STEREO IMPACT

PROBLEM REPORT
PR-3003
Waterman/Walpole
8/18/04

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	**SubAssembly : ATOF FM2**
Component/Part Number: ATOF FM 2_2 (FM2 Instrument)	**Serial Number: 0342**
Originator: Waterman/Walpole	**Organization: UMd**
Phone : 301-405-4517	**Email : waterman@uleis.umd.edu**

Failure Occurred During (Check one √)

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

Environment when failure occurred:

X Ambient □ Vibration □ Shock □ Acoustic
□ Thermal **X** Vacuum □ Thermal-Vacuum □ EMI/EMC

Problem Description

The Start count rate from Time of Flight Electronics was zero.

Analyses Performed to Determine Cause

Using an oscilloscope, a sequence of events was found that will put a high voltage pulse out on one or both of the START and STOP signal lines. Because of the nature of the testing that was being performed, the telescope and the HVPS is in the vacuum and the electronics are outside on the bench. The START and STOP signals come out through BNC feedthrus. To prevent problems with possible spikes during turn-on and turn-off, we connect up the electronics or the scope only after the voltage is stable on the MCPs. Apparently, however, there is a considerable (100pf) capacitance in the anode from which we take our signals and connecting into it when it is charged can produce a hefty signal. Similarly, if we disconnect the load from the anode and then turn off the HV, we end up with a charged capacitor but a system which appears to be safe, because everything is off. Connection to the capacitor at this point produces a several hundred volt negative signal, more than enough to damage the electronics. Therefore, the cause is most likely due to connecting inputs to the MCP stack in vacuum before the high voltage leaked off.

Corrective Action/ Resolution

X Rework (flight board) **X** Repair (GSE) □ Use As Is □ Scrap

On the flight board the start and stop signal electronics, Q1 (AT41435), (1N5711) D1, D2 and D3 was replaced with new parts. To prevent this from occurring again, we have permanently added a 10K ohm termination resistor to ground both the Start and the Stop vacuum chamber BNC connectors after disconnecting. This was added to the outside of the chamber. The test was repeated using the 10K ohm termination resistor, except, this time leaving the 10K termination resistor connected. There was no measurable voltage observed.

Date Action Taken:_____8/19/2004_____ **Retest Results**:____Success, board level test. __
Corrective Action Required/Performed on other Units □ Serial Number(s): ____n/a___

Closure Approvals

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

Analyses Performed to Determine Cause, Continued

From: "Peter Walpole" <walpole@sampex.umd.edu>
To: "Axel Korth" <korth@linmpi.mpg.de>
Cc: "David Curtis" <dwc@ssl.berkeley.edu>,
"Lillian S. Reichenthal" <Lillian.S.Reichenthal@nasa.gov>,
"Chris Waterman" <cwaterman@hst.nasa.gov>,
"Glenn Mason" <Glenn.Mason@umail.umd.edu>
Subject: Continuing Problems with TOF Board Damage
Date: Wed, 18 Aug 2004 12:18:11 -0400
X-Priority: 3

Dear Axel,

I regret to tell you that we have had another problem with damage to the TOF Boards, this time to FM2. Both START and STOP channels have stopped working and it appears that the problem is the same as we had on the FM1 unit.

We have been doing test with an oscilloscope, looking for the cause of the problem and have found a sequence of events that will put a high voltage pulse out on one or both of the START and STOP signal lines. Because of the nature of the testing we have been doing, we have the telescope and the HVPS in the vacuum and the electronics outside on the bench. The START and STOP signals come out through BNC feedthrus. To prevent problems with possible spikes during turn-on and turn-off, we connect up the electronics or the scope only after the voltage is stable on the MCPs. Apparently, however, there is a considerable (100pf) capacitance in the anode from which we take our signals and connecting into it when it is charged can produce a hefty signal. Similarly, if we disconnect the load from the anode and then turn off the HV, we end up with a charged capacitor but a system which appears to be safe, because everything is off. Connection to the capacitor at this point produces a several hundred volt negative signal, more than enough to damage the electronics. We believe this is the cause of our troubles.

We have decided to put 10k bleeding resistors on the outside of the chamber to ensure that the capacitor cannot retain a voltage for more than a few tens of microseconds. Since it takes me seconds to change HV and then make or break connections this should be sufficient to prevent the large signals we have noted from occurring. The 10k is big enough it should not distort the TOF signals too badly. We have also determined that there are no turn-on or turn-off transients from the HVPS or transients from rapid commanding of HV - the HVPS appears incapable of changing voltage quickly enough to cause problems. In space we will be continuously connected to the telescope so there will always be a 50 ohm load on the START and STOP signals. Unless there is a breakdown in the telescope or HVPS (unlikely) the problem of transients therefore is limited to our test setup and we believe that the use of the bleeder resistors will cure this. I expect never to have to tell you again that we have damaged a board.

In the mean time, the parts you sent arrived on time. We have (just!) gotten permission to install them and that is being done today. I have every expectation that this will fix the problem with START of FM1, but I will let you know tomorrow. I don't know what the spares situation is, but could you send more parts:

3 transistors
9 diodes

to fix FM2 START, FM2 STOP and to replace potentially compromised parts on FM1 STOP (it still works, but given that it was probably subjected to the same stresses it may just be hanging on by a thread and cause a failure later).

Best,

Peter

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