STEREO IMPACT

PR Numbers: 1xxx=UCB, 2xxx=Caltech/JPL, 3xxx=UMd, 4xxx=GSFC/SEP, 5xxx=GSFC/Mag, 6xxx=CESR, 7xxx=Keil, 8xxx=ESTEC, 9xxx=MPAe

Assembly : SIT Instrument	**SubAssembly : ATOF electronics board**
Component/Part Number:	**Serial Number: 01**
Originator: Walpole	**Organization: UMd**
Phone : 301-405-6217	**Email : Walpole@umd.edu**

Failure Occurred During (Check one √)

x Functional test x Qualification test □ S/C Integration □ Launch operations

Environment when failure occurred:

□ Ambient □ Vibration □ Shock □ Acoustic
□ Thermal x Vacuum □ Thermal-Vacuum □ EMI/EMC

Problem Description

FM1 STOP Singles count rate is zero. During setup for an alpha test at UMd it was noted that when pulsed from an external source the STOP TOF singles rate was zero. This condition persisted for several days in air and vacuum. Raising the level of the pulser input from 0.1v to 1 v did not solve the problem. Quick tests confirmed the problem is not in the pulser or external cabling.

Looking back, we find that this problem first showed up during Thermal Balance testing of the FM1 unit. The fm1 stop rate went to zero in thermal balance around 3-4PM on Feb 14; this was noted at the time, and was deemed to be due to the MCP "cleaning up". We had believed that there was no discharge since the SIT misc did not reset in association with this incident, and in all other cases of suspected HV discharges, the misc had reset. Also, the HV showed no anomalies. After the thermal balance, a functional would have identified the failure, but this was not done while SIT was hooked up to sep central since the blankets were in place, etc. After it was disconnected from sep central, it would have required a return to UMd to do the functional and we decided against this -- clearly not the right decision.

Looking in detail at the thermal balance data, the failure was around 19:56 UT (see attached plot). There is a burst in the START rate that decays over a period of time -- possibly there was spark that took out the STOP channel, and produced some ionization that was counted by the START (which continued to operate). The HV shows no change, and the MISC continued as before. At the time of this discharge, the telescope had been under HV for about 10 hours at the nominal operating state ("b8").

Analyses Performed to Determine Cause

We have looked at the readouts of the chamber - ion gauge, TCM and temperatures – during the portion of the TB test surrounding the incident. We see a small excursion in chamber pressure But this occurs about 45 minutes after the incident. Nothing else jumps out of the plots.

We examined the log books for the TB test. There was a power glitch but this occurred at 19:00 – hours after the incident.

We have disassembled the telescope looking for possible causes. Does the Kapton tape have bubbles of air under it that could have escaped, temporarily raising the pressure inside the telescope? Is there any sign of damage in the MCP stack that could point to a possible breakdown? We disassembled the FM1 telescope on 4/25 and the STOP MCP assembly. We found no sign of discharge or breakdown and no evidence of air bubbles under the Kapton. We did find a broken ceramic piece (see PR-3012) but it appears this could not have caused a HV problem.

The FM1 ATOF board was removed from the FM1 Electronics box and tested separately in the ETU test setup at UMd. It was verified that the STOP channel had ceased functioning. The board was returned to GSFC where the parts D1, D2, D3, D1B,D2B,D3B and Q1B were removed for failure analysis. The –B

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parts are the first stage transistor and its protective diodes from the STOP channel. The rest are protective diodes from the START channel.
Per an MRB we investigated the effect on the performance of the TOF system of replacing the input resistor (R13), currently a short, with a 301 ohm resistor. We also checked the effect of moving the top ends of diodes D1 and D3 to the protected side of R13. (See atofsch.pdf included below). In both cases the threshold was raised but the performance with alpha particles was not changed. The purpose of both these changes was to protect the input stage from large signals appearing at the input and both appear acceptable.

Corrective Action/ Resolution

x Rework x Repair □ Use As Is □ Scrap

Repaired FM1ATOF board by replacing D1,D2,D3,D1B,D2B,D3B (JANTXV1N5711UR-1) and Q1B (AT-41435). All parts that had a potential of being stressed were replaced. Submitted parts to failure analysis to confirm electrical overstress damage. Failure analysis results confirmed that both failures were confirmed electrically. However, no conclusive physical damage were observed after deprocessing the transistor and diodes D1B and D3B. On the other hand, D2B diode showed damage on the contact area. (reference Q50228 and Q50227)
On both FM1, and FM2 as well as the FS (flight spare) ATOF boards replaced R13 and R13B with 301 ohm metal film chip resistors. (Carbon resistors would have been preferable but do not fit on the board well.)
It is standard practice to turn on the HV very slowly when in vacuum. In addition, the following constraints have been added to the instrument and observatory level thermal vacuum plans. - Operating the supplies in inadequate vacuum could damage the instruments, so they will not be left powered on for long periods of time to minimize the risk of damage caused by pressure transients in the chamber. The high voltage will not be operated unless the chamber pressure has been below 1E-5 Torr for at least 12 hours continuously. In addition, the spacecraft will automatically and immediately shut down the high voltage supplies by issuing a power-down warning to the IMPACT instruments if the chamber pressure exceeds 1E-5 Torr.

Date Action Taken 5/2/2005 **Retest Results**:_Electrical test at board level and functional/alpha tests at box level – all successful

Corrective Action Required/Performed on other Units x Serial Number(s): FM2, flight spare

Closure Approvals

Subsystem Lead: _____ Date:_____
IMPACT Project Manager: _____ Date _____
IMPACT QA: _____ Date:_____
NASA IMPACT Instrument Manager: _____ Date:_____

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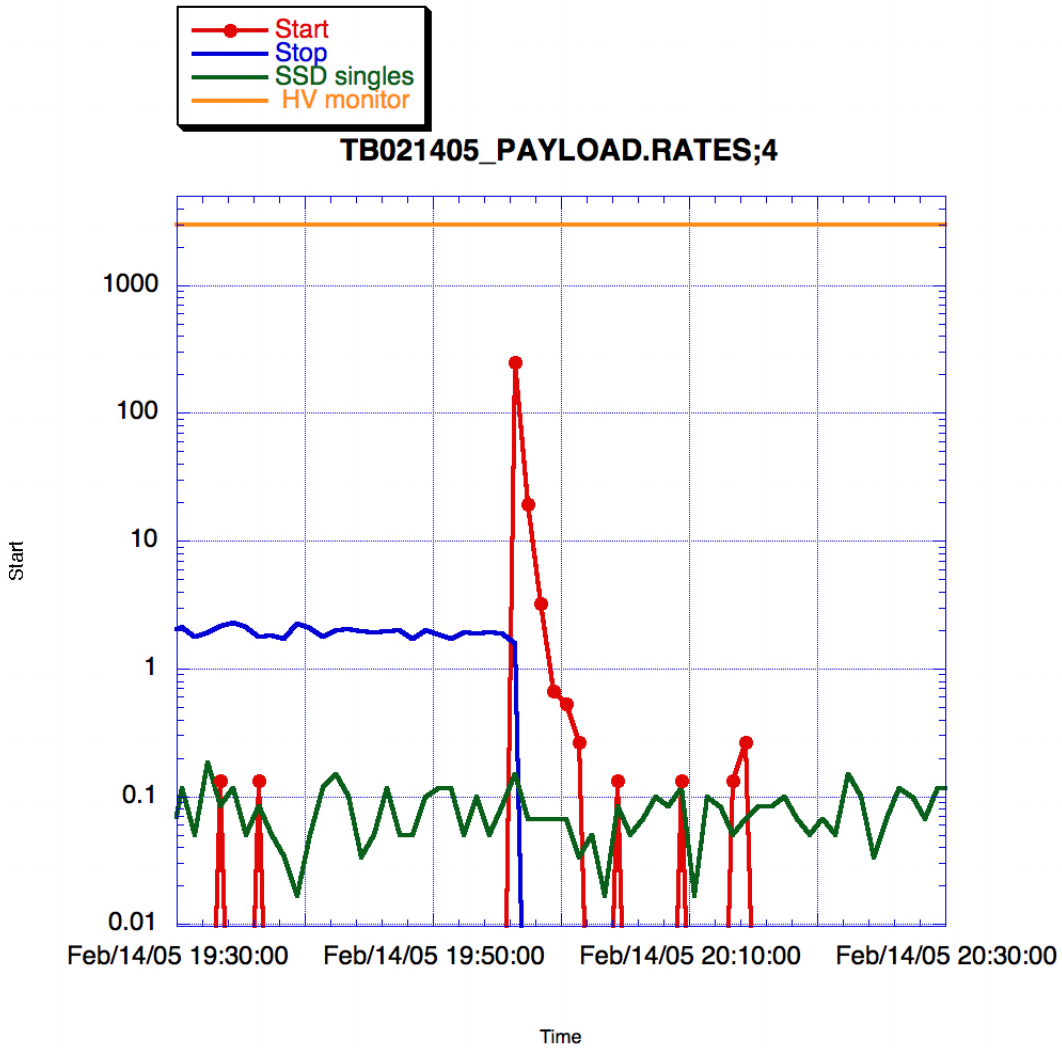

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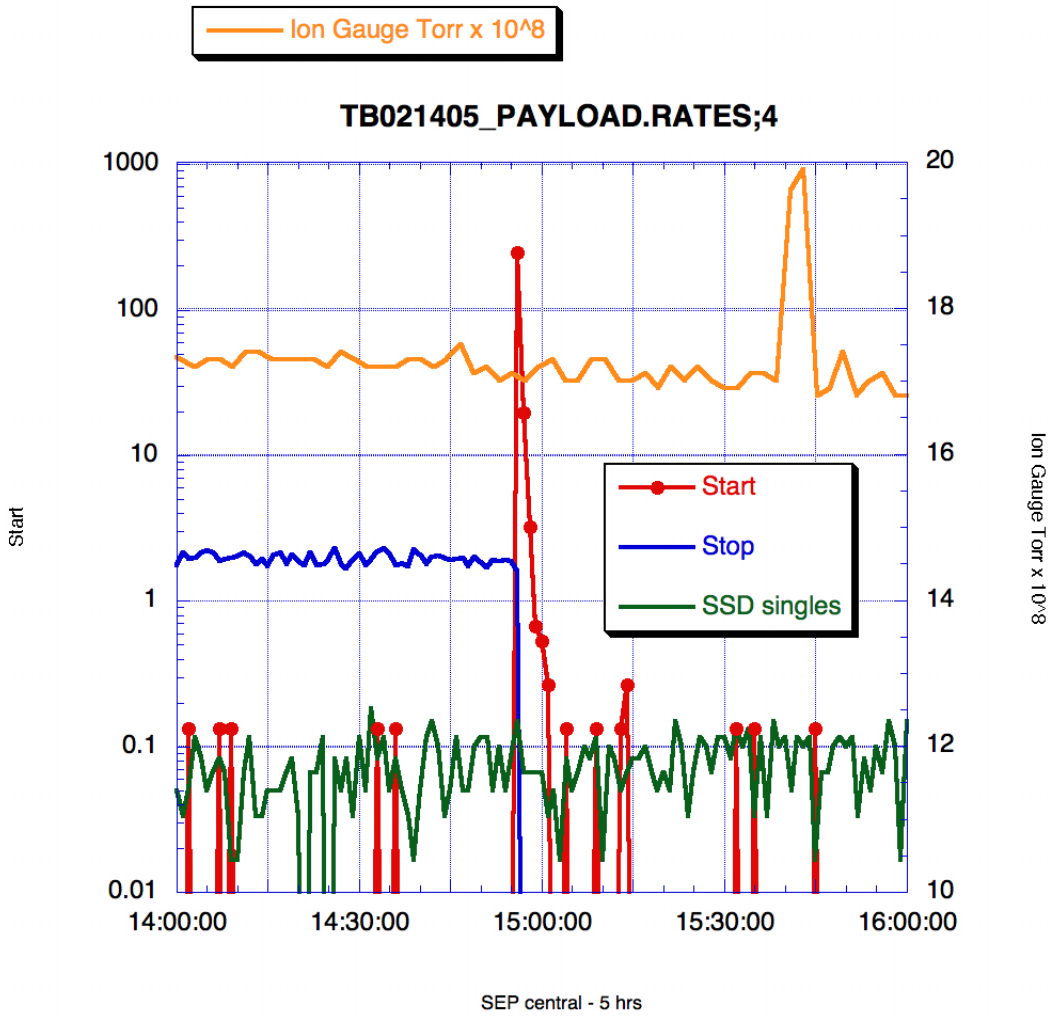

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