

STEREO IMPACT

PROBLEM REPORT

PR-1008

STEU FM1 Door

2004-05-10

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

Assembly : STE-U	SubAssembly : Door
Component/Part Number:	Serial Number: FM1
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Failure Occurred During (Check one)

Functional test Qualification test S/C Integration Launch operations

Environment when failure occurred:

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

Problem Description

At the first cold soak during thermal vac a test was made of the STE door. The door failed to open, or even indicate that it had come off the closed position. The door circuit was taking current. The door timeout was increased to 1.9s (the maximum) and the door opening attempt was repeated a number of times without success. We are sure the door remained closed (not a sense switch error) because the radiation source in the door continued to be seen. The failure occurred when the internal detector temperature sensor read -125C. The temperature was raised in 20C increments up to ambient and the door re-tested at each plateau with no success. The door had worked correctly at ambient just before the start of thermal vac. We had successfully tested the door in thermal balance at -50 and -77C; we had adjusted the end-stop switch since then, but that should not have caused any problem.

Analyses Performed to Determine Cause

1. Careful inspection and measurement of all moving parts uncovered a part (the Overcenter Base, P/N# STE-240), that was out of tolerance. This is a Vespel SP-3 part that has a deep bore in which a bronze shaft slides. Inspection revealed that the bore was the proper diameter for most of its length, but that it had a reducing diameter by a few thousandths near its bottom.
2. The actuator wire overheated when the time out was increased to 1.9s while trying to troubleshoot what the door did not open. Normally the door current is switched off by reaching the desired location in ~0.5s - 0.75s. The default timeout is 1s. This explains why the door continued to fail to operate at warmer temperatures.

Corrective Action/ Resolution

- Rework Repair Use As Is Scrap
1. A custom GSE broach was manufactured to shave the bore to the proper diameter. This was performed on all STE doors (STE-U and STE-D, FM1 and FM2)
 2. The SMA wires on FM2 STE-U were also replaced. Protection has been added into the flight software to prevent overheating the wires in the future.

The entire door was operated while its housing was sitting in LN2 (in a N2) atmosphere). The door operated correctly. All flight door assemblies have been tested in this manner to assure they have adequate margin at cold temps prior to integration with the STE detectors. The door subsequently worked flawlessly in thermal vac for all 6 CPTs.

Date Action Taken: 2004-5-28 **Retest Results:** Passed Thermal Vac tests

Corrective Action Required/Performed on other Units Serial Number(s): STE-U FM2, STE-D FM1, STE-D FM2

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Closure Approvals

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

Failure Analysis Details:

Careful inspection and measurement of all moving parts uncovered a part that was out of tolerance. This is a Vespel SP-3 part that has a deep bore in which a bronze shaft slides. Inspection revealed that the bore was the proper diameter for most of its length, but that it had a reducing diameter by a few thousandths near its bottom. The shaft slid in and out nicely at room temp, but when immersed in a tray of LN2, the Vespel part shrunk enough to cause binding of the shaft. All of the flight assemblies were tested on this fashion, and three of six were found to have the same taper and sticking problem at cold temps.