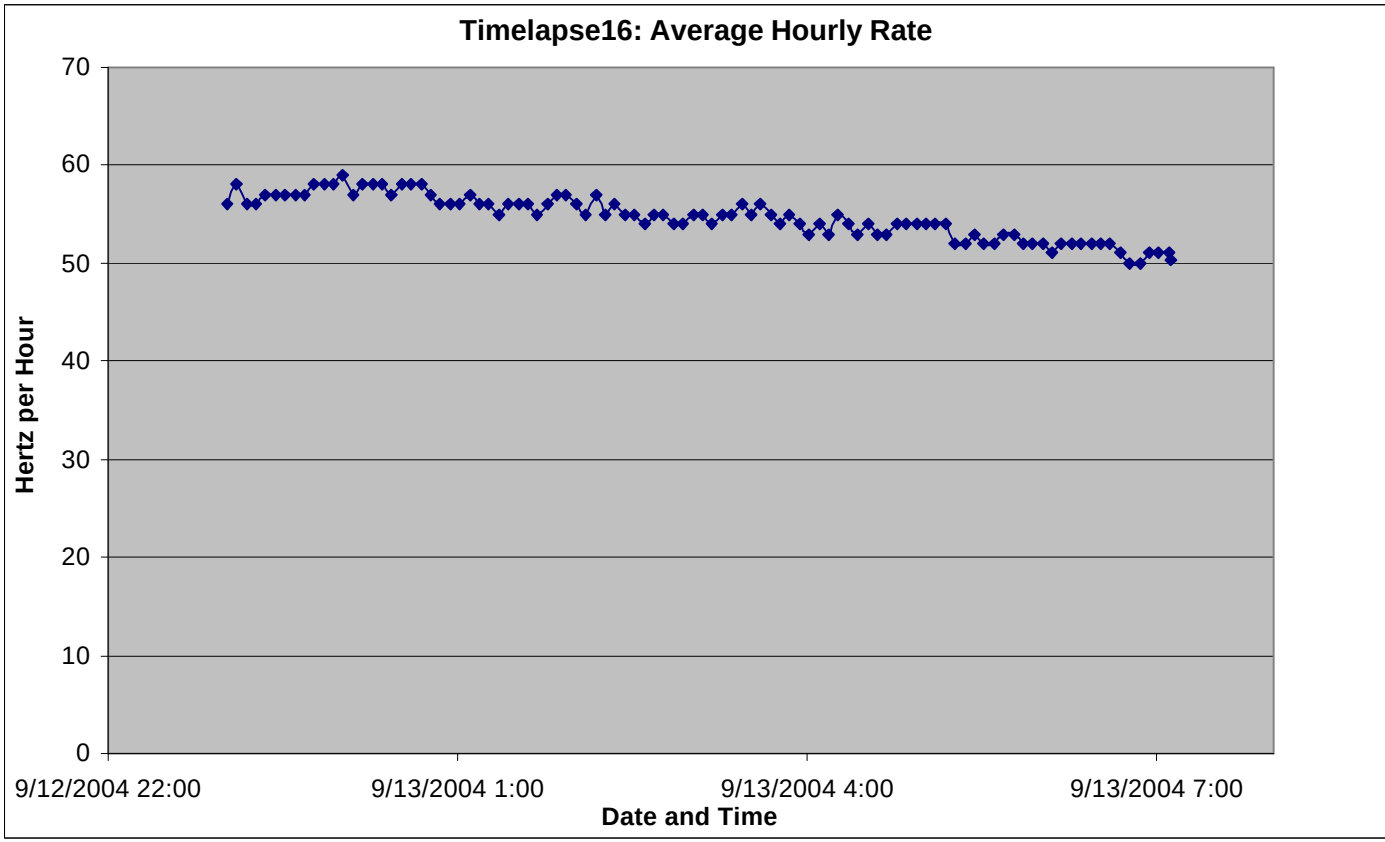




Boom Qualification Bake-out Test

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)

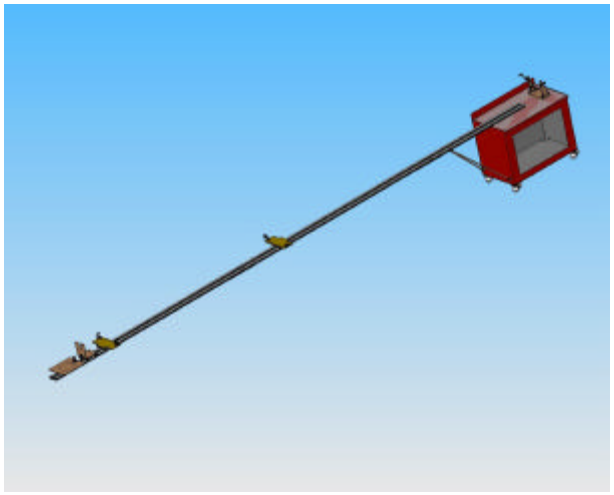
FM2 Boom Test Results

- 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 double-bagged 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.**



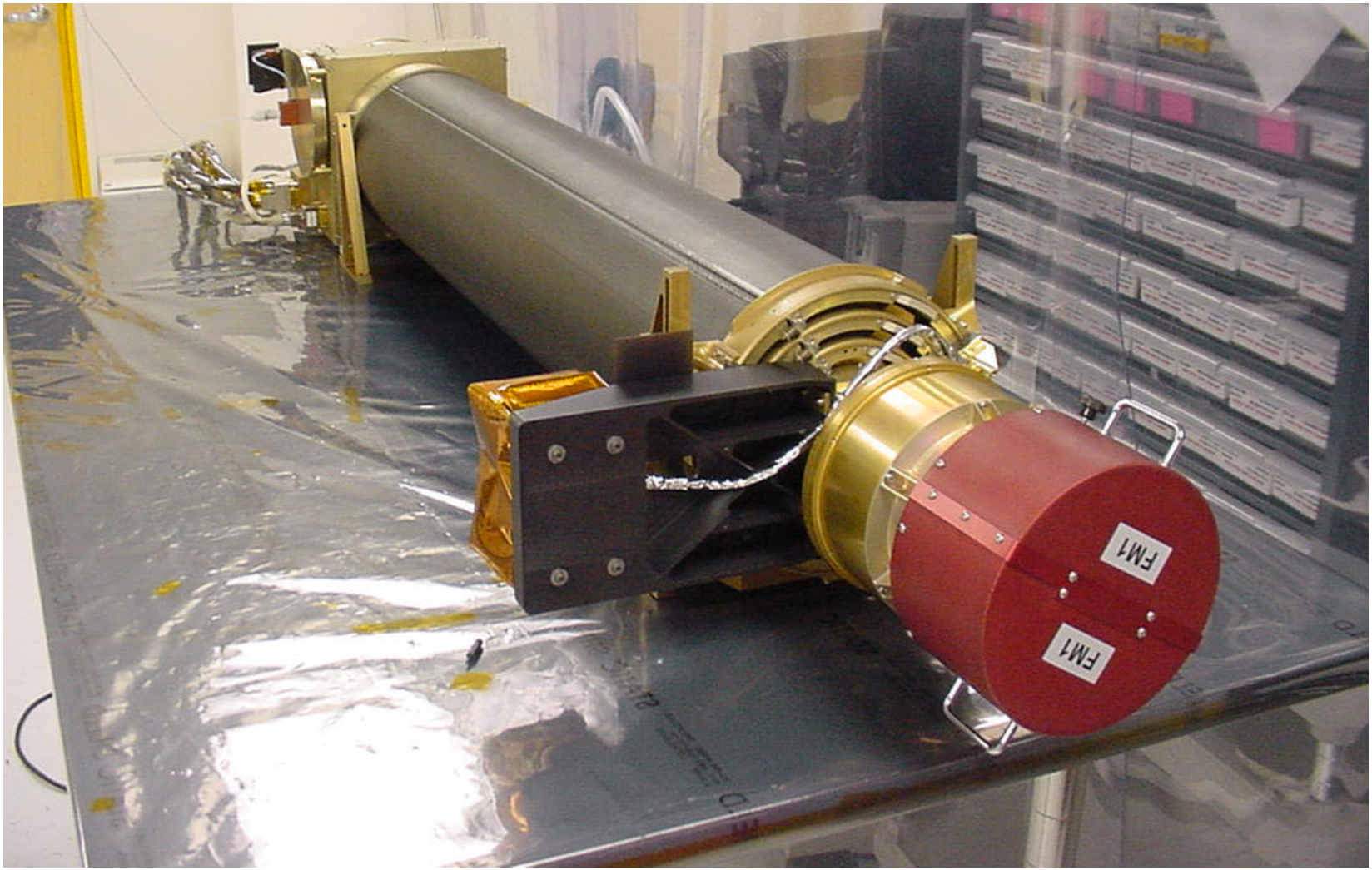
Quality Assurance

- 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: http://sprg.ssl.berkeley.edu/impact/dwc/Problems/
- Boom related Waivers Closed
  - Waivers can be found at: http://sprg.ssl.berkeley.edu/impact/dwc/Waivers/
- Acceptance Data Package Prepared and reviewed

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.**

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/cm^2/sec, Measured = 1.1E-12 g/cm^2/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 CPT): ~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