STEREO IMPACT

PROBLEM REPORT
PR-7001
SEPT-DoorOpening
2004-02-20

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

Assembly : IMPACT SEPT-NS FM2	**SubAssembly : Sensor**
Component/Part Number:	**Serial Number:** A201 SN4
Originator: Reinhold Mueller-Mellin	**Organization:** U. Kiel
Phone : +49-431-880-227	**Email :** mueller-mellin@physik.uni-kiel.de

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

Pinpuller actuation test was performed before and after vibration of SEPT-E FM1, SEPT-NS FM1, SEPT-E FM2, and SEPT-NS FM2. Each unit has four doors and two pinpullers. All doors opened flawlessly except for one door of SEPT-NS FM2 (associated with pinpuller SN 5069) after vibration. While the pinpuller performed nominally, the door did not swing fully open (190°), but was stuck at 90° position. After reclosing manually, a second attempt opened the door successfully.

Analyses Performed to Determine Cause

On component level, many door openings have been performed manually in order not to exceed the pinpuller life cycles. All tests were successful. The doors and collimators were not yet coated. After application of thermal coating to the titanium doors, but still on component level, one incident occurred when the hinge-bolt got stuck in the door hinge. This was attributed to residues of thermal coating or masking material in the hinge. The bolt was removed and the hinge cleaned. This door was not used for flight models, but is dedicated to the flight spare. A new titanium hinge-bolt was fabricated. A second incident occurred during sensor integration, when the door of SEPT-E FM1 (associated with pinpuller SN 5053) opened noticeably slower than it used to. Cleaning and reopening showed normal behaviour. The current problem report covers the third incident and first with a fully integrated flight unit. It is consistent with the hypothesis of mechanical obstruction by particles redistributed during vibration.

Corrective Action/ Resolution

√ Rework □ Repair □ Use As Is □ Scrap

Insufficient spring force is not likely to be the cause (see incident 1). Cleaning, widening the gap between bolt and hinge, and lubricating the hinge-bolt will strongly reduce the possibility for mechanical obstruction. New hinge-bolts will be fabricated (diameter 2.95 mm instead of 3.00 mm) while the hinge diameter (3.01 mm) remains untouched. Application of molybdenum sulfide (layer thickness ~ 0.01 mm) will improve easy motion. Possible non-conductance of MoS2 is no problem, as doors are grounded in closed and open position at other points. Change of thermal isolation is no problem as doors shall not conduct heat to main sensor body. (More attached)

Date Action Taken: AUG-2004 **Retest Results**: All doors opened correctly (NOV-2004)

Corrective Action Required/Performed on other Units √ Serial Number(s): A195 SN1, A201 SN2, A195 SN3

Closure Approvals

Subsystem Lead:	Reinhold Mueller-Mellin	Date: 07-DEC-04
IMPACT Project Manager:	_____	Date _____
IMPACT QA:	_____	Date:_____
NASA IMPACT Instrument Manager:	_____	Date:_____

Additional information resulting from a Failure Review Board telecon held 2004-2-27, consisting of Reinhold Mueller-Mellin, Ludovic Duvet, and David Curtis from the instrument team, Lil Reichenthal, Steve Wasserzug, and Shane Hynes from Project.

Rework plan, continued:

In addition to the work indicated above, the hinge holes in the doors shall be cleaned out using a drill bit and isopropyl alcohol.

Retest plan:

After rework the door force margins shall be verified by opening each door with only one of the two springs active. Following that the thermal vac will proceed as planned, with door openings hot and cold. Finally a repeat of the vibration will be performed (possibly at GSFC). The repeat vibration will be at TBD levels based on results of the spacecraft coupled loads model. Project will provide those levels.

New failure case observed during TV (date: 2004-03-10):

After rework, replacement of hinge-bolts and lubrication with MoS_2 there were 16 covers subjected to TV testing with eight covers to open at hot soak and eight covers to open at cold soak. One cover (SEPT-E FM1 rear electron aperture) failed to open at cold soak (-40 °C) although the associated pinpuller performed nominally, and the partner cover (SEPT-E FM1 proton aperture) opened correctly. When ramping up to higher temperatures (but still below 0 °C), the cover opened by itself.

Rework plan (new):

We envisage that the SEPT sensors will have to be disassembled to install new detector stacks. In this process, the covers, collimators, and pinpuller rods will become available for rework and surface treatment (e.g. tiodize titanium surfaces). The exact steps of the recovery procedure will need further discussion with the failure review board.

Rework completed (August 2004):

All titanium parts received anodize treatment with Teflon impregnation. All parts involved in the mechanism were reworked and/or cleaned. All four sensor units were re-assembled and integrated with associated electronics.

Retest completed (November 2004):

Door opening of all 16 doors prior to vibration successful. Door opening of 12 doors after vibration successful, 2 doors did not open, but for other reasons (see PR-7006 SEPT-Rod), two doors were not attempted to open. After torquing the 2 rods, the latter 4 doors opened successfully. Door opening for 8 doors in TV cold soak successful, door opening of the remaining 8 doors in TV hot soak successful.

Additional door opening test during Thermal Balance Test completed (February/March 2005):

Door opening of 14 doors successful, 2 doors did not open, but for other reasons (see PR-7007 TB door test failure). Retest during both hot and cold soak with redesigned MLI blanket successful for FM1 and FM2 SEPT-NS.