



Problem/Failure Report
THM-PFR-221
Mirror Piece In F1 Probe

PFR-221 Title: Mirror Piece in F1 Probe

Assembly : THEMIS F1 Probe	SubAssembly : Structure	
Component : Bottom Deck	Units Affected:	Units fixed:
Originator: Dalton	<input checked="" type="checkbox"/> - <input type="checkbox"/> - <input type="checkbox"/> - <input type="checkbox"/> - <input type="checkbox"/> - <input type="checkbox"/>	<input checked="" type="checkbox"/> - <input type="checkbox"/> - <input type="checkbox"/> - <input type="checkbox"/> - <input type="checkbox"/> - <input type="checkbox"/>
Organization: SSL - UCB	Date: 21 Aug 06	
Phone: 510.643.9240	Email : gdalton@ssl.berkeley.edu	

Failure Occurred During (Check one √)

☐ Functional test ☐ Qualification test ☐ S/C Integration ☐ Launch operations ☒ Other (Flight Assy)

Environment when failure occurred:

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

Problem Description

With the -Y solar array removed from Probe 1, a piece of inspection mirror was found lying on the bottom deck during closeout inspection, below the fuel tank in the -X-Y corner as shown in Fig. 1.

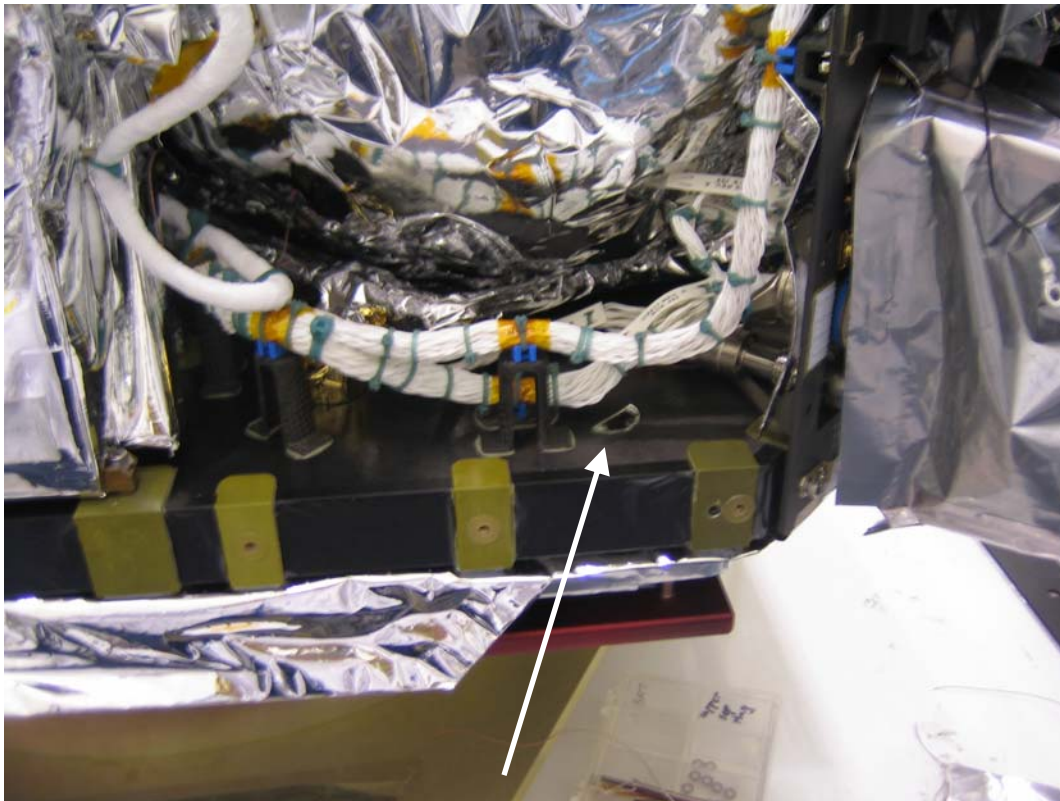
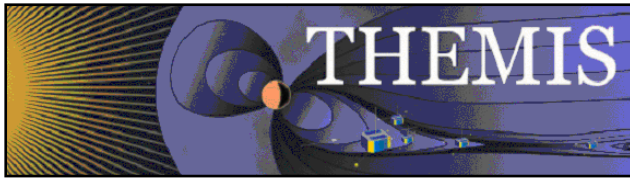


Fig. 1 Mirror piece discovery location.



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Analyses Performed to Determine Cause

The source of the piece of mirror is not known. Previous inspections of the spacecraft bus did not show signs of broken glass, shards of glass, or any other foreign material. A survey of SSL inspection mirrors returned no broken or missing mirrors. It is determined that the piece of mirror was dislodged during environmental testing and the associated probe handling (roll-overs). Mirror piece is shown in Fig.2.

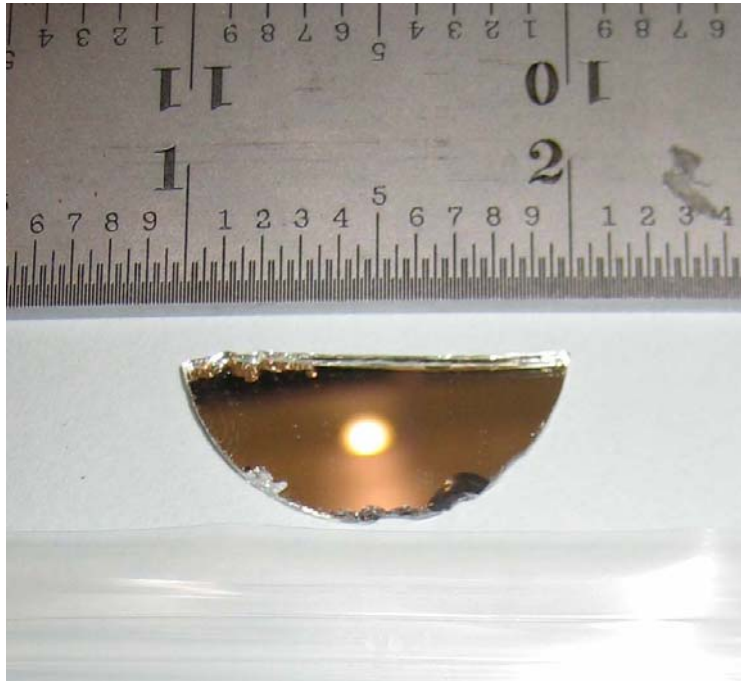


Fig 2. Mirror Piece

Corrective Action/ Resolution

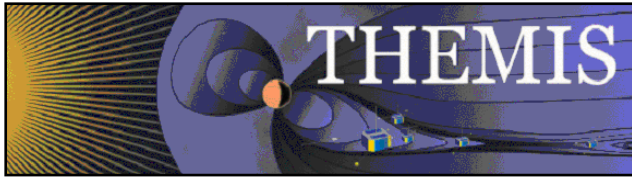
The spacecraft was thoroughly inspected and no other foreign material found. Future inspections, with QA presence, will continue to be performed on any spacecraft when the bus is opened.

Acceptance:

MAM: Ron Jackson _____; MSE: Ellen Taylor _____

PM: Peter Harvey _____; Cognizant Engineer _____

Date of Closure _____

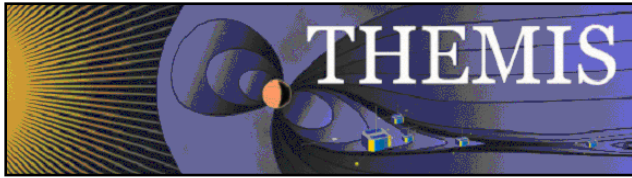


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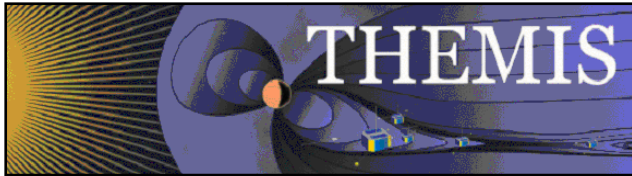
Non-UCB Interviews:

Name	Themis role	Date/Time	Statements	Other comments
Jamie Hollbrook & Larry Henson	PM & Lead Tech at Aerojet	8/29 5:30PM	<ul style="list-style-type: none"> M. Cully spoke with Aerojet's PM and Lead Tech since they were involved with the P1/F1 Pressure Transducer removal here at Swales and had a need to use inspection mirrors for weld inspection. They used a 2x3 inch square mirror and have accounted for all their tools. 	
Joe Calabrese	QA	8/29 6:00PM	<ul style="list-style-type: none"> Has never used such a mirror at the Probes Has never seen any such mirror with a crack or missing section 	<ul style="list-style-type: none"> At UCB, used a boroscope for P2 connector inspections but did not see any inspection mirrors at that time
Doug Ng	Mechanical Tech	8/30 8:20AM	<ul style="list-style-type: none"> Has sometimes used a dental-style mirror but with a smaller diameter Has never seen any such mirror with a crack or missing section 	
Sally McCann	Blankets	8/30 8:30AM	<ul style="list-style-type: none"> Has never used or seen an inspection mirror at the probe 	<ul style="list-style-type: none"> Does not recall seeing any such instruments at UCB
John Pindell	Mechanical	8/30 8:40AM	<ul style="list-style-type: none"> Uses only a "paddle" shaped mirror, using a polished stainless surface (no glass) On search of 5015 tool chests, found: <ul style="list-style-type: none"> At mechanical inspection area: two dental mirrors with 3/4" diameter glass At 5015 high bay: two "paddle" mirrors with polished metal surface; one dental mirror with 3/4" glass At mechanical office area (Doug's cabinet), two dental mirrors with 3/4" glass Does not recall any other type of mirror in high bay, or any mirror having cracked or missing glass 	



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Name	Themis role	Date/Time	Statements	Other comments
Lamont Franklin	QA	8/30 9:00AM	<ul style="list-style-type: none"> Regularly used a magnifying loop, but never an inspection mirror at the probe Cannot recall seeing any mirror used Has never seen any such mirror with a crack or missing section 	
Gale Barnes	QA	8/30 9:00AM	<ul style="list-style-type: none"> Did not use a mirror at the probe, or remember seeing one used Has never seen any such mirror with a crack or missing section 	<ul style="list-style-type: none"> Has a glass mirror in his desk which is paddle shaped with 1" width and rounded ends; an end section from such a mirror could match the section found by UCB Cannot remember seeing another similar mirror at Swales
Gaius Ajamian	Electrical/harness	8/30 9:45AM	<ul style="list-style-type: none"> Does not recall any inspection mirror used at probe 	
Russell Hall	Electrical/harness	8/30 9:45AM	<ul style="list-style-type: none"> Does not recall any inspection mirror used at probe 	
Barbara Shiro	Electrical/harness	8/30 11:00AM	<ul style="list-style-type: none"> Rarely uses an inspection mirror, but then only the polished stainless mirror Does not allow the electrical techs to use glass mirrors around flight hardware 	
Rommel Zara	Thermal/blankets	8/30 11:30AM	<ul style="list-style-type: none"> Sometimes used an inspection mirror, but only the polished stainless mirror (from mechanical tool drawer) 	<ul style="list-style-type: none"> Does not recall seeing any such mirror used at UCB or JPL
Curtiss Dunsmore	Electrical/harness	8/30 12:10PM	<ul style="list-style-type: none"> Has sometimes used the polished mirrors but only in mockup area, not around probe Confirms glass mirrors not used by the electrical techs 	
Craig Woodruff	ADCS	8/30 12:50PM	<ul style="list-style-type: none"> Confirmed mirror section does not match anything from the ADCS sensors 	
Don Jarosz	Sep system/pyros	8/30 1:00PM	<ul style="list-style-type: none"> Mirror used only for connection of PC23 to pyro valve; polished stainless type was used 	



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Name	Themis role	Date/Time	Statements	Other comments
Eric Shaw, Bill Mister (Maryland QC)	Non-destructive weld inspection following PT replacement	9/1 10:30 AM	<ul style="list-style-type: none"> Spoke with Bill Mister Area Manager for Maryland QC and Eric Shaw who was inspector for Probe 1 Pressure Transducer rework. UCB problem report sent by Stan Kos before discussion. Eric said that he had used a square mirror in his inspection and that it was accounted for (Bill confirmed that Eric's initials are on the mirror). Eric did point out that mirror fragment could have been the circular section from an oblong mirror. 	
Rex Richardson	I&T	9/1 2:30PM	<ul style="list-style-type: none"> Has used both the 3/4" dental mirrors and rectangular polished stainless mirrors (from high bay mechanical tool cabinet); I&T does not have its own inspection mirrors Does not recall use of any other mirrors during integration and test 	

UCB Interviews:

Name	Themis Role	Date/Time	Statements	Other Comments
Paul Turin & Greg Dalton	Mechanical	10/4/06 1:30 PM	Jorg Fisher spoke with the Mechanical Lead Engineer and his deputy. Both were involved in all mechanical tasks for probe one thru five. They only used the mirrors in the UCB/SSL mechanical toolboxes: one large rectangular mirror, 2 small dental-style mirrors, and 1 dental-style mirror. All mirrors they used on THEMIS are accounted for and are in mint condition.	See Chris Scholz statement
Chris Scholz	QA	10/3/06 1:30 PM	Does not have a dental-style mirror. After the incident, Chris checked all UCB tool boxes at JPL and found one large rectangular mirror, 2 small dental-style mirrors, and 1 dental-style mirror – all in mint condition.	
Yvette Irvin	Electrical/Harness	10/11/06 11:05 PM	Yvette has no mirror tool and has accounted for all her other tools. She has never used a mirror for her work.	



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Bruce Dalen	Thermal/Blankets	10/16/06 8:30 AM	For his thermal blanket work on THEMIS, Bruce has not used any mirrors.	Bruce stated that he has a small inspection mirror. It is in his toolbox and in perfect condition.
Helen Yuan	Thermal/Blankets	10/3/06 9:30 AM	Has never used such a mirror at or near the probes. She has no mirror in her toolbox.	Stated that there is no need to use a mirror for thermal blanket installation.