

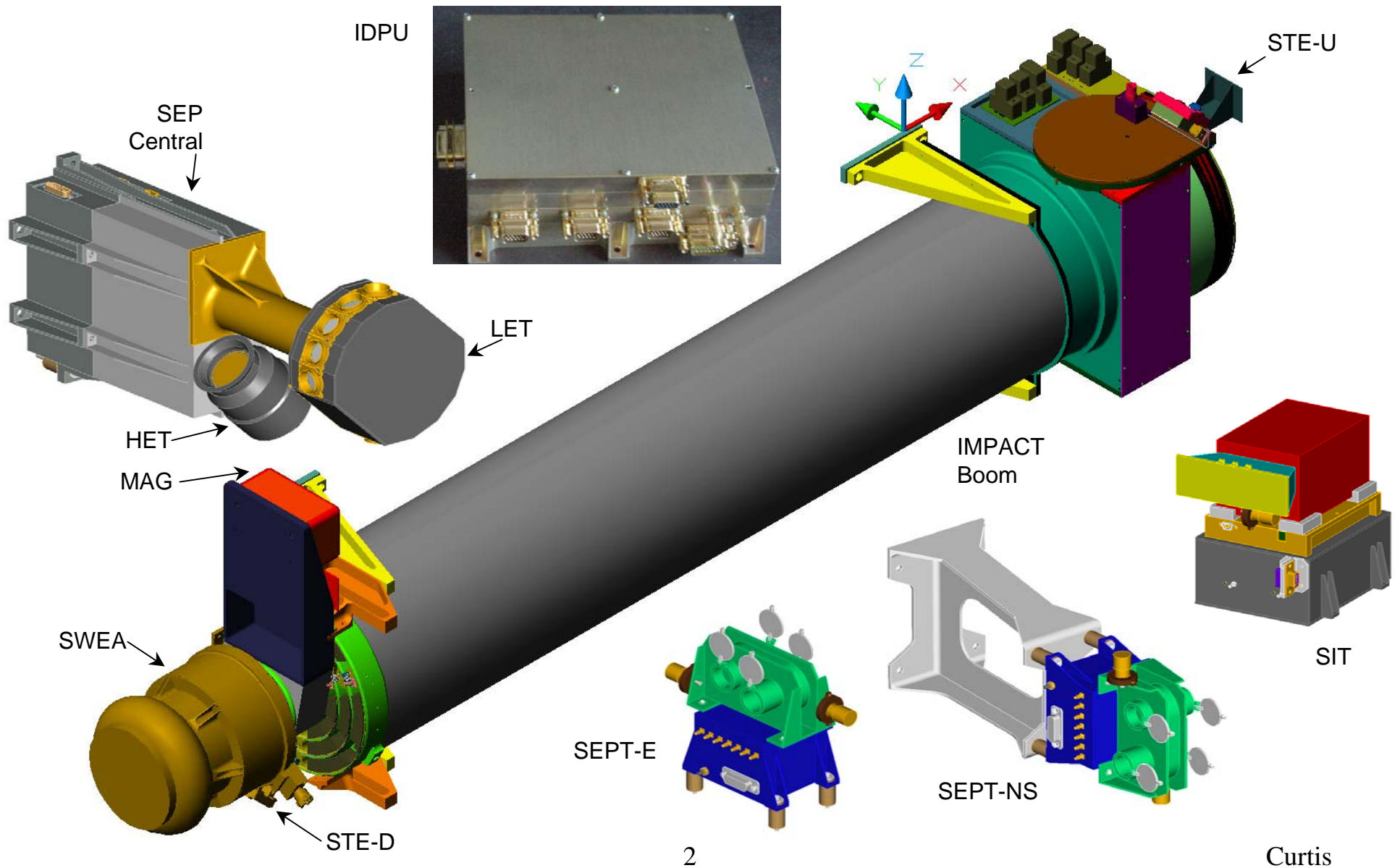
# ***STEREO IMPACT***

Observatory Pre Environmental Review  
2005 September 26, 27



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## **Review History**

- **FM1 IDPU PSR** **March 2, 2005**
  - No RFAs
- **FM1 Boom Suite PSR** **March 31, 2005**
  - No RFAs
- **FM2 Boom Suite PSR** **May 23, 2005**
  - One RFA (FM2 IDPU EMC; see PFR1042 below), Closed.
- **FM1, FM2 SEP Suite PSR** **August 12, 2005**
  - Three RFAs:
    - **Verification of accelerometer locations to monitor loose screws**
      - Done, Closed ?
    - **Memory Bit Flip Software Fix**
      - before observatory thermal vac
    - **FM1/2 Thermal Vac Temperature comparison**
      - done, no significant difference, Closed ?

## PFRs Closed since PSR

- **PFR1029, FM1 SWEA Anode Stopped Counting**
  - One of the 16 SWEA Anode signals failed when warm (>40C)
  - Discovered in Calibrations, prior to start of qualification tests (except EMC)
  - Caused by bad Amptek A111F module
    - Failure analysis indicated bad bonding
    - Possible implications for remaining parts in flight units
  - Part replaced with a spare from the same lot, no further problems with the channel through qualification tests and observatory integration
  - GSFC Parts group completed tests on original lot
  - **Closed.**
- **PFR1042, FM2 IDPU EMC**
  - CE problem, was integrated and re-tested at the observatory; rejected
  - Returned to UCB, diagnosed, fixed (incorrect wiring of common mode filter)
  - Retested (EMC, thermal vac, workmanship vib)
  - Returned to APL, remounted, tests OK
  - Closed
- **PFR1043, IDPU Software Performance**
  - First acceptance test of IMPACT+PLASTIC software with instrument ETU/simulators indicates insufficient processing cycles
  - Rework PLASTIC software to improve performance
  - Latest version keeps up with full processing load
    - UNH test with IMPACT instrument simulators, PLASTIC ETU; Also Mission Sim #2
  - **Closed?**

## PFRs still Open (discussed in PSR)

- **LET L3B Detector (PR-2005)**
  - **Problem:** S/N L3-11 detector in LET (L3B) in FM 1 began to display high and growing leakage current over time.
  - **Cause:** Unknown but now thought to be inherent in double oxide detectors.
  - **Corrective Action:** Replaced with S/N L3-11 on 5/10/05 with L3-06.
  - **Status:** Open because replacement detector also has growing leakage current (currently meets requirements) but won't be replaced unless an opportunity arises. Can meet minimum science requirements even if it fails.

## PFRs still Open (discussed in PSR)

- **LET FM 2 Crashes (PR-2013)**
  - **Problem:**
    - Memory bit flips in multiple locations during thermal vac in 1 of 3 memory devices in LET, usually resulting in a processor crash (see also PR-2009, 2010, 2011, and 2014).
    - Corruption occurs about 70-80% of the time when transitioning from cold to warm at about -2C.
  - **Cause:** Unknown but tests exonerated Actel and failure is believed to be confined to the device.
  - **Corrective Action:**
    - Replaced memory device on 7/28/05; unit successfully passed subsequent thermal vac test.
    - Part sent to Honeywell for failure analysis on 8/9/05.
    - Procured 9 spare devices from a different lot date code.
    - Since we may not be able to find root cause and a fix to the hardware may be too risky, a software workaround is in development to automatically detect and correct a memory error in the SEP suite.
  - **Status:**
    - **Open**

## PFRs still Open (discussed in PSR)

- **LET/HET/SEP Central FM 1 Crashes (PR-2014)**
  - **Problem:**
    - Memory bit flips in multiple locations during thermal vac in 1 of 3 memory devices in SEP Central, resulting in anomalous behavior in SEP Central FM 1 and in LET and HET as well (also seen in thermal balance – PR-2009, 2010, and 2011) and also similar problem seen in LET FM 2, PR-2013).
    - Corruption occurs about 5-10% of the time when transitioning from cold to warm at about –15C.
  - **Cause:** Unknown but tests exonerated Actel and failure is believed to be confined to the device.
  - **Corrective Action:**
    - Replaced memory device on 7/31/05-8/2/05; repeated thermal vacuum test OK.
    - Part sent to Honeywell for failure analysis on 8/9/05.
    - Procured 9 spare devices from a different lot date code.
    - Since we may not be able to find root cause and a fix to the hardware may be too risky, a software workaround is in development to automatically detect and correct a memory error in the SEP suite (to be loaded before observatory thermal vac).
  - **Status:**
    - **Open**



## PFRs still Open (discussed in PSR)

- HET FM1,2 Detector Cross-Talk (PR-4001)
  - **Problem:** Invalid event tagging and processing during accelerator test
  - **Cause:** Cross-talk between the H1i and H1o detectors and between the H2-H6 detectors
  - **Corrective Action:** New software algorithm was written and tested using stim pulser to simulate the two types of cross talk events. Further testing planned at accelerator with EM unit.
  - **Status:** **Open.**
- HET FM1 H1o Anomaly during CPT (PR-4003)
  - **Problem:** During a CPT, which pulses each channel separately, the H1o preamplifier ADC reading dropped from 50 to 12, which resulted in a high current reading of 4.75 volts. When all the channels were enabled, the preamplifier reading normalized.
  - **Cause:** Possible inability of software algorithm to adjust the input resistance DAC due to a very low leakage current on the H1 detector.
  - **Corrective Action:** Unable to replicate this anomaly. Use as is and continue to monitor.
  - **Status:** **Open.**



## PFRs still Open (discussed in PSR)

- **PR-3012 (4/25/05) cracked ceramic piece in SIT MCP stack**
  - When stack opened for inspection of possible HV discharge damage, a cracked ceramic piece was found. It is possible that the stack bolts were over-tightened, since Belleville washers were fully compressed.
  - Replaced part and reassembled stack. Unit passed CPT
  - Status: **OPEN**
  
- **PR-3010 (4/1/05)**
  - SIT Solid state detector (SSD) 44-120F shown high counts; testing reveals that the detector is the likely cause
  - Since no new spares available, reinstall SSD 42-104A, 4/18/05
    - Initiate procurement of ion-implant solid state detectors from Micron Semiconductor
    - **See below for recovery plan**
  - Status: **OPEN**

## **SIT Detector Issue Closure Plan**

- **SIT FM2 bad detector (PFR 3010)**
  - **Detector replacement plan:**
    - **receive and inspect new detectors (on order)**
    - **functional test new detectors**
    - **life test new detectors**
    - **remove FM2 SIT from spacecraft**
      - **Note this was already planned to check performance post-environments in calibration facility, though we would prefer to do this prior to spacecraft thermal vac if possible**
    - **open FM2 SIT, replace detector with best of new lot**
    - **close up SIT, perform functional & alpha tests to verify instrument/detector performance**
    - **1-axis Workmanship vibration**
    - **repeat alpha test**
    - **return to spacecraft at KSC and re-install**
    - **instrument CPT on spacecraft at KSC**

## **PFRs since PSR**

- **APL PFR 0083, IDPU Jackposts not staked**
  - APL to stake them
- **APL PFR 0089, Water spill in clean room containing FM1 boom suite**
  - Boom covered, inspected, no damage
- **APL PFR 0097, FM1 Boom Connector J4, J5 Loose Jackpost**
  - Jackposts re-torqued and staked
- **APL PFR 0107, FM1 MAG Heater Current not balanced between redundant wires**
  - Minor differences in spacecraft harness impedance, not significant
- **APL PFR 0118, SWEA Ground isolation violation**
  - See Waiver 463-258
- **APL PFR 0122, SIT 25KHz CE Noise**
  - Common mode noise on SIT to SEP Central harness in SWAVES receive band
  - Seems to be related to load variations in SIT (SIT shares LVPS with SEP Central)
  - Under investigation; may need added filtering in SIT (TBR)

## **PFRs since PSR**

- **APL PFR 126 SEPT ULTEM bushings misplaced.**
  - New bushings made and installed
- **APL PFR 127 SEPT backshell broke.**
  - Repaired
- **APL PFR 0128, SIT, SEPT Actuator harnessing**
  - Spacecraft, IMPACT actuator wiring incompatible
  - Spacecraft modified their harness
- **APL PFR 129 SIT (FM-1) Jackscrews spinning (A193-J1).**
  - Re-torqued, staked
- **APL PFR 130 SEP-SIT Test Cover Screw Broken.**
  - Removed, replaced with metallic tape.
- **APL PFR 131 SIT and SEP Central failed Grounding Measurements.**
  - Excedance small. Waiver to be submitted.

## **Waivers since PSR**

- **463-241, IMPACT FM1 EMC Test Exceedances**
  - Was still open at Boom Suite PSR; has been approved by EMC committee and CCB
- **463-238, IMPACT FM1 Boom Chassis Ground Pins**
  - ICD calls for one pin from each connector to be connected to chassis ground inside the instrument
  - This was omitted on two of the FM1 IMPACT Boom connectors (J1, J3), discovered during safe-to-mates
  - This signal is not used in the harness
  - Waiver approved by EMC committee and CCB
- **463-258, IMPACT Ground Isolation Violation**
  - The SWEA door sense circuit violates the ground isolation between primary and secondary grounds called out in the EMC specification
  - 10K impedance plus a diode
  - Discovered during safe-to-mates
  - Connection removed after SWEA door opens
    - no problem in science mode
  - Waiver approved by EMC committee and CCB

## **Operating Hours**

- **Operating Hours (A/B), at integration**
  - missing hours since Observatory integration
  - **MAG**                    **350**        **433**
  - **SWEA/STE-D**        **268**        **196**
  - **STE-U**                **940**        **583**
  - **IDPU**                **350**        **433**
  - **HET**                 **750**        **650**
  - **LET**                 **642**        **98**
  - **SEP Central**        **98**         **733**
  - **SIT**                 **106**        **112**
  - **SEPT-NS**           **610**        **377**
  - **SEPT-E**            **824**        **359**

## Limited Life Items

- **Boom Deployments:**
  - Qual boom deployments: 28
  - FM1:2 boom deployments to date: 4 : 4
  - Anticipated boom deployment in spacecraft I&T: 1
  - Anticipated boom deployments on orbit: 1
- **SWEA, SIT, SEPT Door Actuations**
  - Actuator life (manufacturer): 100
  - SWEA FM1:2 door actuations to date: 14 : 13
  - SIT FM1:2 door actuations to date: 12 : 12
  - SEPT FM1:2 door actuations to date (Ea/Eb/NSa/NSb): 14 / 14 / 18 / 20 : 13 / 8 / 18 / 17
  - 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 FM1:2 door actuations to date: 526 / 119 : 216 / 202
  - STE-D FM1:2 door actuations to date: 134 / 46 : 224 / 118
  - Anticipated actuations in spacecraft I&T (2 per CPT): ~20
  - Anticipated actuations on-orbit (2 year mission): ~58



## **Software Metrics**

- **IDPU (v 27, including PLASTIC 2.9.2):**
  - RAM: 88%, EEPROM 68%
  - Processing 0.013 seconds average 0.098 seconds maximum per loop
    - Requirement is <1 second
  - A few features still in work (mostly PLASTIC), due before thermal vac
- **SEP Central (v4-19-05):**
  - 60% Memory, 7% Processor
- **LET (v7-22-05):**
  - 89% Memory, 2000 events/second processing (requirement is >1000)
- **HET (v2.2):**
  - 76% Memory, 2500 events/second processing (requirement is >1000)
  - V3 in work, should improve performance.
- **SIT (v1.3):**
  - 55% Memory, 3500 events/second processing (requirement >1000)
  - Problem with look-up table (not software) in latest version

## **IMPACT Testing**

- **Instrument CPT, LPT, and Aliveness tests defined and tested**
  - CPT is generally an end-to-end test of the hardware exercising all systems
  - Constraints to CPT:
    - SWEA, SIT high voltage on only in thermal vac
      - Use test pulsers to stimulate detectors when in air
    - SWEA door actuation only a few times (manual reclose)
    - SIT CPT requires stimulus GSE attached to instrument
    - STE door opening requires room be darkened (working on GSE cover to avoid this)
    - HET, LET, SEPT require external radiation sources for selected CPTs
      - Not thermal vac
    - SWEA requires radiation source for thermal vac CPT
- **IMPACT Boom deployment at Observatory level**
  - just prior to EMC test
  - fully off-loaded using UCB MGSE
- **Magnetics compatibility test**
  - Part of EMC test
  - Flight MAG sensor to be shielded to measure conducted noise
  - IMPACT-provided non-flight sensors to map spacecraft-generated fields
- **HET, SEPT Muon test, in parallel with other testing, one time, no special setup**

## **Significant IMPACT Verifications Completed (Last Time)**

- **Instrument Calibrations**
  - Instrument CPTs can provide trend data, but is not as extensive
- **Thermal Vac boom deployments**

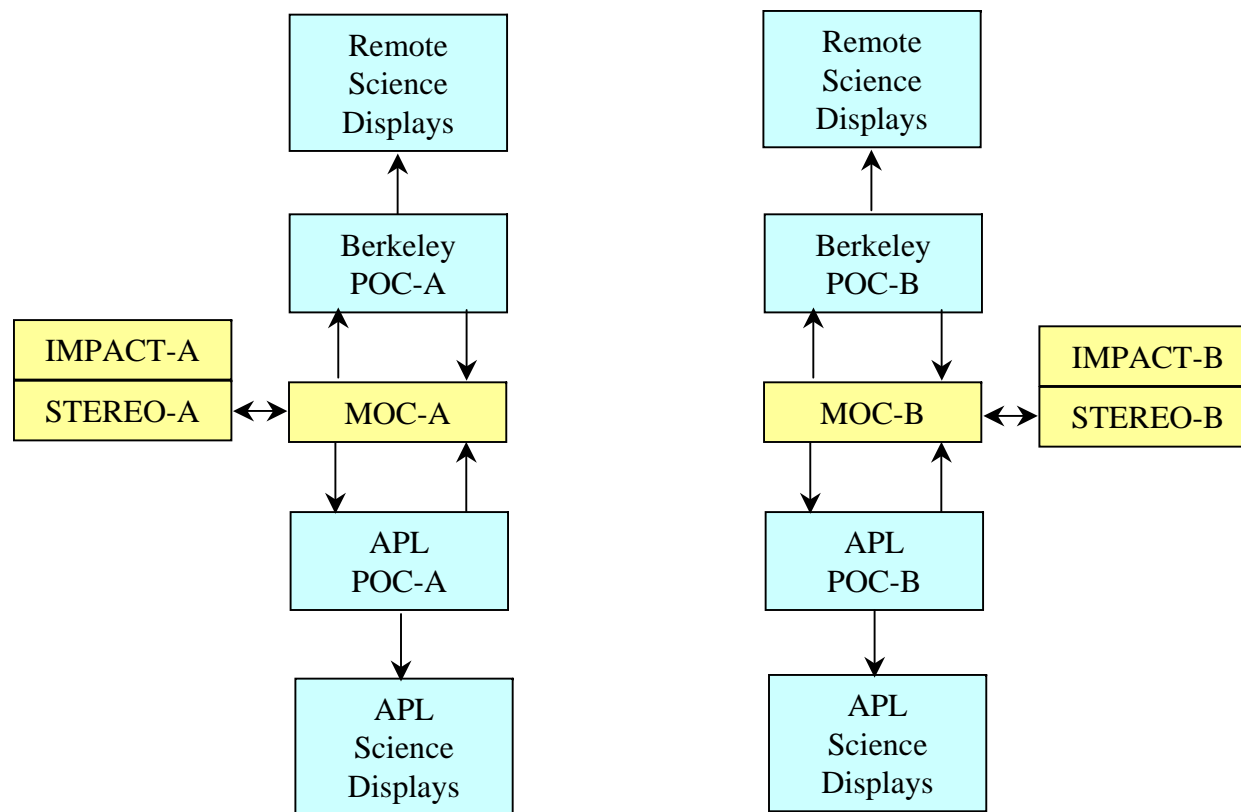
## **Verification Status**

- **Science Performance Compliance**
  - All requirements met, except SIT FM2 (detector failure)
    - Replacement detectors on order
    - Existing detector adequate to verify instrument functionality during I&T
- **Verification Matrix, Unverified Requirements:**
  - 1.2.5, SIT FM2 Energy Resolution (pending new detector)
  - 1.3.5, SEPT max event rate (pending EM test at Van de Graaff facility; ok with pulser)
  - 3.4, Boom Suite self-shock, SWEA; deployment shock enveloped by vibration test; Observatory-level deployment to be performed at EMC.

## **Trending**

- **Supply voltages, currents**
- **MAG:**
  - Internal Calibration mode field response
- **STE:**
  - Calibration source, Test Pulser response
- **SWEA:**
  - Background, control voltages
  - Calibration source response (when in vacuum)
- **SIT**
  - Background SSD counts, MCP counts (in vacuum)
- **SEPT**
  - Detector Bias Currents, Background
- **HET**
  - Detector Leakage currents, Gains, Background
- **LET**
  - Detector Leakage currents, Gains, Offsets, Background

## POC Block Diagram



## **Test Readiness**

- **IMPACT Instruments are mounted to the spacecraft and ready for Observatory Environmental Tests**
  - FM2 SIT Detector needs replacement, after observatory thermal vac
- **IMPACT POC and GSE in place and ready**
  - SIT GSE Thermal Vac cables in fabrication
- **IMPACT Documentation and Test Procedures complete**
- **IMPACT Personnel ready to support tests**
  - Some support will be remote, over the internet (tested)