MSFC Problem Reporting and Corrective Action (PRACA) System
WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A10101	**In-Flight Anomaly Number** --	**Contractor Report Number** E-101-1	**JSC#** --	**KSC#** --
Problem Title TRANSDUCER OUTPUT SIGNAL HAD ELECTRICAL NOISE				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 1R
HCRIT 1	**Sys_Lvl** N	**Misc Codes** A **(4)** B C D E F G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** LH2 ULL PRES TRNSDCR	**PART#** PD7400098-039	**SER/LOT#** 1456	**MANUFACTURER** GULTON
HARDWARE LRU	**NOMENCLATURE** N/A	**PART#** N/A	**SER/LOT#** N/A	**MANUFACTURER** N/A
HARDWARE NCA	**NOMENCLATURE** LH2 ULL PRES TRNSDCR	**PART#** PD7400098-039	**SER/LOT#** 1456	**MANUFACTURER** GULTON
Test/Operation A - ATP	**Prevailing Condtion** F - FUNCTIONAL	**F / U** F	**Fail Mode** UC - UNSAT	**Cause** ETE - EI-TEST-ENVR
System ELECTRICAL	**Defect** CN - CONTAM	**Material** C - EEE	**Work Contact** J. ADAMS	**Fail Date** 05/15/1986
Received at MSFC 07/01/1986	**Date Isolated** --	**FMEA Reference** 3.4.1.2	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location GULTON		**Symptom** EVM - CON/MEG FAIL		**Time Cycle** --
Effectivity Text LWTS 16, 20, 21, 22, 24/SUBS				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** --	**LVL 3 Close** --	**Remark / Action** --	
Investigation / Resolution Summary				
Last MSFC Update 02/14/1995	**CN RSLV SBMT** 02/23/1987	**Defer Date** --	**Add Date** --	**R/C Codes** 2 - MFG -- --
Assignee				
Design P. MULLER	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --
Approval				

Design	Chief Engineer	S & MA	Project	Project MGR
P. MULLER	J. NICHOLS	R. JACKSON	M. PESSIN	--
PAC Assignee	**PAC Review Complete**	**MSFC Closure Date**	**Status**	**F/A Completion**
J.EL-IBRAHIM	JE	11/06/1987	C - CLOSED	--
Problem Type	**SEV**	**Program Name**	**REVL**	**OPRINC**
--	--	--	--	--
FUNC MOD	**Software Effectivity**	**Software Fail CD**	**SUBTYPE**	**Software Closure CD**
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RES PERSON L2	**Approval Signature L3**			
--	--			
Related Document Type	**Related Document ID**			
--	--			
Related Document Title				
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Related Document Type	**Related Document ID**			
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Related Document Title				
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Related Document Type	**Related Document ID**			
--	--			
Related Document Title				
--				
Contractor Status Summary				
Reliability/Quality Assurance Concerns, Recommendations:				

Problem Description

REF: MARS T-10485 AND PREVIOUS CAPS E-091 AND E-082. THE TRANSDUCER EXCEEDED THE MAXIMUM ALLOWABLE WIPER-TO-ELEMENT CONTACT RESISTANCE OF 25 OHMS AT TWO POINTS IN ITS PRESSURE RANGE. THE HIGHEST MEASURED RESISTANCE WAS 90.3 OHMS

Contractor Investigation/Resolution

R/A - ADDITIONAL INSPECTION STEPS HAVE BEEN ADDED TO REDUCE THE FREQUENCY OF OCCURENCE. 7/1/86 LAUNCH CONSTRAINT - NONE - TRANSDUCERS MUST PASS ATP AT VENDOR AND ARE THEN TESTED WHEN INSTALLED INTO TANK AT MAF. TRANSDUCER IS TO BE RETURNED TO MMC/MAF FOR FA. 8/21/86 PRB STATUS - FA CONTINUING. ECD 9-15-86. 9/18/86 PRB STATUS - FA COMPLETE. FAILURE CAUSED BY MICROSCOPIC CONTAMINATION. CONSIDERED NORMAL PRODUCTION FALLOUT. NO CORRECTIVE ACTION PLANNED. ECD 10-31-86. 10/16/86 PRB STATUS - CONTAMINATION IDENTIFIED AS FRICTIONAL PLOYMERS WHICH IS INHERENT TO MANUFACTURING PROCESS. FAILURE IS CONSIDERED NORMAL PRODUCTION FALLOUT. ECD AT MMC IS 11-7-86. 1/29/87 PRB STATUS - CLOSURE IN WORK, CAPS ECD 1-30-87. 2-23-87 - CORRECTIVE ACTION HAS ALREADY BEEN OBTAINED AS PART OF CAPS E-082. AS A RESULT OF THE FAILURES DOCUMENTED IN CAPS E-082, ADDITIONAL MARTIN MARIETTA PROCUREMENT QUAILTY MAN-DATORY INSPECTION POINTS WERE ADDED TO THE VENDORS MANUFACTURING DOCUMENTATION. THE INSPEC- TIONS INCLUDE: 1) EXAMINATION OF THE WIPER AND OF THE RESISTIVE ELEMENT FOR SURFACE FINISH, AND 2) EXAMINATION OF THE COMPLETED INTERNAL MECHANISM FOR ASSEMBLY AND CLEANLINESS JUST

PRIOR TO INSTALLATION OF THE CASE. THE INSPECTIONS SERVE TO REDUCE THE FAILURE RATE OF THE TRANSDUCERS. THIS TASK HAS BEEN COMPLETED AND DOCUMENTED IN CAPS E-082. CAPS E-082 REMAINS OPEN DUE TO ADDITIONAL INVESTIGATIONS OF FAILURE DUE TO SHORTED TURNS. THIS PROBLEM IS SUBMITTED TO MSFC FOR CLOSURE REVIEW AND APPROVAL
MSFC Response/Concurrence

MSFC Problem Reporting and Corrective Action (PRACA) System

ASSESSMENT ADDENDUM REPORT

MSFC Report#	**IFA#**	**Contractor RPT#**	**JSC#**	**KSC#**	**EICN#**
A10101	--	E-101-1	--	--	--
Asmnt Part#	**Asmnt Part Name**	**Asmnt Serial/Lot#**			
PD7400098-039	LH2 ULL PRES TRNSDCR	1456			
HCRIT CD	**FCRIT CD**	**CAUSE CD**	**FAIL MODE**		
--	1R	EIC - EI-CONTAM	UC - UNSAT		
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**		
3.4.1.2	2	G	1		
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**		
--	--	--	--		
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**		
--	--	--	--		
Correlated Part#	**Correlated Part#**	**Correlated Part#**			
--	--	--			
Associated LRU#	**Associated LRU#**	**Associated LRU#**			
--	--	--			
MAJOR DESIGN CHANGES					
APRV DATE	**DESCRIPTION OF CHANGES**				
--	--				
ASSESSMENT TEXT					

MSFC Problem Reporting and Corrective Action (PRACA) System
WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A10102	**In-Flight Anomaly Number** --	**Contractor Report Number** E-100-1	**JSC#** --	**KSC#** --
Problem Title LH2 LEVEL SENSOR FAILED INSULATION RESISTANCE TEST				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 1
HCRIT 1	**Sys_Lvl** Y	**Misc Codes** A **(4)** B C D E F G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** LH2 LEVEL SENSOR	**PART#** 74L4-2	**SER/LOT#** 1293	**MANUFACTURER** SIMMONDS
HARDWARE LRU	**NOMENCLATURE** LH2 TANK	**PART#** 80911000000	**SER/LOT#** N/A	**MANUFACTURER** MMC
HARDWARE NCA	**NOMENCLATURE** LH2 LEVEL SENSOR	**PART#** 74L4-2	**SER/LOT#** 1293	**MANUFACTURER** SIMMONDS
Test/Operation A - ATP	**Prevailing Condtion** F - FUNCTIONAL	**F / U** F	**Fail Mode** EE - RANDOM	**Cause** ETP - EI-TEST-INST
System ELECTRICAL	**Defect** EM - ELADJ	**Material** C - EEE	**Work Contact** J. ADAMS	**Fail Date** 05/20/1986
Received at MSFC 06/23/1986	**Date Isolated** --	**FMEA Reference** 3.6.1.1	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location SIMMONDS		**Symptom** EVM - CON/MEG FAIL		**Time Cycle** --
Effectivity Text LWTS 16, 20, 21, 22, 24 AND SUBS				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** --	**LVL 3 Close** --	**Remark / Action** --	
Investigation / Resolution Summary				
Last MSFC Update 02/10/1995	**CN RSLV SBMT** 09/28/1987	**Defer Date** --	**Add Date** --	**R/C Codes** 4 - TEST -- --
Assignee				
Design P. MULLER	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --
Approval				
Design	**Chief Engineer**	**S & MA**	**Project**	**Project MGR**

P. MULLER	J. NICHOLS	R. JACKSON	M. PESSIN	--
PAC Assignee J.EL-IBRAHIM	**PAC Review Complete** JE	**MSFC Closure Date** 12/17/1987	**Status** C - CLOSED	**F/A Completion** --
Problem Type --	**SEV** --	**Program Name** --	**REVL** --	**OPRINC** --
FUNC MOD --	**Software Effectivity** -- -- -- -- --	**Software Fail CD** --	**SUBTYPE** --	**Software Closure CD** --
RES PERSON L2 --	**Approval Signature L3** --			
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Contractor Status Summary				
Reliability/Quality Assurance Concerns, Recommendations:				

Problem Description

REF: PREVIOUS CAPS E-081, E-093, MARS T-53578, A11016. A LIQUID HYDROGEN LEVEL SENSOR FAILED TO MEET THE INSULATION RESISTANCE REQUIREMENT OF THE VENDOR ACCEPTANCE TEST PLAN. THE MINIMUM ALLOWABLE RESISTANCE AT 500 VOLTS DC IS 2 MEGHOMS. THE ACTUAL VALUE OBTAINED WAS A NEAR 0 OHMS INDICATION

Contractor Investigation/Resolution

REMEDIAL ACTION - THE TEST REQUIREMENTS FOR THE SENSORS ARE NOT CONSISTENT AMONG THE VENDOR, MAF, AND THE LAUNCH SITE. TEST REQUIREMENTS HAVE BEEN REVISED TO BE CONSISTENT WITH THE VENDOR'S ALSO,THE REVISION TO INCLUDE CONTROLS ON THE RELATIVE HUMIDITY AND THE TEMPERATURE DURING THE TEST. LAUNCH CONSTRAINT - NONE. THE FAILURE OCCURRED DURING ACCEPTANCE TESTING AT THE VENDOR. ALL LEVEL SENSORS ARE TESTED AGAIN WHEN INSTALLED IN AN ET. 6/26/86 BACKGROUND INFORMATION - LIQUID LEVEL SENSORS UNDERGO A SERIES OF VENDOR LEVEL ACCEPTANCE TESTS TO ASSURE THAT THEY ARE IN COMPLIANCE WITH THE DRAWING REQUIREMENTS THE SEQUENCE OF TESTS, UP TO THE POINT AT WHICH FAILURE OCCURRED ON THIS SENSOR, ARE AS FOLLOWS: 1. VERIFICATION OF THE PHYSICAL DIMENSIONS OF THE SENSOR. 2. VISUAL EXAMINATION OF THE SURFACE FINISH OF THE CASE AND THE CONDITION OF THE WIRES. 3. WEIGHT OF THE SENSOR. 4. DIELECTRIC STRENGTH TEST OF 500 VOLTS AC FOR 1 MINUTE. 5. INSULATION RESISTANCE GREATER THAN 2 MEGOHMS AT 500 VOLTS DC, AT WHICH POINT THE SENSOR FAILED AND TESTING WAS HALTED. LATER TESTS IN THE SERIES INCLUDE THERMAL SHOCK, RESPONSE RATE, RESISTANCE OF THE ELEMENT, ETC. FAILURE

INVESTIGATION - THE VENDOR, SIMMONDS PRECISION, WILL PERFORM THE INITIAL STEPS OF THE FAILURE ANALYSIS AT THEIR FACILITY. THE F/A PLAN HAS BEEN COORDINATED WITH MMC RELIABILITY ASSURANCE AND WILL BE WITNESSED BY THE MMC PROCUREMENT QUALITY REPRESENTATIVE. 7/15/86 PRB STATUS - FA PARTIALLY COMPLETE. EXPECT COMPLETION WITHIN 40 DAYS. MR G. P. BRIDWELL REQUESTED THE PROBLEM REPORTS SHOULD INDICATE THAT THIS SENSOR IS INTERCHANGEABLE WITH THE DEPLETION SENSOR AND THE DEPLETION SENSOR HAS A CRITICALITY 1 FUNCTION. MMC CONCURRED. 8/21/86 PRB STATUS - TWO ADDITIONAL NOISE FAILURES ON -039. FAILURE ANALYSIS TO BE CONDUCTED ON THE ADDITIONAL FAILURES. 9/18/86 PRB STATUS - FA CONTINUING AT VENDOR. FAILURE IS AN ARC-OVER. PIN HOLES IN COVER PAINT IS WHERE ARC-OVERS OCCUR. COVER TO GE FOR FA. FAILURE CONSIDERED NORMAL PRODUCTION FALLOUT. TEST IS AT 500V. ACTUAL USAGE IS APPROXIMATELY 20V NO CORRECTIVE ACTION PLANNED. ECD IS MID OCTOBER 86. 10/16/86 PRB STATUS - NO CHANGE. ECD FOR COMPLETION AT MMC IS 12-5-86. 2/19/87 PRB STATUS - ELECTRICAL ENGINEERING WILL GENERATE A PRCN TO REVISE OMRSD FILE 4 TO INCLUDE AN ISOLATION RESISTANCE CHECK OF THE LH2 ECO SENSORS AND TO TEST ALL VEHICLES THAT HAVE ALREADY COMPLETED FILE 4 TESTING ENGINEERING IS ALSO EVALUATING THE EFFECT OF THE ADDITIONAL SENSOR FAILURE UPON THE ACCEPTABILITY OF THE SENSORS IN COMPLETED ETS. 4/31/87 - ADDITIONAL CORRECTIVE ACTIONS REQUIRED. ECD 6/19/87 5/28/87 - UPDATE STATUS - NO CHANGE 9/29/87 CLOSURE UPDATE - REF MMC CAPS E-100B GENERAL A. BACKGROUND INFORMATION THE CRYOGENIC, POINT, LIQUID LEVEL SENSORS, PART NUMBERS 74L4-1 AND -2, LOX AND LH2 SENSORS RESPECTIVELY, ARE VIRTUALLY IDENTICAL IN CONSTRUCTION. THE SOLE DIFFERENCE BETWEEN THE SENSORS LIES IN THE TYPE OF TEFLON INSULATION ON THE OUTPUT WIRES. THE SENSORS ARE USED TO INDICATE THE PROPELLANT LEVELS IN THE ET AND, IN THE CASE OF THE LH2 SENSORS, FOUR ARE USED AS PROPELLANT DEPLETION SENSORS TO SHUTDOWN THE ORBITER MAIN ENGINES. VENDOR LEVEL ACCEPTANCE TESTING VERIFIES PHYSICAL DIMENSIONS, RESPONSE RATE, ELEMENT RESISTANCE, AND ISOLATION RESISTANCE OF EACH SENSOR. TESTS AT MAF AND THE LAUNCH SITES CHECK ELEMENT RESISTANCE AND ISOLATION RESISTANCE TASK I - THE RESULTS OF FAILURE ANALYSIS T-53578 PERFORMED BY SIMMONDS PRECISION ARE AS FOLLOWS: 1. THE CAUSE OF THE SENSOR FAILURE WAS ARCING BETWEEN THE CIRCUIT PATH ON THE SENSOR ELEMENT SUBSTRATE AND THE METAL CASE OF THE SENSOR. 2. THE SENSOR DESIGN IS SUCH THAT THE CIRCUIT PATH ON THE SUBSTRATE CAN CONTACT THE METAL CASE FROM WHICH IT IS SUPPOSED TO BE INSULATED. THE SOLE INSULATION AT THAT POINT IS THE SPRAYED ON, BAKED, TEFLON PAINT ON THE INTERNAL SURFACES OF THE CASE. 3. THE TEFLON PAINT ON THE CASE MET THE DESIGN REQUIREMENTS FOR THICKNESS. TASK II CORRECTIVE ACTION A. THE VENDOR DEVELOPED AN ASSEMBLY AID TO MORE ACCURATELY CENTER THE SUBSTRATE IN THE CASE. THIS SHOULD REDUCE THE OCCURRENCES OF THE CIRCUIT PATH TOUCHING THE INTERNAL SURFACE OF THE CASE (REFERENCE MARS T-53578). HOWEVER, THE DESIGN OF THE SENSOR PROVIDES NO POSITIVE MECHANICAL SEPARATION AND THE PARTS COULD SHIFT INTO CONTACT AT A LATER TIME. B. ELECTRICAL ENGINEERING HAS SUBMITTED PRCN-MMC-XL TO REVISE OMRSD FILE 4 TO INCLUDE AN ISO- LATION RESISTANCE TEST OF THE LH2 DEPLETION SENSORS AND TO TEST ALL VEHICLES THAT HAVE ALREADY COMPLETED FILE 4 TESTING. THE RCN HAS BEEN APPROVED AND ASSIGNED NUMBER MT-7484. CHANGE SUMMARY B01806 WAS APPROVED ON SEPTEMBER 16, 1987. THE VENDOR ATP REQUIREMENTS WERE REVISED TO INCLUDE HUMIDITY AND TEMPERATURE CONTROLS DURING THE ISOLATION RESISTANCE TESTS. THE MAF FLIGHT ACCEPTANCE REQUIREMENTS, MMC-ET-TM04K-B, WERE REVISED TO REQUIRE THE SAME ISOLATION RESISTANCE VALUE AS USED DURING THE VENDOR ATP. TASK III CLEARANCE OF EFFECTIVITIES THERE ARE NO CONSTRAINTS. ALL ETS ARE TO BE RETESTED FOR ISOLATION RESISTANCE OF THE LH2 DEPLETION CIRCUITS, PER RCN MT-7484. TASK IV CAPS CLOSURE SUMMARY THE SENSORS EXPERIENCED ISOLATION RESISTANCE FAILURES WHICH RESULTED FROM BOTH THE SENSITIVITY OF THE SENSORS TO HIGH HUMIDITY AND THE ISOLATION RESISTANCE REQUIREMENTS BEING MORE STRINGENT AT MAF THAN AT THE VENDOR. HISTORICALLY, THERE HAVE BEEN NO LEVEL MEASUREMENT CIRCUIT FAILURES AT KSC WHICH WERE ATTRIBUTED TO LOW ISOLATION RESISTANCE ON

ANY OF THE APPROXIMATELY 20 SENSORS ON EACH ET.THE SENSOR DESIGN IS CONSIDERED TO BE ADEQUATE. THE ISOLATION RESISTANCE REQUIREMENTS WERE REVISED AT THE VENDOR, MAF, AND THE LAUNCH SITE. THE CHANGES WILL INCREASE THE LIKELIHOOD OF DETECTING SENSOR FAILURES DURING VENDOR ACCEPTANCE TESTING, RATHER THAN AFTER INSTALLATION ON AN ET. THE REQUIREMENTS AT THE LAUNCH SITE FOR THE SENSORS IN THE LH2 DEPLETION CIRCUITS WERE REVISED TO INCLUDE AN ISOLATION RESISTANCE TEST TO THE SAME VALUE AS A NEW SENSOR. LOW ISOLATION RESISTANCE WILL CAUSE AN ORBITER LEVEL SENSOR SIGNAL CONDITIONER TO GIVE A FALSE "WET" INDICATION. SINCE THIS FAILURE MODE IS CRITICAL ONLY FOR THE LH2 DEPLETION CIRCUITS, ADDITIONAL TESTS FOR THE REMAIN- ING SENSORS WERE NOT ADDED TO THE TESTING AT THE LAUNCH SITE. THE VENDOR ACCEPTANCE TEST REQUIREMENTS ARE NOW SUFFICIENTLY STRINGENT TO DETECT THE MAJORITY OF ALL SENSORS WHICH HAVE LOW ISOLATION RESISTANCE. A LIMITED NUMBER OF ISOLATION RESISTANCE TEST FAILURES CAN BE EXPECTED TO OCCUR DURING VENDOR TESTING AS A NATURAL RESULT OF THE SENSOR DESIGN. THIS PROBLEM IS SUBMITTED TO MSFC FOR CLOSURE REVIEW AND APPROVAL

MSFC Response/Concurrence

MSFC Problem Reporting and Corrective Action (PRACA) System

ASSESSMENT ADDENDUM REPORT

MSFC Report#	**IFA#**	**Contractor RPT#**	**JSC#**	**KSC#**	**EICN#**
A10102	--	E-100-1	--	--	--

Asmnt Part#	**Asmnt Part Name**	**Asmnt Serial/Lot#**
74L4-2	LH2 LEVEL SENSOR	1293

HCRIT CD	**FCRIT CD**	**CAUSE CD**	**FAIL MODE**
--	1R	ETP - EI-TEST-INST	EM - ELECT LEAK

Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
3.6.1.1	1	A	N/A
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
--	--	--	--
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
--	--	--	--

Correlated Part#	**Correlated Part#**	**Correlated Part#**
--	--	--

Associated LRU#	**Associated LRU#**	**Associated LRU#**
--	--	--

MAJOR DESIGN CHANGES

APRV DATE	**DESCRIPTION OF CHANGES**
--	--

ASSESSMENT TEXT

MSFC Problem Reporting and Corrective Action (PRACA) System
WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A10108	**In-Flight Anomaly Number** --	**Contractor Report Number** P-055	**JSC#** --	**KSC#** --
Problem Title LH2 NAFLEX SEAL - SURFACE IRREGULARITY PREVENTED SEALING				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 1
HCRIT --	**Sys_Lvl** Y	**Misc Codes** A **(4)** B C D E F G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** EXTERNAL TANK	**PART#** 80901000000	**SER/LOT#** LWT-35	**MANUFACTURER** MMC
HARDWARE LRU	**NOMENCLATURE** PROPELLANT FEED INST	**PART#** 80921011009	**SER/LOT#** N/A	**MANUFACTURER** MMC
HARDWARE NCA	**NOMENCLATURE** NAFLEX SEAL	**PART#** 55L6-7T	**SER/LOT#** 82312	**MANUFACTURER** LANGLEY CORP
Test/Operation A - ATP	**Prevailing Condtion** F - FUNCTIONAL	**F / U** F	**Fail Mode** MV - EXT LEAK	**Cause** U - UNKNOWN
System PROPULSION	**Defect** DB - BENT	**Material** P - SEAL	**Work Contact** C. CAMPBELL	**Fail Date** 05/19/1986
Received at MSFC 06/25/1986	**Date Isolated** --	**FMEA Reference** 2.2	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location MAF		**Symptom** MV - EXT LEAK		**Time Cycle** --
Effectivity Text LWTS 16, 20, 21, 22, 24 AND UP				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** --	**LVL 3 Close** --	**Remark / Action** --	
Investigation / Resolution Summary				
Last MSFC Update 11/04/1991	**CN RSLV SBMT** 05/19/1987	**Defer Date** --	**Add Date** --	**R/C Codes** 0 - EXPL -- --
Assignee				
Design P. MULLER	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --
Approval				

Design	Chief Engineer	S & MA	Project	Project MGR
P. MULLER	J. NICHOLS	R. JACKSON	M. PESSIN	--

PAC Assignee	PAC Review Complete	MSFC Closure Date	Status	F/A Completion
J.EL-IBRAHIM	JE	07/14/1987	C - CLOSED	--

Problem Type	SEV	Program Name	REVL	OPRINC
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FUNC MOD	Software Effectivity	Software Fail CD	SUBTYPE	Software Closure CD
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RES PERSON L2	Approval Signature L3
--	--

Related Document Type	Related Document ID
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Related Document Title
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Related Document Type	Related Document ID
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Related Document Title
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Related Document Type	Related Document ID
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Related Document Title
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Contractor Status Summary

Reliability/Quality Assurance Concerns, Recommendations:

Problem Description

DURING LEAK TESTING OF LWT-35, LH2 AFT DOME -Z MANHOLE COVER, A LEAKAGE RATE OF 48 SCCM WAS DETECTED (SPECIFICATION IS 21 SCCM, MAXIMUM). THE MANHOLE COVER WAS REMOVED AND THE SEAL AND SEALING SURFACES INSPECTED FOR DEFECTS. MICROSCOPIC EXAMINATION OF THE SEAL REVEALED A 6 INCH AREA ALONG THE PRIMARY SEALING SURFACE WITH INTERMITTENT COMPRESSION MARKS IN THE TEFLON COATING. THESE MARKS WERE THE RESULT OF HIGH SPOTS IN THE SEALING SURFACE NOT VISIBLE THROUGH NORMAL INSPECTIONS. THIS SURFACE IRREGULARITY PREVENTED SEALING OF THE PRIMARY SEAL DURING INSTALLATION

Contractor Investigation/Resolution

R/A - NONE, ORIGIN OF THE DAMAGE COULD NOT BE DETERMINED. THIS WAS A FIRST OCCURRENCE FOR THIS TYPEFAILURE AND IS BELIEVED TO BE AN ISOLATED CASE. 6/26/86 - ALL EFFECTIVITIES ARE REQUIRED TO PASS TM04 LEAK TEST REQUIREMENTS. A NEW SEAL WAS INSTALLED ON LWT-35 AND SUCCESSFULLY RETESTED. THERE ARE NO VEHICLE CONSTRAINTS. DURING THE ET PROGRAM, SEAL DEFECTS HAVE BEEN A RECURRING PROBLEM. A RECENT REVIEW BY PERFORMANCE EVALUATION ON 55L6-7T SEALS (REFERENCE MEMORANDUM 3742-86-079) REVEALED A TOTAL OF 47 NONCONFORMANCEREPORTS WRITTEN SINCE JANUARY 1, 1983. OF THE ITEMS IDENTIFIED (74 EACH), 51 PERCENT WERE DIS- POSITIONED NO ITEM OR USE-AS-IS, THE REMAINDER WERE RETURNED TO VENDOR. THIS SIGNIFICANT NUMBER OF ACCEPTABLE DEFECTS IS A RESULT OF INCONSISTENCIES BETWEEN MAF AND VENDOR INSPECTION REQUIREMENTS. FAILURE ANALYSIS - MEASUREMENT WAS MADE BY METROLOGY LABS OF THE COMPRESSION MARKS. THESE WERE FOUND TO BE

APPROXIMATELY 0.002 INCH HIGHER IN ELEVATION THAN ADJACENT AREAS WITH NO EVIDENCE OF CONTACT WITH THE SEALING SURFACE. THIS WOULD INDICATE THE COMPRESSED AREAS WERE EXCESSIVELY HIGH PRIOR TO INSTALLATION. THE SEAL, WHICH FAILED ON LWT-35, IS BEING RETURNED TO THE VENDOR FOR FAILURE ANALYSIS. THIS WILL DETERMINE SUBSTRATE OR COATING THICKNESS IRREGULARITIES AS CAUSE FOR INTERMITTENT CONTACT ON THE PRIMARY SEALING SURFACE. ACCEPTANCE REQUIREMENTS - TEFLON COATING INSPECTION CRITERIA ON MMC STANDARD 55L6 IS IN CONFLICT WITH VENDOR PROCESS SPECIFICATION VA0-621-003 (APPROVED ON DAS AYU-001). 7/15/86 PRB STATUS - INTERMITTENT FLAT SPOTS DETECTED ON TEFLON COATING DURING SECOND INSPECTION. FA IS BEING CONDUCTED BY THE VENDOR. 55L6 REQUIREMENT ALLOWS NO DEFECTS. 8/21/86 PRB STATUS - AWAITING VENDOR FA. 9/18/86 PRB STATUS - IRREGULARITIES IN THE PRIMARY SEALING SURFACE CAUSED BY SUBSTRATE DAMAGE OF UNKNOWN ORIGIN. VENDOR FA WAS INCONCLUSIVE. MMC CONSIDERS THIS AN ISOLATED CASE. MMC'S ACCEPTANCE SPEC MORE STRIGENT THAN VENDOR'S SPEC. 10/16/86 PRB STATUS - NO CHANGE. ECD IS 11-3-86 AT MMC. 2/19/87 PRB STATUS- CAPS IS BEING UPDATED FOR CLOSURE ECD 2/27/87 5/26/87 STATUS UPDATE - MMC STANDARDS MMC 55L6/55L11 HAVE BEEN REVISED TO ELIMINATE THE CONFLICT WITH VENDOR SPECIFICATIONS (REF. INTEROFFICE MEMORANDUM 3573-87-018 AND 55L6 REV. 16 16-55L11, REV. 1) SPECIFICATION 55L6 HAS BEEN REVISED TO PUT EMPHASIS ON THE COATING OF THE PRIMARY AND SECONDARY SEALING SURFACES SHALL BE CONTINUOUS, ETC....WHILE IT USED TO SPECIFY NONE. SPECIFICATION55L11, REV. 1 WILL IMPOSE SURFACE PARALLELISM REQUIREMENTS WHICH WERE NOT INCLUDED IN 55L6. BASI- CALLY, NEW REQUIREMENTS ARE MORE STRINGENT THAN BEFORE. THE CAUSE OF THE FAILURE COULD NOT BE IDENTIFIED MMC AND VENDOR (LANGLEY CORP.) HAVE DIFFERENT IN- TERPRETATION FOR CAUSE OF FAILURE (REF. CAPS P-55A AND SCAR 3761-86-127). THEREFORE ONLY A SUSPECT CAUSE HAS BEEN IDENTIFIED. THIS PROBLEM IS SUBMITTED TO MSFC FOR CLOSURE REVIEW AND APPROVAL

MSFC Response/Concurrence

MSFC Problem Reporting and Corrective Action (PRACA) System

ASSESSMENT ADDENDUM REPORT

MSFC Report#	**IFA#**	**Contractor RPT#**	**JSC#**	**KSC#**	**EICN#**
A10108	--	P-055	--	--	--

Asmnt Part#	**Asmnt Part Name**	**Asmnt Serial/Lot#**
55L6-7T	NAFLEX SEAL	82312

HCRIT CD	**FCRIT CD**	**CAUSE CD**	**FAIL MODE**
--	1	U - UNKNOWN	MV - EXT LEAK
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
2.10.6.1	1	B	2
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
--	--	--	--
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
--	--	--	--

Correlated Part#	**Correlated Part#**	**Correlated Part#**
--	--	--

Associated LRU#	**Associated LRU#**	**Associated LRU#**
--	--	--

MAJOR DESIGN CHANGES

APRV DATE	**DESCRIPTION OF CHANGES**
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ASSESSMENT TEXT

MSFC Problem Reporting and Corrective Action (PRACA) System
WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A10109	**In-Flight Anomaly Number** --	**Contractor Report Number** E-101-2	**JSC#** --	**KSC#** --
Problem Title TRANSDUCER OUTPUT SIGNAL HAD ELECTRICAL NOISE				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 1R
HCRIT 1	**Sys_Lvl** N	**Misc Codes** A **(4)** B C D E F G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** LH2 ULL PRES TRNSDCR	**PART#** PD7400098-039	**SER/LOT#** 1457	**MANUFACTURER** GULTON
HARDWARE LRU	**NOMENCLATURE** N/A	**PART#** N/A	**SER/LOT#** N/A	**MANUFACTURER** N/A
HARDWARE NCA	**NOMENCLATURE** LH2 ULL PRES TRNSDCR	**PART#** PD7400098-039	**SER/LOT#** 1457	**MANUFACTURER** GULTON
Test/Operation A - ATP	**Prevailing Condtion** F - FUNCTIONAL	**F / U** F	**Fail Mode** UC - UNSAT	**Cause** ETE - EI-TEST-ENVR
System ELECTRICAL	**Defect** CN - CONTAM	**Material** C - EEE	**Work Contact** J. ADAMS	**Fail Date** 05/15/1986
Received at MSFC 07/01/1986	**Date Isolated** --	**FMEA Reference** 3.4.1.2	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location GULTON		**Symptom** EVM - CON/MEG FAIL		**Time Cycle** N/A
Effectivity Text LWTS 16, 20, 21, 22, 24/SUB				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** --	**LVL 3 Close** --	**Remark / Action** --	
Investigation / Resolution Summary				
Last MSFC Update 02/14/1995	**CN RSLV SBMT** 02/23/1987	**Defer Date** --	**Add Date** --	**R/C Codes** 2 - MFG -- --
Assignee				
Design P. MULLER	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --
Approval				

Design	Chief Engineer	S & MA	Project	Project MGR
P. MULLER	J. NICHOLS	R. JACKSON	M. PESSIN	--
PAC Assignee	**PAC Review Complete**	**MSFC Closure Date**	**Status**	**F/A Completion**
J.EL-IBRAHIM	JE	11/06/1987	C - CLOSED	--
Problem Type	**SEV**	**Program Name**	**REVL**	**OPRINC**
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FUNC MOD	**Software Effectivity**	**Software Fail CD**	**SUBTYPE**	**Software Closure CD**
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RES PERSON L2	**Approval Signature L3**			
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Related Document Type	**Related Document ID**			
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Related Document Title				
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Related Document Type	**Related Document ID**			
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Related Document Title				
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Related Document Type	**Related Document ID**			
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Related Document Title				
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Contractor Status Summary

Reliability/Quality Assurance Concerns, Recommendations:

Problem Description

REF: MARS T-10486 AND CAPS E-091 AND E-082
THE TRANSDUCER HAD A SIGNAL DROPOUT OF GREATER THAN 150 MILLIVOLTS AT AN INPUT PRESSURE OF 48.5 PSIA

Contractor Investigation/Resolution

R/A - ADDITIONAL INSPECTION STEPS HAVE BEEN ADDED TO REDUCE THE FREQUENCY OF OCCURENCE. 7/1/86 LAUNCH CONSTRAINT - NONE - TRANDUCERS MUST PAS ATP AT VENDOR AND ARE THEN TESTED WHEN INSTALLED INTO TANK AT MAF. TRANSDUCER IS TO BE RETURNED TO MMC/MAF FOR FA. 8/21/86 PRB STATUS - TWO ADDITIONAL NOSE FAILURES ON -039. FAILURE ANALYSIS TO BE CONDUCTED ON THE ADDITIONAL FAILURES. 9/18/86 PRB STATUS - FA COMPLETE FAILURE CAUSED BY MICROSCOPIC CONTAMINATION. CONSIDERED NORMAL PRODUCTION FALLOUT. NO CORRECTIVE ACTION PLANNED. ECD 10-31-86 10/16/86 PRB STATUS - CONTAMINATION IDENTIFIED AS FRICTIONAL POLYMERS WHICH IS INHERENT TO MANUFACTURING PROCESS. FAILURE IS CONSIDERED NORMAL PRODUCTION FALLOUT. ECD AT MMC IS 11-7-86. 1-29-87 PRB STATUS - CLOSURE IN WORK. CAPS ECD 1-30-87. 2-23-87 - CORRECTIVE ACTION HAS ALREADY BEEN OBTAINED AS PART OF CAPS E-082. AS A RESULT OF THE FAILURES DOCUMENTED IN CAPS E-082, ADDITIONAL MARTIN MARIETTA PROCUREMENT QUALITY MANDATORY IN- SPECTION POINTS WERE ADDED TO THE VENDORS MANUFACTURING DOCUMENTATION. THE INSPECTIONS INCLUDE: 1) EXAMINATION OF THE WIPER AND OF THE RESISTIVE ELEMENT FOR SURFACE FINISH, AND 2) EXAMINATION OF THE COMPLETED INTERNAL MECHANISM FOR

ASSEMBLY AND CLEANLINESS JUST PRIOR TO INSTALLATION OF THE CASE. THE INSPECTIONS SERVE TO REDUCE THE FAILURE RATE OF THE TRANSDUCERS. THIS TASK HAS BEEN COMPLETED AND DOCUMENTED IN CAPS E-082. CAPS E-082 REMAINS OPEN DUE TO ADDITIONAL IN- VESTIGATION OF FAILURE DUE TO SHORTED TURNS. THIS PROBLEM IS SUBMITTED TO MSFC FOR CLOSURE REVIEW AND APPROVAL

MSFC Response/Concurrence

MSFC Problem Reporting and Corrective Action (PRACA) System

ASSESSMENT ADDENDUM REPORT

MSFC Report#	**IFA#**	**Contractor RPT#**	**JSC#**	**KSC#**	**EICN#**
A10109	--	E-101-2	--	--	--

Asmnt Part#	**Asmnt Part Name**	**Asmnt Serial/Lot#**
PD7400098-039	LH2 ULL PRES TRNSDCR	1457

HCRIT CD	**FCRIT CD**	**CAUSE CD**	**FAIL MODE**
--	1R	EIC - EI-CONTAM	UC - UNSAT

Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
3.4.1.2	2	G	1
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
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Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
--	--	--	--

Correlated Part#	**Correlated Part#**	**Correlated Part#**
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Associated LRU#	**Associated LRU#**	**Associated LRU#**
--	--	--

MAJOR DESIGN CHANGES

APRV DATE	**DESCRIPTION OF CHANGES**
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ASSESSMENT TEXT

MSFC Problem Reporting and Corrective Action (PRACA) System
WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A10110	**In-Flight Anomaly Number** --	**Contractor Report Number** E-101-3	**JSC#** --	**KSC#** --
Problem Title TRANSDUCER OUTPUT SIGNAL HAD ELECTRICAL NOISE				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 1R
HCRIT 1	**Sys_Lvl** N	**Misc Codes** A **(4)** B C D E F G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** LH2 ULL PRES TRNSDCR	**PART#** PD7400098-039	**SER/LOT#** 1455	**MANUFACTURER** GULTON
HARDWARE LRU	**NOMENCLATURE** N/A	**PART#** N/A	**SER/LOT#** N/A	**MANUFACTURER** N/A
HARDWARE NCA	**NOMENCLATURE** LH2 ULL PRES TRNSDCR	**PART#** PD7400098-039	**SER/LOT#** 1455	**MANUFACTURER** GULTON
Test/Operation A - ATP	**Prevailing Condtion** F - FUNCTIONAL	**F / U** F	**Fail Mode** UC - UNSAT	**Cause** ETE - EI-TEST-ENVR
System ELECTRICAL	**Defect** CN - CONTAM	**Material** C - EEE	**Work Contact** J. ADAMS	**Fail Date** 05/15/1986
Received at MSFC 07/01/1986	**Date Isolated** --	**FMEA Reference** 3.4.1.2	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location GULTON		**Symptom** EVM - CON/MEG FAIL		**Time Cycle** --
Effectivity Text LWTS 16, 20, 21, 22, 24/SUB				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** --	**LVL 3 Close** --	**Remark / Action** --	
Investigation / Resolution Summary				
Last MSFC Update 02/14/1995	**CN RSLV SBMT** 02/23/1987	**Defer Date** --	**Add Date** --	**R/C Codes** 2 - MFG -- --
Assignee				
Design P. MULLER	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --
Approval				

Design	Chief Engineer	S & MA	Project	Project MGR
P. MULLER	J. NICHOLS	R. JACKSON	M. PESSIN	--
PAC Assignee	**PAC Review Complete**	**MSFC Closure Date**	**Status**	**F/A Completion**
J.EL-IBRAHIM	JE	11/06/1987	C - CLOSED	--
Problem Type	**SEV**	**Program Name**	**REVL**	**OPRINC**
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FUNC MOD	**Software Effectivity**	**Software Fail CD**	**SUBTYPE**	**Software Closure CD**
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RES PERSON L2	**Approval Signature L3**			
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Related Document Type	**Related Document ID**			
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Related Document Title				
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Related Document Type	**Related Document ID**			
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Related Document Title				
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Related Document Type	**Related Document ID**			
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Related Document Title				
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Contractor Status Summary				
Reliability/Quality Assurance Concerns, Recommendations:				

Problem Description

REF: MARS T-10487 AND CAPS E-091 AND E-082. THE TRANSDUCER EXCEEDED THE MAXIMUM ALLOWABLE WIPER-TO-ELEMENT CONTACT RESISTANCE OF 25 OHMS AT SEVERAL POINTS IN ITS PRESSURE RANGE. THE HIGHEST MEASURED RESISTANCE WAS 258 OHMS

Contractor Investigation/Resolution

R/A: ADDITIONAL INSPECTION STEPS HAVE BEEN ADDED TO REDUCE THE FREQUENCY OF OCCURENCE. 7/1/86 LAUNCH CONSTRAINT - NONE - TRANSDUCERS MUST PASS ATP AT VENDOR AND ARE THEN TESTED WHEN INSTALLED INTO TANK AT MAF. TRANSDUCER IS TO BE RETURNED TO MMC/MAF FOR FA. 8/21/86 PRB STATUS - TWO ADDITIONAL NOISE FAILURES ON -039. FAILURE ANALYSIS TO BE CONDUCTED ON THE ADDITIONAL FAILURES. 9/18/86 PRB STATUS - FA COMPLETE FAILURE CAUSED BY MICROSCOPIC CONTAMINATION. CONSIDERED NORMAL PRODUCTION FALLOUT. NO CORRECTIVE ACTION PLANNED. ECD 10-31-86 10/16/86 PRB STATUS - CONTAMINATION IDENTIFIED AS FRICTIONAL POLYMERS WHICH IS INHERENT TO MANUFACTURING PROCESS. FAILURE IS CONSIDERED NORMAL PRODUCTION FALLOUT. ECD AT MMC IS 11-7-86. 1/29/87 PRB STATUS - CLOSURE IN WORK. CAPS ECD 1-30-87. 2-23-87 - CORRECTIVE ACTION HAS ALREADY BEEN OBTAINED AS PART OF CAPS E-082. AS A RESULT OF THE FAILURES DOCUMENTED IN CAPS E-082, ADDITIONAL MARTIN MARIETTA PROCUREMENT QUAILTY MANDATORY IN- SPECTION POINTS WERE ADDED TO THE VENDORS MANUFACTURING DOCUMENTATION. THE INSPECTIONS INCLUDE: 1) EXAMINATION OF THE WIPER AND OF THE RESISTIVE ELEMENT FOR SURFACE

FINISH, AND 2) EXAMINATION OF THE COMPLETED INTERNAL MECHANISM FOR ASSEMBLY AND CLEANLINESS JUST PRIOR TO INSTALLATION OF THE CASE. THE INSPECTIONS SERVE TO REDUCE THE FAILURE RATE OF THE TRANSDUCERS. THIS TASK HAS BEEN COMPLETED AND DOCUMENTED IN CAPS E-082. CAPS E-082 REMAINS OPEN DUE TO ADDITIONAL IN- VESTIGATIONS OF FAILURE DUE TO SHORTED TURNS. THIS PROBLEM IS SUBMITTED TO MSFC FOR CLOSURE REVIEW AND APPROVAL

MSFC Response/Concurrence

MSFC Problem Reporting and Corrective Action (PRACA) System

ASSESSMENT ADDENDUM REPORT

MSFC Report#	**IFA#**	**Contractor RPT#**	**JSC#**	**KSC#**	**EICN#**
A10110	--	E-101-3	--	--	--

Asmnt Part#	**Asmnt Part Name**	**Asmnt Serial/Lot#**
PD7400098-039	LH2 ULL PRES TRNSDCR	1455

HCRIT CD	**FCRIT CD**	**CAUSE CD**	**FAIL MODE**
--	1R	EIC - EI-CONTAM	UC - UNSAT
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
3.4.1.2	2	G	1
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
--	--	--	--
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
--	--	--	--

Correlated Part#	**Correlated Part#**	**Correlated Part#**
--	--	--

Associated LRU#	**Associated LRU#**	**Associated LRU#**
--	--	--

MAJOR DESIGN CHANGES

APRV DATE	**DESCRIPTION OF CHANGES**
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ASSESSMENT TEXT

MSFC Problem Reporting and Corrective Action (PRACA) System
WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A10111	**In-Flight Anomaly Number** --	**Contractor Report Number** E-101-4	**JSC#** --	**KSC#** --
Problem Title TRANSDUCER OUTPUT SIGNAL HAD ELECTRICAL NOISE				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 1R
HCRIT 1	**Sys_Lvl** N	**Misc Codes** A **(4)** B C D E F G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** LO2 ULL PRES TRNSDCR	**PART#** PD7400098-079	**SER/LOT#** 1525	**MANUFACTURER** GULTON
HARDWARE LRU	**NOMENCLATURE** N/A	**PART#** N/A	**SER/LOT#** N/A	**MANUFACTURER** N/A
HARDWARE NCA	**NOMENCLATURE** LO2 ULL PRES TRNSDCR	**PART#** PD7400098-079	**SER/LOT#** 1525	**MANUFACTURER** GULTON
Test/Operation A - ATP	**Prevailing Condtion** F - FUNCTIONAL	**F / U** F	**Fail Mode** UC - UNSAT	**Cause** ETE - EI-TEST-ENVR
System ELECTRICAL	**Defect** CN - CONTAM	**Material** C - EEE	**Work Contact** J. ADAMS	**Fail Date** 05/15/1986
Received at MSFC 07/01/1986	**Date Isolated** --	**FMEA Reference** 3.4.1.2	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location GULTON		**Symptom** EF - INTERMITTENT		**Time Cycle** --
Effectivity Text LWTS 16, 20, 21, 22, 24/SUBS				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** --	**LVL 3 Close** --	**Remark / Action** --	
Investigation / Resolution Summary				
Last MSFC Update 02/14/1995	**CN RSLV SBMT** 02/23/1987	**Defer Date** --	**Add Date** --	**R/C Codes** 2 - MFG -- --
Assignee				
Design P. MULLER	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --
Approval				

Design	Chief Engineer	S & MA	Project	Project MGR
P. MULLER	J. NICHOLS	R. JACKSON	M. PESSIN	--
PAC Assignee	**PAC Review Complete**	**MSFC Closure Date**	**Status**	**F/A Completion**
J.EL-IBRAHIM	JE	11/06/1987	C - CLOSED	--
Problem Type	**SEV**	**Program Name**	**REVL**	**OPRINC**
--	--	--	--	--
FUNC MOD	**Software Effectivity**	**Software Fail CD**	**SUBTYPE**	**Software Closure CD**
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RES PERSON L2	**Approval Signature L3**			
--	--			
Related Document Type	**Related Document ID**			
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Related Document Title				
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Related Document Type	**Related Document ID**			
--	--			
Related Document Title				
--				
Related Document Type	**Related Document ID**			
--	--			
Related Document Title				
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Contractor Status Summary

Reliability/Quality Assurance Concerns, Recommendations:

Problem Description

REF: MARS T-35867, CAPS E-091 AND E-082. THE TRANSDUCER EXCEEDED THE MAXIMUM ALLOWABLE WIPER-TO-ELEMENT CONTACT RESISTANCE OF 25 OHMS AT SEVERAL POINTS IN ITS PRESSURE RANGE. THE HIGHEST MEASURED RESISTANCE WAS 85 OHMS

Contractor Investigation/Resolution

R/A: ADDITIONAL INSPCTION STEPS HAVE BEEN ADDED TO REDUCE THE FREQUENCY OF OCCURENCE. 7/1/86 LAUNCH CONSTRAINT - NONE - TRANSDUCERS MUST PASS ATP AT VENDOR AND ARE THEN TESTED WHEN INSTALLED INTO TANK AT MAF TRANSDUCER IS TO BE RETURNED TO MMC/MAF FOR FA. 8/21/86 PRB STATUS - TWO ADDITIONAL NOISE FAILURES ON -039. FAILURE ANALYSIS TO BE CONDUCTED ON THE ADDITIONAL FAILURES. 9/18/86 PRB STATUS - FA COMPLETE. FAILURE CAUSED BY MICROSCOPIC CONTAMINATION. CONSIDERED NORMAL PRODUCTION FALLOUT. NO CORRECTIVE ACTION PLANNED. ECD 10-31-86. 10/16/86 PRB STATUS - CONTAMINATION IDENTIFIED AS FRICTIONAL POLYMERS WHICH IS INHERENT TO MANUFACTURING PROCESS. FAILURE IS CONSIDERED NORMAL PRODUCTION FALLOUT. ECD AT MMC IS 11-7-86. 1/29/87 PRB STATUS - CLOSURE IN WORK. CAPS ECD 1-30-87. 2-23-87 - CORRECTIVE ACTION HAS ALREADY BEEN OBTAINED AS PART OF CAPS E-082. AS A RESULT OF THE FAILURES DOCUMENTED IN CAPS E-082, ADDITIONAL MARTIN MARIETTA PROCUREMENT QUALITY MANDATORY IN- SPECTION POINTS WERE ADDED TO THE VENDORS MANUFACTURING DOCUMENTATION. THE INSPECTIONS INCLUDE: 1) EXAMINATION OF THE WIPER AND OF THE RESISTIVE ELEMENT FOR SURFACE FINISH, AND 2) EXAMINATION OF THE

COMPLETED INTERNAL MECHANISM FOR ASSEMBLY AND CLEANLINESS JUST PRIOR TO INSTALLATION OF OF THE CASE. THE INSPECTIONS SERVE TO REDUCE THE FAILURE RATE OF THE TRANSDUCERS. THIS TASK HAS BEEN COMPLETED AND DOCUMENTED IN CAPS E-082. CAPS E-082 REMAINS OPEN DUE TO ADDITIONAL IN-VESTIGATIONS OF FAILURE DUE TO SHORT TURNS. THIS PROBLEM IS SUBMITTED TO MSFC FOR CLOSURE REVIEW AND APPROVAL
MSFC Response/Concurrence

MSFC Problem Reporting and Corrective Action (PRACA) System

ASSESSMENT ADDENDUM REPORT

MSFC Report#	**IFA#**	**Contractor RPT#**	**JSC#**	**KSC#**	**EICN#**
A10111	--	E-101-4	--	--	--
Asmnt Part#	**Asmnt Part Name**	**Asmnt Serial/Lot#**			
PD7400098-079	L02 ULL PRES TRNSDCR	1525			
HCRIT CD	**FCRIT CD**	**CAUSE CD**	**FAIL MODE**		
--	1R	EIC - EI-CONTAM	UC - UNSAT		
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**		
3.4.1.2	2	G	1		
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**		
--	--	--	--		
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**		
--	--	--	--		
Correlated Part#	**Correlated Part#**	**Correlated Part#**			
--	--	--			
Associated LRU#	**Associated LRU#**	**Associated LRU#**			
--	--	--			
MAJOR DESIGN CHANGES					
APRV DATE	**DESCRIPTION OF CHANGES**				
--	--				
ASSESSMENT TEXT					

MSFC Problem Reporting and Corrective Action (PRACA) System
WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A10159	**In-Flight Anomaly Number** --	**Contractor Report Number** S-070-1	**JSC#** --	**KSC#** --
Problem Title DARK LINE, X-RAY INDICATION AT INTERSECTION OF VPPA WELDS - LWT-43/ASSEMBLY INSPECTION				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 1
HCRIT --	**Sys_Lvl** N	**Misc Codes** A **(4)** B C D E F G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** LH2 AFT DOME	**PART#** 80914900900-010	**SER/LOT#** N/A	**MANUFACTURER** MMC
HARDWARE LRU	**NOMENCLATURE** LH2 TANK COMPLETE	**PART#** 80904000000	**SER/LOT#** N/A	**MANUFACTURER** MMC
HARDWARE NCA	**NOMENCLATURE** LH2 AFT DOME	**PART#** 80914900900-010	**SER/LOT#** N/A	**MANUFACTURER** MMC
Test/Operation L - FLD	**Prevailing Condtion** N - INSPECTION	**F / U** F	**Fail Mode** UC - UNSAT	**Cause** U - UNKNOWN
System STRUCTURAL	**Defect** DC - BROKEN	**Material** H - WELD	**Work Contact** MATTHEESSEN	**Fail Date** 05/08/1986
Received at MSFC 07/17/1986	**Date Isolated** --	**FMEA Reference** 1.1.1	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location MAF		**Symptom** UC - UNSAT		**Time Cycle** --
Effectivity Text LWTS 16, 20, 21, 22, 24/SUBS				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** --	**LVL 3 Close** --	**Remark / Action** --	
Investigation / Resolution Summary				
Last MSFC Update 05/07/1992	**CN RSLV SBMT** 02/23/1987	**Defer Date** --	**Add Date** --	**R/C Codes** 0 - EXPL -- --
Assignee				
Design J. WHITE	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --
Approval				
Design	**Chief Engineer**	**S & MA**	**Project**	**Project MGR**

J. WHITE	J. NICHOLS	R. JACKSON	M. PESSIN	--
PAC Assignee J.EL-IBRAHIM	**PAC Review Complete** --	**MSFC Closure Date** 11/25/1987	**Status** C - CLOSED	**F/A Completion** --
Problem Type --	**SEV** --	**Program Name** --	**REVL** --	**OPRINC** --
FUNC MOD --	**Software Effectivity** -- -- -- -- --	**Software Fail CD** --	**SUBTYPE** --	**Software Closure CD** --
RES PERSON L2 --	**Approval Signature L3** --			
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Contractor Status Summary				
Reliability/Quality Assurance Concerns, Recommendations:				

Problem Description

REF MARS: T-94523, T-94524, T-94525, T-94528, T-94529, T-94530 AND T-94531. LWT-43 LH2 AFT DOME HAD TEN DARK LINE INDICATIONS IN THE INTERSECTIONS OF VARIABLE POLARITY PLASMA ARC (VPPA) WELDS, OR AT TIG AND VPPA WELDS

Contractor Investigation/Resolution

R/A - THE FAULTY AREAS WERE REPAIRED. FOR CORRECTIVE ACTION, ALL FUTURE OCCURRENCES WILL BE DOCUMENTED AND EVALUATED PER PAD 3740-054. 7/22/86 GENERAL - ON 80914900900-010 LWT-43 (LH2 AFT DOME) TEN INDICATIONS WERE NOTED BY X-RAY. THESE WERE SHORT BLACK LINES (.200 INCH TO .300 INCH) LOCATED NEAR THE EDGE OF THE WELD IN THE INTERSECTION OF TWO WELDS THIS CONDITION IS UNIQUE DUE TO THE FACT THAT INDICATIONS ARE AT VPPA SECTIONS OR VPPA TO TIG INTERSECTIONS. THE AREAS WERE INSPECTED BY ULTRASONICS AND INDICATIONS WERE NOTED. THE AREAS WERE REPAIRED. IN SOME CASES, A SHALLOW REPAIR WAS ENOUGH TO REMOVE THE DEFECT. WHILE IN OTHERS, A LARGE GRIND FROM BOTH SIDES WERE REQUIRED. CAUSE OF FAULTY WELD AREAS IS UNDER INVESTIGATION. THIS PROBLEM IS A LAUNCH CONSTRAINT TO LWT-16, -20, -21, -22, -24 AND SUBS. 8/21/86 PRB STATUS - SOURCE OF THE SHORT BLACK LINES ON X-RAYS ARE UNKNOWN. UNDER INVESTIGATION 9/18/86 PRB STATUS - MMC PREPARING TO RUN FULL SCALE TEST PANELS. ECD IS UNDETERMINED. 10/16/86 PRB STATUS - MMC HAS BEEN UNABLE TO DUPLICATE DARK LINE X-RAY INDICATIONS DURING TESTS; HOWEVER, THEY EXPECT TO OBTAIN A DEFECTIVE WELD SPECIMEN DURING REPAIR OF A DEFECTIVE WELD. FA WILL BE DONE ON THIS SPECIMEN TO TRY TO BETTER UNDERSTAND THE FAILURE

MODE. ADDITIONALLY, ALL X-RAYS OF PREVIOUSLY BUILT HARDWARE ARE TO BE REVIEWED FOR X-RAY INDICATIONS. ECD FOR COMPLETION OF X-RAY REVIEW IS 9-6-89. 1/29/87 PRB STATUS - CLOSURE IN WORK. CAPS ECD 2-6-87. 2-26-87 STATUS - AFTER EXTENSIVE INVESTIGATION, THE CAUSE COULD NOT BE DETERMINED. THE DEFECTED WELDS WERE REPAIRED AND X-RAYED WITHOUT RECURRENCE OF BLACKLINE INDICATIONS. CLEARANCE OF EFFECTIVITIES - ALL EFFECTIVITIES ARE BEING CLEARED USING THE FOLLOWING RATIONALE: IF AN INDICATION IS FOUND, ULTRASONIC WILL BE PERFORMED AND DISPOSITION WILL BE REQUESTED FROM ENGINEERING. THIS WILL BE ACCOMPLISHED BY THE RE-REVIEW OF X-RAYS PRIOR TO PROOF X-RAY REVIEW AND DUAL X-RAY REVIEW
MSFC Response/Concurrence

MSFC Problem Reporting and Corrective Action (PRACA) System
ASSESSMENT ADDENDUM REPORT

MSFC Report#	**IFA#**	**Contractor RPT#**	**JSC#**	**KSC#**	**EICN#**
A10159	--	S-070-1	--	--	--
Asmnt Part#	**Asmnt Part Name**	**Asmnt Serial/Lot#**			
80914900900-010	LH2 AFT DOME	N/A			
HCRIT CD	**FCRIT CD**	**CAUSE CD**	**FAIL MODE**		
--	1	U - UNKNOWN	UC - UNSAT		
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**		
6.2.1.1	1	D	1		
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**		
--	--	--	--		
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**		
--	--	--	--		
Correlated Part#	**Correlated Part#**	**Correlated Part#**			
--	--	--			
Associated LRU#	**Associated LRU#**	**Associated LRU#**			
--	--	--			
MAJOR DESIGN CHANGES					
APRV DATE	**DESCRIPTION OF CHANGES**				
--	--				
ASSESSMENT TEXT					

MSFC PRACA : 2003-02-12 08:41

WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A10212	**In-Flight Anomaly Number** --	**Contractor Report Number** E-102	**JSC#** --	**KSC#** --
Problem Title RSS BOX AND RSS ANTENNA COUPLERS WERE SUBJECTED TO OVERHEAT - LWT-34/MFG				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 1
HCRIT --	**Sys_Lvl** N	**Misc Codes** A **(4)** B C D E F G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** ET COMPLETE	**PART#** 80901010000	**SER/LOT#** LWT-34	**MANUFACTURER** MMC
HARDWARE LRU	**NOMENCLATURE** N/A	**PART#** N/A	**SER/LOT#** N/A	**MANUFACTURER** N/A
HARDWARE NCA	**NOMENCLATURE** ET COMPLETE	**PART#** 80901010000	**SER/LOT#** LWT-34	**MANUFACTURER** MMC
Test/Operation M - MFG	**Prevailing Condtion** N - INSPECTION	**F / U** F	**Fail Mode** UC - UNSAT	**Cause** MP - MFG-PRC
System ELECTRICAL	**Defect** HD - OVRHTD	**Material** A - CIRC T	**Work Contact** J. ADAMS	**Fail Date** 07/17/1986
Received at MSFC 07/25/1986	**Date Isolated** --	**FMEA Reference** 3.0	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location MAF		**Symptom** UC - UNSAT		**Time Cycle** --
Effectivity Text LWTS 16, 20, 21, 22, 24 AND UP				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** --	**LVL 3 Close** --	**Remark / Action** --	
Investigation / Resolution Summary				
Last MSFC Update 05/25/1988	**CN RSLV SBMT** 03/12/1987	**Defer Date** --	**Add Date** --	**R/C Codes** 1 - DES -- --
Assignee				
Design P. MULLER	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --
Approval				
Design	**Chief Engineer**	**S & MA**	**Project**	**Project MGR**

P. MULLER	J. NICHOLS	R. JACKSON	M. PESSIN	--
PAC Assignee J.EL-IBRAHIM	**PAC Review Complete** --	**MSFC Closure Date** 04/06/1987	**Status** C - CLOSED	**F/A Completion** --
Problem Type --	**SEV** --	**Program Name** --	**REVL** --	**OPRINC** --
FUNC MOD --	**Software Effectivity** -- -- -- -- --	**Software Fail CD** --	**SUBTYPE** --	**Software Closure CD** --
RES PERSON L2 --	**Approval Signature L3** --			
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Contractor Status Summary				
Reliability/Quality Assurance Concerns, Recommendations:				

Problem Description

REF: MARS T-62776 AND T-62791 THE RANGE SAFETY SYSTEM BOX, AND THE RSS ANTENNA COUPLERS WHICH ARE MOUNTED IN IT, WERE SUBJECTED TO TEMPERATURES HIGHER THAN THAT FOR WHICH THEY ARE QUALIFIED. THE BOX AND COUPLERS WERE INSTALLED PRIOR TO TPS FOAM APPLICATION TO THE INTERTANK DURING FOAM APPLICATION, THE AIR AROUND THE BOX AND COUPLERS MAY EXCEED 230 DEGREES F. THE COUPLERS ARE RATED FOR 165 DEGREES F AND THE BOX FOR 150 DEGREES F

Contractor Investigation/Resolution

R/A - OVER HEATED COUPLERS WERE REPLACED. COUPLERS ON FUTURE ETS WILL BE INSTALLED AFTER TPS APPLICATION. REVISED TWO FAULTY MATERIALS TO WITHSTAND HIGHER TEMPERATURES. 7/28/86 - PROBLEM WAS CAUSED BY ENGINEERING INSTALLING THE RSS EQUIPMENT TOO EARLY IN THE PRODUCTION CYCLE. CONSTRAINT TO FLT - LWT'S 16, 20, 21, 24 AND SUBS. 8/21/86 PRB STATUS - COUPLERS OVERHEATED DURING TPS FOAM APPLICATION TO INTERTANK ECO TO INSTRUMENT HEAT ON 8-21-86. HYBRID COUPLERS WILL BE REPLACED ON LWT-20 AND SUB. ON FUTURE BUILDS THIS EQUIPMENT WILL NOT BE INSTALLED UNTIL AFTER TPS APPLICATION. ECD IN SEPTEMBER OR OCTOBER. 9/18/86 PRB STATUS - A CHANGE SUMMARY IS BEING WRITTEN TO REQUIRE REPLACEMENT OF DIRECTIONAL COUPLERS ON ALL INHOUSE TANKS THAT HAVE BEEN EXPOSED TO OVERHEAT. ECD UNDETERMINED. 10/7/86 UPDATED FROM REVISED CAPS E-102A BACKGROUND - AS PART OF THE EXTERNAL TANK PROJECT ASSESSMENT REVIEW (EPAR), THE PROCESSING OF GOVERNMENT FURNISHED PARTS (GFP) AT MAF WAS BEING EXAMINED BY A COMMITTEE CHAIRED BY PERSONNEL FROM THE MMC

CONTRACTS DEPARTMENT. AT A MEETING ON THIS SUBJECT ON JULY 16, 1986, IT WAS FOUND THAT THE RANGE SAFETY COMMAND DESTRUCT SYSTEM ANTENNA CIRCUIT HYBRID COUPLER AND DIRECTIONAL COUPLER, WHICH ARE GFP, ARE RATED FOR A MAXIMUM TEMPERATURE OF 165 DEGREES F. FURTHER, IT WAS FOUND THAT THE INTERIOR OF THE INTERTANK, WHERE THESE TWO COUPLERS ARE MOUNTED, IS HEATED DURING TPS FOAM APPLICATION AND THAT THE TEMPERATURE MIGHT EXCEED 200 DEGREES F. HEATING OF THE INTERTANK SKIN TO APPROXIMATELY 150 DEGREES F DURING CPR FOAM APPLICATION ASSURES OPTIMAL BONDING OF THE FOAM TO THE EPOXY PRIMER ON THE ALUMINUM STRUCTURE. A REVIEW OF THE SYSTEMS IN THE VERTICAL ASSEMBLY BUILDING (VAB), WHICH HEATS THE INTERIOR OF TH INTERTANK, FOUND THAT: THE HEATING SYSTEM IS OF THE RECIRCULATING FORCED-AIR TYPE; HEAT IS PROVIDED BY A STEAM-TO-AIR HEAT EXCHANGER; THE STEAM IS SUPPLIED AT 15 PSIG, WHICH HAS AN EQUILIBRIUM TEMPERATURE OF 250 DEGREES F; THE INTERTANK AIR TEMPERATURES MIGHT POSSIBLY EXCEED 200 DEGREES F. MATERIALS ENGINEERING, DEPARTMENT 3573, AND ELECTRICAL ENGINEERING, DEPARTMENT 3513, REVIEWED THE QUALIFICATION TESTS AND MATERIAL USAGE AGREEMENTS (MUA'S) FOR A NUMBER OF ITEMS MOUNTED IN THE INTERTANK AND IDENTIFIED ADDITIONAL ITEMS WHICH COULD BE OVERHEATED. FAILURE INVESTIGATION - A. ELECTRICAL ENGINEERING, DEPARTMENT 3513, PERFORMED TESTS WHICH MEASURED THE TEMPERATURES AT VARIOUS POINTS WITHIN THE INTERTANK WHILE BEING HEATED BY THE VAB SYSTEMS USED FOR TPS APPLICATION. PRELIMINARY RESULTS INDICATE THAT THE HIGHEST TEMPERATURE POSSIBLE IS 204 DEGREES F. A FORMAL TEST REPORT IS BEING PREPARED. B. MATERIAL ENGINEERING, DEPARTMENT 3573, IS REVIEWING THE MUA'S FOR VARIOUS COMPONENTS IN THE INTERTANK. THE MUA'S WILL BE REVISED BASED UPON THE TEST REPORT. C. ELECTRICAL ENGINEERING, DEPARTMENT 3514, IS PROCESSING CHANGE SUMMARY B0 1767 TO REPLACE HYBRID AND DIRECTIONAL COUPLERS WHICH HAVE BEEN OVERHEATED. THE CHANGE SUMMARY WILL ALSO MOVE THE INSTALLATION OF THE COUPLERS ON FUTURE ET'S TO A POINT IN THE PRODUCTION CYCLE AFTER THE HEATING OF THE INTERTANK 10/16/86 PRB STATUS - ENGINEERING TESTS OF THE TEMPERATURES IN THE INTERTANK DURING FOAM APPLICATION FOUND THAT HIGHEST TEMPERATURE ATTAINABLE WAS 204 DEGREES F AT ONE POINT IN THE RSS BOX. ALL OTHER COMPONENTS WERE BELOW 200 DEGREES F. MATERIALS ENGINEERING IS REVISING VARIOUS MATERIAL USAGE AGREEMENTS TO TAKE INTO ACCOUNT THE TEMPERATURES MEASURED DURING THE ENGINEERING TESTS OF THE INTERTANK HEATING. CHANGE SUMMARY, B01767, IS BEING WRITTEN TO REPLACE THE HYBRID AND DIRECTIONAL COUPLERS ON AFFECTED VEHICLES, AND TO CHANGE THE POINT OF INSTALLATION OF THE COUPLERS FOR FUTURE ET'S TO LATER IN THE PRODUCTION CYCLE. ECD AT MMC IS 12-2-86. 11/24/86 PRB STATUS - REMOVAL AND REPLACEMENT OF THE DIRECTIONAL COUPLERS ON ALL DELIVERED VEHICLES IS IN PROGRESS MATERIALS ENGINEERING REVISED TWO MATERIAL USAGE AGREEMENTS (MUA) TO TAKE INTO ACCOUNT THE TEMPERATURES MEASURED DURING THE ENGINEERING TESTS OF THE INTERTANK HEATING, MUA 357 FOR THE RSS LIGHTNING PROTECTORS STUB, AND MUA 197 FOR THE RSS BOX "BONDALITE" PANELS. NO OTHER MATERIALS REQUIRED APPROVAL FOR HIGHER TEMPERATURES THAN ORIGINALLY SPECIFIED. ECD AT MMC IS 12-12-86. 3/12/87 - CLOSURE SUMMARY: REVISIONS TO THE MATERIALS USAGE AGREEMENTS FOR THE ALUMINUM/BALSA PANELS IN THE RSS ENCLOSURE AND THE MATERIALS IN THE RSS LIGHTNING PROTECTOR STUB WERE SUBMITTED TO AND APPROVED BY NASA (REFERENCE MMMA CONTRACTS LETTER 86MO-1195; MUA-197A; MUA-357, MSFC LETTERS SA32/1250-86 AND SA32/1249-86). A CHANGE SUMMARY B0 1767 WAS ALSO ISSUED TO CHANGE THE POINT OF INSTALLATION OF THE HYBRID AND COUPLERS TO THE MAF FINAL ASSEMBLY AREA WHICH IS AFTER THE TPS APPLICATION IN THE VERTICAL ASSEMBLY BUILDING. THE CHANGE IN THE POINT OF INSTALLATION IS EFFECTIVE WITH LTW-44 AND SUBSEQUENT. THE CHANGE SUMMARY ALSO: 1) REPLACED ALL COUPLERS THAT HAD BEEN OVERHEATED ON EARLIER EFFECTIVITIES, AND 2) REMOVED COUPLERS FROM INTERTANKS STILL IN BUILD WHICH HAVE NOT YET HAD THE TPS FOAM APPLIED

MSFC Response/Concurrence

ASSESSMENT ADDENDUM REPORT

MSFC Report#	IFA#	Contractor RPT#	JSC#	KSC#	EICN#
A10212	--	E-102	--	--	--

Asmnt Part#	Asmnt Part Name	Asmnt Serial/Lot#
80901010000	ET COMPLETE	LWT-34

HCRIT CD	FCRIT CD	CAUSE CD	FAIL MODE
--	1	MP - MFG-PRC	UC - UNSAT

Asmnt FMEA	Asmnt FM	FMEA CSE	FMEA SCSE
N/A	N/A	N/A	N/A

Asmnt FMEA	Asmnt FM	FMEA CSE	FMEA SCSE
--	--	--	--

Asmnt FMEA	Asmnt FM	FMEA CSE	FMEA SCSE
--	--	--	--

Correlated Part#	Correlated Part#	Correlated Part#
--	--	--

Associated LRU#	Associated LRU#	Associated LRU#
--	--	--

MAJOR DESIGN CHANGES

APRV DATE	DESCRIPTION OF CHANGES
--	--

ASSESSMENT TEXT

WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A10213	**In-Flight Anomaly Number** --	**Contractor Report Number** S-070-2	**JSC#** --	**KSC#** --
Problem Title DARK LINE, X-RAY INDICATIONS AT INTERSECTION OF VPPA WELDS - LWT-42/ASSEMBLY INSPECTION				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 1
HCRIT --	**Sys_Lvl** N	**Misc Codes** A **(4)** B C D E F G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** LH2 FWD DOME	**PART#** 80914100900-010	**SER/LOT#** N/A	**MANUFACTURER** MMC
HARDWARE LRU	**NOMENCLATURE** LH2 TANK COMPLETE	**PART#** 80904000000	**SER/LOT#** N/A	**MANUFACTURER** MMC
HARDWARE NCA	**NOMENCLATURE** LH2 FWD DOME	**PART#** 80914100900-010	**SER/LOT#** N/A	**MANUFACTURER** MMC
Test/Operation L - FLD	**Prevailing Condtion** N - INSPECTION	**F / U** F	**Fail Mode** UC - UNSAT	**Cause** U - UNKNOWN
System STRUCTURAL	**Defect** DC - BROKEN	**Material** H - WELD	**Work Contact** MATTHEESSEN	**Fail Date** 05/08/1986
Received at MSFC 07/22/1986	**Date Isolated** --	**FMEA Reference** 1.1.1	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location MAF		**Symptom** UC - UNSAT		**Time Cycle** --
Effectivity Text NONE				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** --	**LVL 3 Close** --	**Remark / Action** --	
Investigation / Resolution Summary				
Last MSFC Update 05/07/1992	**CN RSLV SBMT** 02/23/1987	**Defer Date** --	**Add Date** --	**R/C Codes** 4 - TEST -- --
Assignee				
Design J. WHITE	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --
Approval				
Design	**Chief Engineer**	**S & MA**	**Project**	**Project MGR**

J. WHITE	J. NICHOLS	R. JACKSON	M. PESSIN	--
PAC Assignee J.EL-IBRAHIM	**PAC Review Complete** --	**MSFC Closure Date** 04/06/1987	**Status** C - CLOSED	**F/A Completion** --
Problem Type --	**SEV** --	**Program Name** --	**REVL** --	**OPRINC** --
FUNC MOD --	**Software Effectivity** -- -- -- -- --	**Software Fail CD** --	**SUBTYPE** --	**Software Closure CD** --
RES PERSON L2 --	**Approval Signature L3** --			
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Contractor Status Summary				
Reliability/Quality Assurance Concerns, Recommendations:				

Problem Description

REF MARS: T-94534, T-94535, T-94536, T-94537 AND T-94728. LWT-42 LH2 FORWARD DOME HAD TEN DARK LINE INDICATIONS AT INTERSECTIONS OF VARIABLE POLARITY PLASMA ARC (VPPA) WELDS OR AT TIG AND VPPA WELDS

Contractor Investigation/Resolution

R/A - THE FAULTY AREAS WERE REPAIRED. FOR CORRECTIVE ACTION, ALL FUTURE OCCURRENCES WILL BE DOCUMENTED AND EVALUATED PER PAD 3740-054. 7/22/86 GENERAL - ON 80914100900-010 (LHW FORWARD DOME) TEN DARK LINE INDICATIONS WERE NOTED BY X-RAY. THESE WERE SHORT BLACK LINES (.200 INCH TO .300 INCH) LOCATED NEAR THE EDGE OF THE WELD IN THE INTERSECTION OF TWO WELDS. THIS CONDITION IS UNIQUE DUE TO THE FACT THAT INDICATIONS ARE AT VPPA INTERSECTIONS OR VPPA TO TIG INTERSECTIONS. THE AREAS WERE INSPECTED BY ULTRASONICS AND INDICATIONS WERE NOTED. THE AREAS WERE REPAIRED. IN SOME CASES, A SHALLOW REPAIR WAS ENOUGH TO REMOVE THE DEFECT. WHILE IN OTHERS, A LARGE GRIND FROM BOTH SIDES WERE REQUIRED. CAUSE OF FAULTY WELD AREAS IS UNDER INVESTIGATION. THIS PROBLEM IS A LAUNCH CONSTRAINT TO LWT-15, -20, -21, -22, -24 AND SUBS. 8/21/86 PRB STATUS - SOURCE OF THE SHORT BLACK LINES ON X-RAYS ARE UNKNOWN. UNDER INVESTIGATION. 9/18/86 PRB STATUS - MMC PREPARING TO RUN FULL SCALE TEST PANELS. ECD IS UNDETERMINED. 10/16/86 PRB STATUS - MMC HAS BEEN UNABLE TO DUPLICATE DARK LINE X-RAY INDICATIONS DURING TESTS; HOWEVER, THEY EXPECT TO OBTAIN A DEFECTIVE WELD SPECIMEN DURING REPAIR OF A DEFECTIVE WELD. FA WILL BE DONE ON THIS SPECIMEN TO TRY TO BETTER UNDERSTAND THE FAILURE MODE

ADDITIONALLY, ALL X-RAYS OF PREVIOUSLY BUILT HARDWARE ARE TO BE REVIEWED FOR X-RAY INDICATIONS. ECD FOR COMPLETION OF X-RAY REVIEW IS 9-6-89. 1/29/87 PRB STATUS - CLOSURE IN WORK. CAPS ECD 2-6-87. 2-26-87 STATUS - AFTER EXTENSIVE INVESTIGATION, THE CAUSE COULD NOT BE DETERMINED. THE DEFECTED WELDS WERE REPAIRED AND X-RAYED WITHOUT RECURRENCE OF BLACKLINE INDICATIONS. CLEARANCE OF EFFECTIVITIES - ALL EFFECTIVITIES ARE BEING CLEARED USING THE FOLLOWING RATIONALE: IF AN INDICATION IS FOUND, ULTRASONICS WILL BE PERFORMED AND DISPOSITION WILL BE REQUESTED FROM ENGINEERING. THIS WILL BE ACCOMPLISHED BY THE RE-REVIEW OF X-RAYS PRIOR TO PROOF X-RAY REVIEW, AND DUAL X-RAY REVIEW

MSFC Response/Concurrence

ASSESSMENT ADDENDUM REPORT

MSFC Report#	**IFA#**	**Contractor RPT#**	**JSC#**	**KSC#**	**EICN#**
A10213	--	S-070-2	--	--	--

Asmnt Part#	**Asmnt Part Name**	**Asmnt Serial/Lot#**
80914100900-010	LH2 FWD DOME	N/A

HCRIT CD	**FCRIT CD**	**CAUSE CD**	**FAIL MODE**
--	1	U - UNKNOWN	UC - UNSAT
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
6.2.1.1	1	D	1
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
--	--	--	--
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
--	--	--	--

Correlated Part#	**Correlated Part#**	**Correlated Part#**
--	--	--

Associated LRU#	**Associated LRU#**	**Associated LRU#**
--	--	--

MAJOR DESIGN CHANGES

APRV DATE	**DESCRIPTION OF CHANGES**
--	--

ASSESSMENT TEXT

WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A10220	**In-Flight Anomaly Number** --	**Contractor Report Number** E-103	**JSC#** --	**KSC#** --
Problem Title SUSPECT NB SERIES ELEC CONNECTORS ON ET'S MAY HAVE BAD THREADS - MFG/INSP				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 1
HCRIT --	**Sys_Lvl** N	**Misc Codes** A **(4)** B C D E F G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** ELECTRICAL CONNECTOR	**PART#** NB SERIES	**SER/LOT#** N/A	**MANUFACTURER** N/A
HARDWARE LRU	**NOMENCLATURE** N/A	**PART#** N/A	**SER/LOT#** N/A	**MANUFACTURER** N/A
HARDWARE NCA	**NOMENCLATURE** ELECTRICAL CONNECTOR	**PART#** NB SERIES	**SER/LOT#** N/A	**MANUFACTURER** N/A
Test/Operation L - FLD	**Prevailing Condtion** N - INSPECTION	**F / U** F	**Fail Mode** MM - BIND OR JAM	**Cause** MNP - MFG-ISP-INST
System ELECTRICAL	**Defect** ER - EL PIN	**Material** E - EL C/W	**Work Contact** J. ADAMS	**Fail Date** 07/24/1986
Received at MSFC 08/05/1986	**Date Isolated** --	**FMEA Reference** 3.2	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location MAF		**Symptom** EVP - ELEC TOLRNCE		**Time Cycle** --
Effectivity Text LWTS 16, 20, 21, 22, 24/SUBS				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** --	**LVL 3 Close** --	**Remark / Action** --	
Investigation / Resolution Summary				
Last MSFC Update 02/13/1995	**CN RSLV SBMT** 04/09/1987	**Defer Date** --	**Add Date** --	**R/C Codes** 2 - MFG -- --
Assignee				
Design P. MULLER	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --

Approval				
Design P. MULLER	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --
PAC Assignee C. MEYER	**PAC Review Complete** CM	**MSFC Closure Date** 06/15/1987	**Status** C - CLOSED	**F/A Completion** --
Problem Type --	**SEV** --	**Program Name** --	**REVL** --	**OPRINC** --

FUNC MOD	Software Effectivity	Software Fail CD	SUBTYPE	Software Closure CD
--	-- -- -- -- --	--	--	--

RES PERSON L2	Approval Signature L3
--	--

Related Document Type	Related Document ID
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Related Document Title
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Related Document Type	Related Document ID
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Related Document Title
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Related Document Type	Related Document ID
--	--

Related Document Title
--

Contractor Status Summary

Reliability/Quality Assurance Concerns, Recommendations:

Problem Description

THE MANUFACTURING PROCESS PLANS FOR THE ASSEMBLY OF ELECTRICAL CONNECTORS HAVE NOT CONSISTENTLY INSPECTED RFI TYPE BACKSHELLS FOR FULL THREAD ENGAGEMENT PER PROCESS INSTRUCTION REQUIREMENTS. THE INSPECTION IS ACCOMPLISHED BY MEASURING THE DISTANCE BETWEEN THE BACKSHELL AND THE CONNECTOR LOCKING RING OR FLANGE. THE INSPECTION HAD ORIGINALLY BEEN ADDED TO THE PROCESS INSTRUCTION AS A RESULT OF VARIOUS ELECTRICAL CONNECTOR VENDORS HAVING MADE CONNECTOR BODIES AND BACKSHELLS WITH DEFECTIVE THREADS. DEVIATION APPROVAL REQUEST MMC-ET-141, PCIN67831 REQUIRES THE INSPECTION TO BE PERFORMED. CRITICALITY - THE FOLLOWING CRITICALITY 1 AND 1R CIRCUITS ARE INVOLVED - LOX ULLAGE PRESSURE SENSORS, LH2 ULLAGE PRESSURE SENSORS, LH2 ENGINE CUTOFF SENSORS, ET/ORB TO SRB ELECTRICAL CABLES, ET TUMBLE SYSTEM, AND RANGE SAFETY SYSTEM

Contractor Investigation/Resolution

R/A - PROCESS INSTRUCTION PI 6501 HAS BEEN CORRECTED BY THE ADDITION OF INSPECTION REQUIREMENTS TO THE ENGINEERING PROCESS SPECIFICATION TO PREVENT RECURRENCE. 8/5/86 PROBLEM CAUSE - THE INSPECTION REQUIREMENTS FOR THE THREAD ENGAGEMENT OF CONNECTOR BACKSHELLSWAS INADVERTENTLY DELETED FROM MANUFACTURING PROCESS PLANS WHICH IMPLEMENT PROCESS INSTRUCTION 6501. 8/5/86 - LAUNCH CONSTRAINTS - LWT-16, -20, -22, -24 AND SUBS ARE CONSTRAINED FROM FLIGHT. NOTE: RFI BACKSHELLS ON THE ET

MAY HAVE BEEN IMPROPERLY INSTALLED AND THEREBY AFFECT THE SAFETY OF CRITICALITY 1 AND 1R CIRCUITS. BACKGROUND INFORMATION - IN FEBRUARY, 1982, DIFFICULTY IN ASSEMBLING ELECTRICAL CONNECTORS WAS EXPERIENCED AT MAF. THE PROBLEMS WERE THE RESULT OF DEFECTIVE THREADS, PRIMARILY ON RFI BACKSHELLS,BUT ALSO ON CONNECTOR BODIES AND STRAIN RELIEF BACKSHELLS. THE PROBLEMS COULD RESULT IN CONNECTOR/ BACKSHELL ASSEMBLIES WHICH HAD AN INTERFERENCE FIT IN THE BACKSHELL TO CONNECTOR THREADS. IN SUCH A CASE, THE PARTS COULD SEIZE DURING ASSEMBLY AND TORQUING, AND ACHIEVE THE RATED TORQUE WHILE ONE THREAD OR LESS OF THE FIVE TO EIGHT THREADS PRESENT WAS ENGAGED. THE DEFECTIVE ASSEMBLY, WHICH RESULTS, MAY NOT WITHSTAND THE NORMAL BENDING AND TENSION LOADS ON THE BACKSHELL WITHOUT THE BACKSHELL SEPARATING FROM THE CONNECTOR BODY. EXAMINATION OF SAMPLE DEFECTIVE ASSEMBLIES FOUND CLEAR VIOLATIONS OF THE THREAD SPECIFICATIONS LISTED IN THE CONNECTOR ENGINEERING DRAWING MSFC 40M39569. RATHER THAN REINSPECT ALL CONNECTORS AND BACKSHELLS IN MAF INVENTORY STORES FOR PROPER THREADS, AN AGREEMENT WAS REACHED BETWEEN MSFC AND MMC TO INSPECT ALL COMPLETED CONNECTOR/BACKSHELL ASSEMBLIES FOR PROPER THREAD ENGAGEMENT AS CONTAINED IN DAR MMC-ET-141. THE DAR WAS IMPLEMENTED BY THE ADDITION OF A QC VERIFICATION TO PI 6501, REVISION 5, ISSUED ON JUNE 18, 1982. AT A LATER TIME, DUE TO CONTINUING CONNECTOR THREAD PROBLEMS, MAF BEGAN INSPECTING THE THREADS OF CONNECTORS ON INCOMING SHIPMENTS AS PART OF THE RECEIVING ACCEPTANCE PLAN. ON JULY 24, 1986, A QC INSPECTOR RECENTLY REASSIGNED TO THE MAF HARNESS FABRICATION SHOP, NOTICED THAT MANUFACTURING PROCESS PLANS FOR WIRE HARNESS ASSEMBLIES VERIFIED THE BACKSHELL THREAD ENGAGEMENT ON STRAIN RELIEF BACKSHELLS, BUT NOT ON RFI BACKSHELLS. QUALITY ENGINEERING INVESTIGATED THIS AND FOUND THAT WHEN PI 6501 WAS REFORMATTED IN MAY, 1983, FOR ENTRY INTO THE WORD PROCESSING SYSTEM, THAT THE BACKSHELL ENGAGEMENT CHECK HAD BEEN APPLIED ONLY TO STRAIN RELIEF BACKSHELLS. MANUFACTURING PROCESS PLANS WRITTEN WITH THE WORD PROCESSOR ARE IN ERROR. ELECTRICAL CONNECTORS ARE CONSIDERED BULK STOCK ITEMS IN MAF INVENTORY STORES. BECAUSE OF THIS, CONNECTORS ARE NOT SUBJECT TO FIRST-IN-FIRST-OUT INVENTORY CONTROL. THE RESULT IS THAT, DESPITE THE LARGE NUMBER OF CONNECTORS WHICH HAVE BEEN USED, IT IS NOT KNOWN WHEN, OR IF, ALL OF THE OLDER CONNECTORS WITH SUSPECT THREADS WERE USED UP. THE RESULT OF THE ABOVE DESCRIBED EVENTS IS THAT SOME, OR ALL, OF THE RFI BACKSHELLS ON EVERY COMPLETED ET NOW REMAINING WERE NOT INSPECTED FOR THREAD ENGAGEMENT. 9/8/86 PRB STATUS - BACKSHELLS NOT CONSISTENTLY INSPECTED FOR FULL THREAD ENGAGEMENT INSPECTION ADDED TO VERIFY THE PROPER GAP BETWEEN BACKSHELL AND CONNECTOR. 9/18/86 PRB STATUS - STP-6501 IS BEING REVISED TO INCLUDE THE CONNECTOR/BACKSHELL ASSEMBLY DIMENSIONS. PI-6501 BEING REVISED TO INCORPORATE THE STP CHANGES. DC&R'S BEING ISSUED TO INSPECT TANKS AND WIRING HARNESSES THAT ARE ACCEPTABLE. ECD IS UNDERTERMINED. 10/16/86 PRB STATUS - NO CHANGE. 10/27/86 UPDATE FROM CAPS E-103A - MATERIALS ENGINEERING, DEPARTMENT 3573, IS REVISING ENGINEERING PROCESS SPECIFICATION STP 6501 TO INCLUDE THE BACKSHELL THREAD ENGAGEMENT REQUIREMENT FOR ALL BACKSHELLS. THE DAR ORIGINALLY DIRECTED ONLY THE PI TO BE CHANGED. THE INCLUSION OF THE REQUIREMENT IN THE STP WILL REDUCE THE RISK THAT ERRORS, SUCH AS OCCURRED IN THE REFORMATTED PI, WILL OCCUR IN THE FUTURE. ADDITIONAL CONNECTOR TYPES, WHICH WERE NOT INCLUDED IN THE ORIGINAL DAR, HAVE BEEN INCLUDED IN THE STP REVISION EVEN THOUGH THERE IS NO HISTORY OF PROBLEMS WITH THEM. THIS WILL PREVENT PROBLEMS SHOULD MMC RECEIVE DEFECTIVE HARDWARE IN THE FUTURE 11/24/86 PRB STATUS - DC&R'S E-86-007, E-86-008, AND E-86-009 HAVE BEEN ISSUED TO INSPECT CONNECTORS ON ALL DELIVERED TANKS AND ALL ASSEMBLED TANKS AT MAF. COMPLETION DATE IS NOT DETERMINED SINCE IT IS CONTROLLED BY ACCESS TO THE TANKS. 2/19/87 PRB STATUS - NO CHANGE 4/10/87 - UPDATE FROM CAPS E-103B: CLEARANCE OF EFFECTIVITIES: LWTS 16, 20, 21, 22, AND 24 THROUGH 35: DC&R E-86-007 WILL INSPECT THE CONNECTORS WHICH MATE WITH THE ORBITER AND THE SRBS. DC&R E-86-009 WILL INSPECT THE REMAINING CONNECTORS ON THE ETS IF ACCESS IS AVAILABLE. NOTE: BOTH DC&RS WERE

OPEN AT THE TIME THE CAPS WAS CLOSED. LWT-36: DC&R E-86-006 INSPECTED THE CONNECTORS. QUANTITY INSPECTED: 68 QUANTITY DEFECTIVE: 0 LWTS 37 THROUGH 45: DC&R E-86-008 WILL INSPECT THOSE CONNECTORS WHICH WERE NOT INSPECTED DURING ASSEMBLY. NOTE: THE DC&R WAS OPEN AT THE TIME THE CAPS WAS CLOSED. LWT-46/SUBSEQUENT: THE MANUFACTURING PROCESS PLANS HAVE BEEN REVISED TO INCLUDE INSPECTION OF THE BACKSHELL THREAD EN-GAGEMENT. PROBLEM CLOSURE SUMMARY - DUE TO AN ERROR WHICH OCCURRED DURING A REVISION OF PROCESS INSTRUCTION 6501, CONNECTORS WITH RFI BACKSHELLS WERE NOT INSPECTED AFTER ASSEMBLY FOR PROPER THREAD ENGAGE-MENT. THE PI HAS BEEN CORRECTED. THE INSPECTION REQUIREMENTS WERE ADDED TO THE ENGINEERING PROCESSSPECIFICATION SO AS TO PREVENT A RECURRENCE THE ETS WHICH WERE NOT INSPECTED AT THE TIME OF ASSEM-BLY ARE BEING INSPECTED BY DC&RS. THIS PROBLEM IS SUBMITTED TO MSFC FOR CLOSURE REVIEW AND APPROVAL

MSFC Response/Concurrence

ASSESSMENT ADDENDUM REPORT

MSFC Report#	**IFA#**	**Contractor RPT#**	**JSC#**	**KSC#**	**EICN#**
A10220	--	E-103	--	--	--

Asmnt Part#	**Asmnt Part Name**	**Asmnt Serial/Lot#**
NB SERIES	55PIN ELEC CONNECTOR	N/A

HCRIT CD	**FCRIT CD**	**CAUSE CD**	**FAIL MODE**
--	1	MNP - MFG-ISP-INST	UC - UNSAT
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
3.12.7.2	2	AA	N/A
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
--	--	--	--
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
--	--	--	--

Correlated Part#	**Correlated Part#**	**Correlated Part#**
--	--	--

Associated LRU#	**Associated LRU#**	**Associated LRU#**
--	--	--

MAJOR DESIGN CHANGES

APRV DATE	**DESCRIPTION OF CHANGES**
--	--

ASSESSMENT TEXT

MSFC PRACA : 2003-02-12 07:54

WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A10330	**In-Flight Anomaly Number** --	**Contractor Report Number** T-055	**JSC#** --	**KSC#** --
Problem Title PDL LIFTOFF AT EPOXY PRIMER/POFI BONDLINE				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 1
HCRIT --	**Sys_Lvl** N	**Misc Codes** A B C D E **(X)** F G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** ET COMPLETE	**PART#** 80901010000	**SER/LOT#** N/A	**MANUFACTURER** PDL
HARDWARE LRU	**NOMENCLATURE** N/A	**PART#** N/A	**SER/LOT#** N/A	**MANUFACTURER** N/A
HARDWARE NCA	**NOMENCLATURE** ET COMPLETE	**PART#** 80901010000	**SER/LOT#** N/A	**MANUFACTURER** MMC
Test/Operation L - FLD	**Prevailing Condtion** N - INSPECTION	**F / U** F	**Fail Mode** UC - UNSAT	**Cause** MP - MFG-PRC
System TPS	**Defect** DD - DETACH	**Material** F - INSUL	**Work Contact** W. JOHNSON	**Fail Date** 05/05/1986
Received at MSFC 10/08/1986	**Date Isolated** --	**FMEA Reference** 1.2.3	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location VAFB		**Symptom** UC - UNSAT		**Time Cycle** --
Effectivity Text LWT 16 AND UP				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** --	**LVL 3 Close** --	**Remark / Action** --	
Investigation / Resolution Summary				
Last MSFC Update 01/15/1992	**CN RSLV SBMT** 07/21/1987	**Defer Date** --	**Add Date** --	**R/C Codes** 2 - MFG -- --
Assignee				
Design B. DAVIS	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** J. CAVALARIS	**Project MGR** --

Approval				
Design B. DAVIS	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** J. CAVALARIS	**Project MGR** --
PAC Assignee J.EL-IBRAHIM	**PAC Review Complete** --	**MSFC Closure Date** 08/06/1987	**Status** C - CLOSED	**F/A Completion** --
Problem Type --	**SEV** --	**Program Name** --	**REVL** --	**OPRINC** --
FUNC MOD --	**Software Effectivity** -- -- -- -- --	**Software Fail CD** --	**SUBTYPE** --	**Software Closure CD** --
RES PERSON L2 --	**Approval Signature L3** --			
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Contractor Status Summary				
Reliability/Quality Assurance Concerns, Recommendations:				

Problem Description

REF: 1. AFTER TRIMMING TO REMOVE CRUSHED FOAM (LO2 FEEDLINE FLANGE; STATION 1360), IT WAS NOTED THAT PDL "LIFTOFF" HAD OCCURRED AT THE EPOXY PRIMER/POFI BONDLINE. 2. REIVEW OF EXTERNAL TANK FLIGHT SEPARATION PHOTOS INDICATE LO2 FEEDLINE FLANGE PDL DEBOND DURING FLIGHT (POSSIBLE DEBRIS ISSUED)

Contractor Investigation/Resolution

R/C: NEW PROCESS HAS BEEN DEVELOPED BY AMT WHICH REQUIRES THE REDESIGN OF THE POFI MOLD TOOLS FOR THE L02 FEED LINE AND THE THRUST STRUT FLANGE CLOSE OUTS. 10/9/86 - FAILURE ANALYSIS DETERMINED THE CAUSE OF DEBOND IS THE RESULT OF AN INEFFECTIVE PDL POUR MOLD PROCESS/TOOLING 1/29/87 PRB STATUS - ALL ACTIONS TO BE CLOSED BY APPROXIMATELY 3-1-87 MMC IS REVIEWING PROCESS TO ILLUMINATE DEBRIS. 2/3/87 - UPDATED CRITICALITY TO 1 THIS PROBLEM IS CONSTRAINT TO 61M. THIS CONSTRAINT WAS COORDINATED WITH ET PROJECT MANAGER G. P. BRIDWELL. 5/28/87 - PRB STATUS - MMC IS REVIEWING POFI MOLD TOOL PROCESS FOR IMPROVEMENT AND MOD KITS TO BE ISSUED TO REPAIR THE FLEET. ECD 7/16/87. 7/22/87 - UPDATE GENERAL (REF T-055C) A. AN ACTION REQUEST (V-6126) WAS RECEIVED AT MAF FROM VAFB FOR LATENT DEFECT RECURRENCE CONTROL PER PR-ET-34-TS-0022. LOCATION: STATION 1360 - 4TH LEVEL - LWT-27 ANOMALY: CRUSHED FOAM ON L02 FEEDLINE - 30 DEGREES AFTER TRIMMING TO REMOVED

CRUSHED FOAM, IT WAS NOTED THAT PDL "LIFT OFF" HAD OCCURRED AT THE EPOXY PRIMER/POFI BONDLINE. B. EXTERNAL TANK SEPARATION FLIGHT PHOTOS DEPICT A LOSS OF PDL FOAM FROM THE L02 FEEDLINE FLANGE CLOSEOUTS. C. AS A RESULT OF AR V-6126, AMELIORATION OF THE EXISTING POFI MOLD PROCESS WAS EXPEDITED TO SUP- PORT THE VALIDATION OF A NEW POFI MOLD TOOL/PROCESS FOR LWTS 37 AND UP; TO AFFECT THE VALIDA- TION OF PROCESSES FOR PREVIOUS BUILT VEHICLES (LWTS 16 THROUGH 36). D. TASKS I THROUGH IV OF THIS CAPS, ADDRESSES THE FAILURE ANALYSIS OF THE L02 POFI FEEDLINE CLOSE- OUT FLANGE, PROCESS AMELIORATION, CORRECTIVE ACTION FOR PREVIOUS BUILT VEHICLES, AND CONTROL TO PREVENT RECURRENCE. TASK I - CORRECTIVE ACTION A. THE L02 FEEDLINE AND THRUST STRUT FLANGE POFI MOLD CLOSEOUT PROCESSES ARE VALIDATED BY A COMMIT- TEE OF MMC AND AMT PERSONNEL. AMELIORATION OF THE PROCESSES INCLUDED FABRICATION OF NEW POFI MOLD TOOLS. TWO SUCCESSIVE, SUCCESSFUL RUNS WERE PERFORMED ON EACH FLANGE WITH SUBSTRATE BOND TENSION, SHORE "A" HARDNESS, SOFI FOAM DUROMETER, AND INTERNAL VOIDS MEETING THE PROCESS RE- QUIREMENTS (REFERENCE INTEROFFICE MEMORANDUM 3693-87-MK-017, MK-006, MK-011; 3693-86-DB-364; 3693-86-MK-398 AND 3693-87-TW-206). LWT -37 WAS THE PATH FINDER VEHICLE USED FOR FIRST PART VERIFICATION. B. A DEBRIS ASSESSMENT TEAM REVIEWED FLIGHT SEPARATION PHOTOS, ENGINEERING (DRAWING/STP) REQUIRE- MENTS, PROCESSING PLANS (MPP/PI), DEVELOPMENT/VERIFICATION/VALIDATION HISTORY, THERMAL AND AEROLOADING CONCERNS, AND THE IMPACTS OF REWORK TO DETERMINE L02 FEEDLINE PDL DEBOND SIMILAR DEBRIS/PROCESS CONCERNS. EXTERNAL TANK FLEET REWORK OF THE L02 FEEDLINE AND THRUST STRUT FLANGES WAS THE TEAM RECOMMENDATION (REFERENCE INTEROFFICE MEMORANDUM 3571-86-46). SUBSEQUENT- LY, THE THRUST STRUT FLANGE CLOSEOUT WAS INCLUDED AS A CORRECTIVE ACTION, HEREIN. - CLOSURE SUMMARY - A LATENT DEFECT (DEBONDED PDL L02 FLANGE CLOSEOUT) DISCOVERED AT VAFB, LWT-27, AND EXTERNAL TANK FLIGHT SEPARATION PHOTOS (DEPICTING A LOSS OF PDL FOAM MATERIAL DURING FLIGHT) VERIFIED AN EXISTING INADEQUATE POFI MOLD PROCESS. AN INVESTIGATION INTO THIS PHENOMENA SHOWED THAT THE INCUMBENT POFI MOLD TOOLING WAS NOT SECURED SUFFICIENTLY TO PRECLUDE FOAM VOIDS DURING MATERIAL RISE. IN ADDITION,THE METHOD UTILIZED IN THE FOAM CHARGING OF THE MOLD CREATED IRREGULAR BOND LINES. THIS LED TO FOAM RUNOVER AND SEPARATION OF MATERIAL FROM SUBSTRATE. SIMULATION OF THE INCUMBENT POFI MOLD PROCESS WAS PERFORMED IN THE ADVANCED MANUFACTURING TECHNOLOGYLABORATORIES. AN IMPROVED PROCESS WAS THEN DEVELOPED BY AMT (REF. ATTACHMENT 1). TENSILE TESTS ANDTHE DISSECTION OF THE FOAM MATERIAL (DETERMINATION OF VOID ANOMALIES), WERE THE PHYSICAL PARAMETERS USED TO INDICATE AN IMPROVED PROCESS. SUBSEQUENT RESULTS SHOWED A SIGNIFICANT PROCESS IMPROVEMENT (REF. ATTACHMENT 2). THE NEW PROCESS REQURIED THE REDESIGN OF THE POFI MOLD TOOLS FOR THE L02 FEEDLINE AND THE THRUST STRUT CLOSEOUTS. THE PDL FOAM WAS POURED INTO THE NEW MOLD CONFIGURATION IN TWO STEPS. AFTER THE FIRST POUR, THE POFI INTERFACES WERE SANDED SMOOTH, ADHESIVE APPLIED, AND THE SECOND POUR WAS PERFORMED, CREATING A RELIABLE MATERIAL-SUBSTRATE BOND. THE AMT DEVELOPED PROCESS WAS VALIDATED FOR EACH NEW POFI MOLD TOOL USED. THE FIRST PART VERIFICA- TION WAS WITNESSED TWICE BY THE VALIDATION COMMITTEE (MMC AND MAT PERSONNEL) DURING THE LWT-37 BUILDCYCLE. SUBSEQUENT MOLD VALIDATIONS WERE PERFORMED (SIMULATED IN THE AMT LABORATORY) ON THE POFI MOLD TOOLS WHICH WILL BE UTILIZED (FOR FLANGE CLOSEOUT) WHEN THE EXTERNAL TANK IS IN THE VERITICAL POSITION (KSC). REWORK/REPAIR OF THE FLEET CLOSEOUT FLANGES (AS DETAILED, HEREIN) WILL BE ACCOMPLISHED PER MODIFI- CATION KITS (REFERENCE B01777). THIS PROBLEM IS SUBMITTED TO MSFC FOR REVIEW AND APPROVAL

MSFC Response/Concurrence

MSFC Report#	IFA#	Contractor RPT#	JSC#	KSC#	EICN#
A10330	--	T-055	--	--	--

Asmnt Part#	Asmnt Part Name	Asmnt Serial/Lot#
80901010000	ET COMPLETE	N/A

HCRIT CD	FCRIT CD	CAUSE CD	FAIL MODE
--	1	MP - MFG-PRC	UC - UNSAT

Asmnt FMEA	Asmnt FM	FMEA CSE	FMEA SCSE
5.8.1.1	1	B	3
--	--	--	--
--	--	--	--

Correlated Part#	Correlated Part#	Correlated Part#
--	--	--

Associated LRU#	Associated LRU#	Associated LRU#
--	--	--

MAJOR DESIGN CHANGES

APRV DATE	DESCRIPTION OF CHANGES
--	--

ASSESSMENT TEXT

WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A10383	**In-Flight Anomaly Number** --	**Contractor Report Number** E-105	**JSC#** --	**KSC#** --
Problem Title TRACEABILITY OF KAPTON WIRE (E659 AND E741) NOT MAINTAINED				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 3
HCRIT --	**Sys_Lvl** N	**Misc Codes** A B C D E F G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** N/A	**PART#** N/A	**SER/LOT#** N/A	**MANUFACTURER** N/A
HARDWARE LRU	**NOMENCLATURE** ET COMPLETE	**PART#** 80901010000	**SER/LOT#** N/A	**MANUFACTURER** MMC
HARDWARE NCA	**NOMENCLATURE** KAPTON WIRE	**PART#** STM E659/E741	**SER/LOT#** N/A	**MANUFACTURER** BARCEL
Test/Operation L - FLD	**Prevailing Condtion** N - INSPECTION	**F / U** F	**Fail Mode** EV - NOT-TO-SPEC	**Cause** MAP - MFG-ASY-INST
System ELECTRICAL	**Defect** MT - TYPE W	**Material** E - EL C/W	**Work Contact** J. ADAMS	**Fail Date** 11/05/1986
Received at MSFC 11/10/1986	**Date Isolated** --	**FMEA Reference** N/A	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location MAF		**Symptom** EV - NOT-TO-SPEC		**Time Cycle** --
Effectivity Text LWTS 16, 20, 21, 22, 24/SUBS				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** --	**LVL 3 Close** --	**Remark / Action** --	
Investigation / Resolution Summary				
Last MSFC Update 02/13/1995	**CN RSLV SBMT** 07/27/1987	**Defer Date** --	**Add Date** --	**R/C Codes** 2 - MFG -- --
Assignee				
Design P. MULLER	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --
Approval				
Design	**Chief Engineer**	**S & MA**	**Project**	**Project MGR**

P. MULLER	J. NICHOLS	R. JACKSON	M. PESSIN	--
PAC Assignee J.EL-IBRAHIM	**PAC Review Complete** --	**MSFC Closure Date** 08/27/1987	**Status** C - CLOSED	**F/A Completion** --
Problem Type --	**SEV** --	**Program Name** --	**REVL** --	**OPRINC** --
FUNC MOD --	**Software Effectivity** -- -- -- -- --	**Software Fail CD** --	**SUBTYPE** --	**Software Closure CD** --
RES PERSON L2 --	**Approval Signature L3** --			
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Contractor Status Summary				
Reliability/Quality Assurance Concerns, Recommendations:				

Problem Description

TRACEABILITY OF THE WIRE HAS NOT BEEN MAINTAINED. KAPTON INSULATED WIRE, FABRICATED BY BARCEL WIRE AND CABLE, MMC/MATERIAL SPECIFICATION STM E659 AND E741, WAS NOT ASSIGNED VALID LOT CODES AT THE TIME OF MANUFACTURE. THE LOT CODE, AS USED BY BARCEL, INDICATED THE SALES CONTRACT, NOT THE ACTUAL PRODUCTION RUN AND MATERIALS. BARCEL CONTROLLED TRACEABILITY BY DATE OF PRODUCTION AND THE DATE WAS NOT CARRIED FORWARD INTO THE MPP'S OR ABITS

Contractor Investigation/Resolution

R/A - THE VENDOR (BARCEL) HAS IMPLEMENTED A TRACEABILITY CONTROL SYSTEM WHICH ASSIGNS PROPER LOT CODES. 11/10/86 - PROBLEM CAUSED BY VENDOR (BARCEL) FAILING TO IDENTIFY EACH REEL OF WIRE WITH VALID LOT CODES 5/28/87 STATUS UPDATE - THE VENDOR HAS REVISED HIS WIRE IDENTIFICATION SYSTEM. WIRE LOT CODES ARE NOW PROPERLY ASSIGNED. ALL WIRE IN STOCK AT MAF NOW HAS VALID LOT CODES PER MARS DISPOSITION. MARS WERE SUBMITTED FOR ALL VEHICLES FOR WHICH TRACEABILITY WAS NOT MAINTAINED. THE MARS WERE DIS- POSITIONED "USE-AS-IS"; FORM, FIT, AND FUNCTION ARE NOT AFFECTED. THE ACCEPTANCE TEST REPORTS FOR ALL KAPTON WIRE ARE BEING CORRECTED TO IDENTIFY ALL LOT CODES CO- VERED BY EACH REPORT. THIS IS BEING ACCOMPLISHED BY REVEIWING THE VENDOR'S RECORDS. ECD 6/5/87 7/27/87 CLOSURE UPDATE - BARCEL IMPLEMENTED A TRACEABILITY CONTROL SYSTEM WHICH ASSIGNS PROPER LOT CODES BY JUNE 17, 1986. MMMSS PROCUREMENT QUALITY VISITED BARCEL ON NOVEMBER 14, 1986, AND FOUND THE NEW SYSTEM TO BE ADEQUATE. REFERENCE INTEROFFICE MEMORANDUM

3761-86-148. ALL WIRE PRODUCED BY BARCEL AND LOCATED IN THE HARNESS FABRICATION SHOP WAS DOCUMENTED ON MARS FOR THE LACK OF TRACEABILITY THE DISPOSITIONS OF THE MARS WERE TO RELABEL THE WIRE WITH THE PROPER LOT CODES. THE MARS NUMBERS ARE LISTED BELOW: T-92251 T-92257 T-92609 T-92252 T-92258 T-92610 T-92253 T-92259 T-92611 T-92254 T-92606 T-92612 T-92255 T-92607 T-92614 T-92256 T-92608 T-95839 ALL WIRE PRODUCED BY BARCEL AND LOCATED IN THE INVENTORY STORES WAREHOUSE WAS DOCUMENTED ON MARS FORTHE LACK OF TRACEABILITY. THE DISPOSITIONS OF THE MARS WERE TO RELABEL THE WIRE WITH THE PROPER LOTCODES. THE MARS NUMBERS ARE LISTED BELOW: T-93027 T-93036 T-94901 T-93031 T-93039 T-93902 T-93032 T-93040 T-94903 T-93033 T-93042 T-94904 T-93034 T-93044 ALL WIRE HARNESSES BUILT USING BARCEL WIRE, BUT NOT YET INSTALLED ON ETS, WERE DOCUMENTED ON MARS FOR THE LACK OF TRACEABILITY. THE MARS DISPOSITIONS WERE TO USE-AS-IS. THE MARS NUMBERS ARE LISTEDBELOW: T-95139 T-95141 T-95140 T-95142 SUMMARY: THE VENDOR HAD FAILED TO PROPERLY ASSIGN THE LOT CODES TO THE WIRE. THE VENDOR'S LOT CODE LABELLINGPROCEDURES WERE CORRECTED ALL WIRE IN STOCK WAS PROPERLY LABELLED PER MARS DISPOSITIONS. ALL PLETED WIRE HARNESSES WERE DOCUMENTED ON MARS WHICH WERE DISPOSITIONED US-AS-IS

MSFC Response/Concurrence

ASSESSMENT ADDENDUM REPORT

MSFC Report#	**IFA#**	**Contractor RPT#**	**JSC#**	**KSC#**	**EICN#**
A10383	--	E-105	--	--	--
Asmnt Part#	**Asmnt Part Name**	**Asmnt Serial/Lot#**			
STM E659/E741	KAPTON WIRE	--			
HCRIT CD	**FCRIT CD**	**CAUSE CD**	**FAIL MODE**		
--	3	MAP - MFG-ASY-INST	EV - NOT-TO-SPEC		
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**		
N/A	N/A	N/A	N/A		
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**		
--	--	--	--		
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**		
--	--	--	--		
Correlated Part#	**Correlated Part#**	**Correlated Part#**			
--	--	--			
Associated LRU#	**Associated LRU#**	**Associated LRU#**			
--	--	--			
MAJOR DESIGN CHANGES					
APRV DATE	**DESCRIPTION OF CHANGES**				
--	--				
ASSESSMENT TEXT					

WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A10384	**In-Flight Anomaly Number** --	**Contractor Report Number** S-072	**JSC#** --	**KSC#** --
Problem Title FORWARD SRB FITTINGS AND VERTICAL STRUTS HEAT TREATMENT PROCESS IS SUSPECT				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 1
HCRIT 1	**Sys_Lvl** Y	**Misc Codes** A **(0)** B **(X)** C D E F **(X)** G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** FWD SRB FITTING	**PART#** 80913000637-001/-002	**SER/LOT#** VARIOUS	**MANUFACTURER** BENNET
HARDWARE LRU	**NOMENCLATURE** N/A	**PART#** N/A	**SER/LOT#** N/A	**MANUFACTURER** N/A
HARDWARE NCA	**NOMENCLATURE** FWD SRB FITTING	**PART#** 80913000637-001/-002	**SER/LOT#** VARIOUS	**MANUFACTURER** BENNET
Test/Operation M - MFG	**Prevailing Condtion** N - INSPECTION	**F / U** F	**Fail Mode** UC - UNSAT	**Cause** MAW - MFG-ASY-WORK
System AERODYNAMIC	**Defect** HS - TEMSEN	**Material** S - STRUCT	**Work Contact** MATTHEESSEN	**Fail Date** 10/28/1986
Received at MSFC 11/10/1986	**Date Isolated** --	**FMEA Reference** 4.5.50.1	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location BENNET		**Symptom** UC - UNSAT		**Time Cycle** --
Effectivity Text LWTS 16, 20, 21, 22, 24 AND UP				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** --	**LVL 3 Close** --	**Remark / Action** --	
Investigation / Resolution Summary				
Last MSFC Update 01/10/1992	**CN RSLV SBMT** 05/11/1988	**Defer Date** --	**Add Date** --	**R/C Codes** 1 - DES -- --
Assignee				
Design F. HUNEIDI	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** P. BRIDWELL

Approval				
Design A. JACKMAN	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** P. BRIDWELL
PAC Assignee J.EL-IBRAHIM	**PAC Review Complete** JE	**MSFC Closure Date** 06/03/1988	**Status** C - CLOSED	**F/A Completion** --
Problem Type --	**SEV** --	**Program Name** --	**REVL** --	**OPRINC** --
FUNC MOD --	**Software Effectivity** -- -- -- -- --	**Software Fail CD** --	**SUBTYPE** --	**Software Closure CD** --
RES PERSON L2 --	**Approval Signature L3** --			
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Contractor Status Summary				
Reliability/Quality Assurance Concerns, Recommendations:				

Problem Description

THE 80913000637-001 AND -002 FORWARD SRB FITTINGS MAY NOT HAVE BEEN PROPERLY PROCESSED BY THE HEAT TREATING VENDOR. CERTAIN CRITERIA SPECIFIED IN STP 8002 IS IN QUESTION, SUCH AS ELECTRICAL CONDUCTIVITY REQUIREMENTS, TENSILE PROPERTY VERIFICATION, PLACEMENT OF THERMOCOUPLES, AND OTHER HEAT TREAT IRREGULARITIES

Contractor Investigation/Resolution

CAUSE - SUPPLIER ERROR. AVCO DID NOT PROPERLY INTERPRET THE SPECIFICATIONS, MONITOR THE PRODUCTION AND TESTING OF THE FITTINGS, AND REVIEW ACCEPTANCE DOCUMENTATION. MMMA ALSO FAILED TO DETECT THE UNACCEPTABLE TEST VALUES
12/4/86 GENERAL -
A. THE SRB ATTACH FITTINGS ARE ALLOY 7050 DIE FORGINGS THAT ARE HEAT TREATED TO T736. THE FORGINGS ARE FORGED FROM INGOT BY ALCOA TO STM 5168. THE ELLANEF COMPANY THEN ROUGH MACHINES THE PARTS TO SIZE SO BENNET HEAT TREAT COMPANY CAN HEAT TREAT TO STP 8002A AND MIL-H-6088 THE HERCULES COMPANY PERFORMS MECHANICAL PROPERTIES TESTING. UPON ACCEPTANCE BY BENNETT HEAT TREAT COMPANY, THE PARTS ARE SHIPPED TO ELLANEF COMPANY FOR FINAL MACHINING. THE FINISHED PARTS ARE THEN SHIPPED TO AVCO FOR FINAL ACCEPTANCE AND ASSEMBLY INTO THE SRB BEAM
B. THE ORIGINAL PROBLEM WAS THAT BENNETT HEAT TREATING EXCEEDED THE TIME

DELAY REQUIREMENT FOR QUENCHING. THIS WOULD NOT ALLOW OPTIMUM PROPERTIES TO BE DEVELOPED. IN ORDER TO CLARIFY THE DATA, AN AUDIT TEAM MADE UP OF QUALITY AND ENGINEERING VISITED BENNETT ON OCTOBER 28 AND 29, 1986 SEVERAL ADDITIONAL, AND MORE SERIOUS, ISSUES WERE DISCOVERED. THE ISSUES ADDRESSED WERE:

1. THE QUENCH DELAY TIME FROM SOLUTION ANNEAL TO QUENCH VARIED FROM 10 TO 30 SECONDS. A MAXIMUM OF 15 SECOND DELAY IS ALLOWED BY SPECIFICATION. THIS IMPLIES POSSIBLE LOSS OF OPTIMUM MECHANICAL PROPERTIES
2. THE PART, AS HEAT TREATED BY BENNETT, HAS NEVER BEEN PROPERLY TESTED TO SEE IF IT CONFORMS TO ACCEPTABLE MECHANICAL PROPERTIES
3. LOAD THERMOCOUPLES WERE NOT ATTACHED TO THE PART. THE ACTUAL TIME AT TEMPERATURE DURING SOLUTION ANNEAL AND AGING IS IN DOUBT
4. THE TREPANNED TEST SPECIMEN WAS NOT WIRED TO THE PART. THEREFORE, IT IS UNCERTAIN IF THE SPECIMENS REPRESENT THE PART
5. ELECTRICAL CONDUCTIVITY WAS NOT MEASURED ON ALL OF THE TREPANNED TEST SPECIMENS, AND WHERE PERFORMED, IT WAS NOT RECORDED
6. BENNETT AND AVCO HAVE ACCEPTED PARTS THAT DO NOT MEET REQUIREMENTS SOME OF THESE PARTS ARE LOCATED AT MAF
   A. SEVERAL FITTINGS HAVE UNKNOWN STRESS CORROSION CRACKING RESITANCE (LWT'S 32, 35, AND 44)
   B. GRAIN FLOW ORIENTATION IS QUESTIONABLE RELATIVE TO IN-HOUSE ANALYSIS AND ALCOA'S REPORTS RELATING TO THE SUBJECT

1/7/87 - CRITICALITY 3 ASSIGNMENT CHANGED TO CRITICALITY 1 PER REVISION B TO CAPS S-072. THIS PROBLEM CONSTRAINS USE OF LWT-26, -32, -33, -35, AND -44. MISSION ASSIGNMENT OF THESE TANKS HAS NOT BEEN MADE TO DATE, THEREFORE A FICTICIOUS MISSION ASSIGNMENT (STS-00X) HAS BEEN USED TO ASSURE TRACKING OF THESE CONSTRAINTS. THE FICTICIOUS MISSION ASSIGNMENT (STS-00X) WILL BE REPLACED WITH A LEGITIMATE ASSIGNMENT NUMBER AS THE TANKS ARE ALLOCATED TO MISSIONS. THIS ACTION HAS BEEN COORDINATED WITH ET PROJECT MANAGER, G. P. BRIDWELL - G.P. BRIDWELL 1/29/87

1/29/87 PRB STATUS - MMC VENDOR INVESTIGATION OF SHOT PEENING IS BEING DONE FOR IMPROVING THE STRESS CORROSION RESISTANCE OF THE FITTING

2/19/87 PRB STATUS - MMC IS STILL COLLECTING BULK MATERIAL PROPERTIES OF THE FITTINGS. ECD 3/21/87. MMC TO REVIEW THE DATA AND TO RECOMMEND RATIONALE FOR CLOSURE BY 4/1/87. IT WAS AGREED ON FOR J. WHITE AND P HINKELEY TO MEET WITH MSFC MATERIAL ENGINEERS FOR STATUS UPDATE AFTER 2/27/87

3/26/87 PRB STATUS - A MEETING HAS BEEN SCHEDULED IN THE WEEK OF 3/30/87 FOR MSFC'S UPDATE. NO CHANGE

4/28/87 UPDATE STATUS (REF. MMC CAPS OPEN ITEMS SUMMARY DATED 4/21/87) ET CLEARANCE: - LWTS 24, 30, AND 40 ARE CLEARED OF ALL CONSTRAINTS. THIS IS BASED ON MARS T-62347 (ENGINEERING STRESS ANALYSIS. - LWTS 26, 32, 33, 35, AND 44 HAVE CONSTRAINTS TO LAUNCH. THESE WILL BE CLEARED BY ENGINEERING TEST AND/OR REPAIR. - ALL OTHER ETS CLEARED BY ACCEPTABLE TEST RESULTS IN ACCEPTANCE DATA

5/28/87 - PRB STATUS - NO CHANGE

9/14/87 - THE FOLLOWING IS A VERBATIM OF MCC CAPS S-072G DATED 5/3/88:

TASK I PROBLEM INVESTIGATION

A. DOCUMENTATION AND SYSTEMS REVIEW

ITEM 1: REVIEW MARTIN MARIETTA MICHOUD AEROSPACE APPROVAL OF BENNETT MANUFACTURING PROCEDURES WITH RESPECT TO THE LISTED PROBLEMS. THIS SHALL INCLUDE THE DOCUMENTS APPROVED ON DAS

CLOSURE STATEMENT

RECOMMENDS REJECTING THE BENNETT PROCEDURES AS NOT COMPLYING WITH THE REQUIREMENTS. BENNETT IS NO LONGER A HEAT TREATING SUPPLIER AND NO ADDITIONAL FORGINGS WERE HEAT TREATED BY THAT VENDOR. (INTEROFFICE MEMORANDUM 3743-86-196 FROM B. GOUFMAN)

ITEM 2: REVIEW ALL OTHER CRITICAL PROCESS DEPENDENT CRITICAL HARDWARE DOCUMENTATION FOR PROBLEMS SIMILAR TO BENNETT. THE REVIEW WILL CONSIST OF CRITICAL INTERFACE HARDWARE ONLY AND 7050 ALLOY PARTS. IT WILL BE FOR LWTS 16, 20, 21, 22, 24 THROUGH 53, AND 20 SETS OF LONG LEAD FORGINGS

AND CASTINGS

A. DETERMINE HARDWARE AND PARAMETERS FOR REVIEW, INCLUDING PART NUMBERS. COMPLETE

B. REVIEW CRITICAL HARDWARE DOCUMENTATION (REFERENCE ATTACHED SUMMARY REPORT). STATUS: 7050 REVIEW IS COMPLETE

CLOSURE STATEMENT

ALL ITEMS WERE FOUND TO BE IN COMPLIANCE WITH SPECIFICATION REQUIREMENT EXCEPT FOR CERTAIN 7050 ALUMINUM ALLOY PARTS. ALL DISCREPANT HARDWARE WAS DOCUMENTED ON MARS AND SUBMITTED FOR MRB ACTION (IOM 3761-87-193)

ITEM 3: REVIEW BENNETT'S PROCESSING TO DETERMINE WHY THE PROBLEMS LISTED IN PARAGRAPH B OF THE GENERAL SECTION OCCURRED

CLOSURE STATEMENT

AVCO AND BENNETT DID NOT PROPERLY MONITOR THE PRODUCTION AND TESTING OF THE FORGINGS. (INTEROFFICE MEMORANDUM 3761-86-151 FROM J. KING)

ITEM 4: REVIEW OF AVCO ACCEPTANCE, QUALITY CONTROL, AND VENDOR SURVEILLANCE SYSTEMS TO DETERMINE HOW NONCONFORMING MATERIAL COULD BE DELIVERED AS ACCEPTABLE HARDWARE

CLOSURE STATEMENT

AVCO QUALITY PERSONNEL DID NOT PROPERLY INTERPRET AND ENFORCE THE SPECIFICATIONS. (INTEROFFICE MEMORANDUM 3761-86-151)

B. FORGING REVIEW/EVALUATION

ITEM 1: REVIEW OF EACH PART INDIVIDUALLY FOR TENSILE, HARDNESS, AND CONDUCTIVITY DATA USING THE SUPPLIER DATA PACKAGES

CLOSURE STATEMENT

THE DATA HAS BEEN EXTRACTED AND ADDITIONAL DATA REQUESTED AND RECEIVED SEVERAL FORGINGS ARE SUSPECT OF HAVING EITHER LOW MECHANICAL PROPERTIES OR STRESS CORROSION RESISTANCE (LWTS 24, 26, 30, 32, 33, 35, 40 AND 44 - 1 FITTING EACH). (FORWARD SRB ATTACH FITTINGS DATA SHEETS 11/10/86) (NOTE: SEE TASK I, ITEM B.8 FOR DATA APPLICABLE TO LWTS 24, 30, AND 40)

ITEM 2: PERFORM ADDITIONAL TESTING ON AVAILABLE RETAINED TEST BARS THIS SHALL CONSIST OF MECHANICAL PROPERTY TESTING, HARDNESS, CONDUCTIVITY, AND TENSILE BAR GRAIN FLOW ORIENTATION

CLOSURE STATEMENT

THE BARS HAVE BEEN TESTED. THE DATA IS IN ENGINEERING FOR REVIEW (M&P LAB REPORTS MTL-1462-86, MTL-1421-86, QC LAB REPORT 86A337)

ITEM 3: PERFORM HARDNESS AND CONDUCTIVITY READING ON ALL MAF FITTINGS ON ETS AND INVENTORY STORES

CLOSURE STATEMENT

ALL FITTINGS AT MAF HAS BEEN INSPECTED. THE RESULTS HAVE BEEN SUBMITTED TO ENGINEERING FOR ANALYSIS. (QC LAB REPORTS 86A333, A, B, C, AND 86A334, A, B, C)

ITEM 4: AN AS "HEAT TREATED FORGING" SHALL BE TESTED TO DETERMINE MECHANICAL PROPERTIES AND CONDUCTIVITY

CLOSURE STATEMENT

TEST RESULTS SHOWED SEVERAL AREAS WITH LOWER THAN EXPECTED TENSILE RESULTS. ALSO, THE GRAIN FLOW DIRECTION WAS UNCLEAR. (INTEROFFICE MEMORANDUM 3573-86-289, W. BAXTER)

ITEM 5: A SECOND FORGING SHALL BE REHEATED USING PROPER PROCEDURES AND INSTRUMENTATION. AFTER HEAT TREATMENT, THE PARTS SHALL BE TESTED FOR MECHANICAL PROPERTIES AND CONDUCTIVITIES

CANCELLED BENNETT: HEAT TREAT DISAPPROVED BY QUALITY. BENNETT WAS DROPPED FROM THE APPROVED SUPPLIER LIST AND NOT USED FOR ANY OTHER HEAT TREATING (REFERENCE INTEROFFICE MEMORANDUM 3573-87-106)

ITEM 6: ENGINEERING ESTABLISHED ACCEPTANCE CRITERIA FOR DISCREPANT FITTINGS WITH CONCURRENCE OF RELIABILITY ASSURANCE

CLOSURE STATEMENT

ENGINEERING EVALUATED THE FOLLOWING DATA THAT WAS GENERATED TO DETERMINE THE ACCEPTABILITY OF THE FORWARD SRB FITTINGS:

A. SUPPLIER DATA PACKAGE (TASK I.B. ITEM 1)

B. RETAINED TEST BAR MECHANICAL PROPERTY TESTING (TASK I.B. ITEM 2)

C. HARDNESS AND CONDUCTIVITY READINGS THAT WERE TAKEN ON THE PRODUCTION FITTINGS (TASK I.B. ITEM 3)

D. FORGING ORIENTATION (TASK I.B. ITEM 10)
LWTS 26, 32, 33, 35, AND 44 ARE UNACCEPTABLE FOR FLIGHT. THEY WILL BE REMOVED AND REPLACED BY B01795 AND MRB DISPOSITION
(REFERENCE INTEROFFICE MEMORANDUM 3540-87-030, R HOKANSON)
ITEM 7: PERFORM ADDITIONAL THERMO ANALYSIS AND TESTING TO DETERMINE:
A. TREPAN SLUG IS REPRESENTATIVE OF FORGING
B. COMPONENT SAW CORRECT TIME AND TEMPERATURES
CLOSURE STATEMENT
THE BENNETT PROCEDURE FOR HEAT TREATING THE FORWARD SRB THRUST FITTING MEETS ALL SPECIFICATION REQUIREMENTS. HOWEVER, PROCEDURAL VARIABLES, ESPECIALLY FURNACE LAG TIME DURING SECONDARY AGING, ALLOW FOR A WIDE RANGE OF FINAL PROPERTIES (REFERENCE STRUCTURAL MATERIALS TEST REPORT ETTR-271)
ITEM 8: EVALUATE LOW MECHANICAL PROPERTIES OF DISCREPANT FORGINGS AND PERFORM ADDITIONAL STRESS ANALYSIS TO DETERMINE THE ACCEPTABILITY OF THE FORGINGS
CLOSURE STATEMENT
LOW MECHANICAL PROPERTIES ACCEPTABLE TO STRESS ANALYSIS. (REFERENCE INTEROFFICE MEMORANDUM 3521-87-004, C. BALASABRAMANIAN AND MARS T-62347)
ITEM 9: PERFORM TESTING TO DETERMINE THE RESIDUAL STRESS LEVELS AT SELECTED LOCATIONS ON THE PART. THESE WILL BE BASED ON PROBABLE HIGH STRESS AREAS AND GRAIN FLOW DIRECTION
CLOSURE STATEMENT
RESIDUAL STRESS LEVELS ARE HIGH AND POSITIVE IN THE 7.5" BORE (REFERENCE RESIDUAL STRESS REPORT FOR S/NS 132 AND 175, AND C. O. RUAD, "RESIDUAL STRESS MEASUREMENT ON ALUMINUM FORWARD SRB THRUST FITTINGS", MARCH 1987)
ITEM 10: EVALUATE AND RECONCILE THE VARIOUS REPORTS OF THE FORGING ORIENTATION. DETERMINE THE MAXIMUM PART THICKNESS
CLOSURE STATEMENT
FORGING ORIENTATION IS DEPENDENT ON EXACT LOCATION (REFERENCE REPORT ON S/N 142, INTEROFFICE MEMORANDUM 3573-87-100)
ITEM 11: FAILURE ANALYSIS OF FITTING, S/N #94. THIS FITTING CRACKED BEFORE HEAT TREATMENT COMPLETION AT BENNETT HEAT TREAT
CLOSURE STATEMENT
THE FAILURE ANALYSIS SHOWED THE FOLLOWING (REFERENCE FAR CAPS S-072):
A. THE INITIAL PORTION OF THE CRACK (0.3 INCHES) WAS LIKELY DUE TO ENVIRONMENTALLY ASSISTED STRESS CORROSION CRACKING, WHILE THE REMAINING PORTION OF THE CRACK WAS BY STRESS OVERLOAD
B. THE FORWARD SOLID ROCKET BOOSTER BEAM FITTING, S/N 94, WAS FABRICATED FROM 7050 ALUMINUM ALLOY AND HEAT TREATED TO THE T736 CONDITION
C. MECHANICAL PROPERTIES MET STM 5168 REQUIREMENTS, HOWEVER, THE SHORT TRANSVERSE YIELD STRENGTH EXCEEDED STP 8002 ACCEPTANCE CRITERIA
D. EXTENSIVE SEM AND SURFACE ANALYSIS CHARACTERIZED AND OXIDE LAYERS AND DETECTED CONTAMINATES ON THE PART AND FRACTURE SURFACE. THEY ALSO SHOWED THAT THE USE OF CHEMICALS IN THE INSPECTION OF THE CRACK PRECLUDED A MORE DEFINITIVE EVALUATION. PROOF OF WHEN THE FRACTURE OCCURRED COULD HAVE BEEN GAINED HAD CHEMICALS NOT BEEN USED
NO CORRECTIVE ACTIONS NEED BE ADDRESSED BEYOND THOSE COVERED BY THIS CAPS FOR THE FOLLOWING REASONS:
1. THIS IS AN ISOLATED CASE OF CRACKING SINCE THE INITIAL STARTUP PROBLEMS (2 FORGINGS WITH CRACKS)
2. THE PROCESS DEFICIENCIES THAT COULD HAVE CONTRIBUTED TO THIS PROBLEM (POOR CONTROL OF AGING TIME AND TEMPERATURES) HAVE BEEN ADDRESSED BY THIS CAPS
3. ALL FUTURE SUPPLIERS PROCESSING DOCUMENTATION WILL BE REVIWED TO ASSURE COMPLIANCE TO STP 8002
4. ALL PRESENT SUPPLIERS' PROCESSING DOCUMENTATION HAVE BEEN REVIEWED TO ASSURE COMPLIANCE TO STP 8002
ITEM 12: SECTIONING OF SEVERAL FITTINGS TO DETERMINE THE VARIATIONS IN

MECHANICAL PROPERTIES AND CONDUCTIVITY. SEVERAL NODIAL POINTS SHALL BE EXAMINED WITH SPECIAL ATTENTION TO C5, D2, D8, AND D11

CLOSURE STATEMENT

NODE ANALYSIS FOR C5 SHOWS SEVERAL ADDITIONAL QUESTIONABLE FITTINGS: LWTS 25-002, 27-001, 29-002, 31-002, 47-001, 48-001, AND 48-002. FURTHER INVESTIGATIONS WERE PERFORMED AND THESE FITTINGS WERE CLEARED OF ALL CONCERNS. (REFERENCE INTEROFFICE MEMORANDUM 3573-87-100 AND TASK I, ITEM 13)

ITEM 13: PRODUCE ADDITIONAL STRESS CORROSION CRACKING DATA (SCC) TO CLARIFY YIELD CONDUCTIVITY ACCEPTANCE BOX AND CLARIFY NODE ANALYSIS

CLOSURE STATEMENT

TESTING HAS SHOWN THE FWD SRB FITTING TO BE IMMUNE TO SCC THROUGHOUT THE FITTING AT STRESSES 45 KSI OR LESS. THE WORST CASE RESIDUAL STRESS LEVEL IS 32 KSI SO THE FITTINGS WITH QUESTIONABLE C5 READINGS ARE ACCEPTABLE FOR USE. (IOM 3573-87-198)

C. REPAIR INVESTIGATION

ITEM 1: SHOT-PEENING IS A CANDIDATE FOR IMPROVING THE STRESS CORROSION RESISTANCE OF THE FITTING. TO DETERMINE THE ACCEPTABILITY OF THIS FIX, ADDITIONAL WORK NEEDS TO BE PERFORMED

- A. DETERMINE THE AREAS THAT SHOULD BE SHOT-PEENED
- B. DETERMINE THE CRITICAL DIMENSIONS AND SURFACE FINISHES THAT MUST BE MAINTAINED AFTER SHOT-PEENING
- C. DETERMINE THE ABILITY TO:
  1. SUPPORT THE TANK SO ALL OSL SURFACES CAN BE SHOT-PEENED
  2. GAIN PHYSICAL ACCESS TO PERFORM SHOT-PEENING ON THE ISL OF THE FITTING. THIS INCLUDES THE REMOVAL OF SRB BEAM WEB 5 INSTALLED AT MAF

CLOSURE STATEMENT

ADDITIONAL WORK WAS NOT NEEDED AS REHEAT TREATMENT IS THE METHOD OF REPAIR IN LIEU OF SHOT PEENING. (INTEROFFICE MEMORANDUM 3511-86-054, W. VANBEEK AND 3573-86-317, B. SYMS)

ITEM 2: DETERMINE THE USEFULNESS AND PRACTICALITY OF AN INSITU HEAT TREATMENT OF THE FITTINGS. CLOSURE STATEMENT INSITU HEAT TREATMENT OF THE FORGING WAS NOT PRACTICAL (REFERENCE INTEROFFICE MEMORANDUM 3540-87-030, R. HOKANSON AND 3522/T-87-016, L. HARTLEY)

ITEM 3: DETERMINE BEST METHOD TO NONDESTRUCTIVELY INSPECT FORWARD SRB FITTINGS

CLOSURE STATEMENT

THERE IS NO BEST METHOD. EACH AREA HAS ITS OWN BEST METHOD. ADDITIONAL WORK IS NEEDED TO GET A FINAL SRB FITTING TEST PLAN (INTEROFFICE MEMORANDUM 3770-87-002, M. MCANDREW)

ITEM 4: DETERMINE THE BEST METHOD OUT OF THE PROPOSED METHODS OF REPAIR:

- A. INSITU HEAT TREATMENT
- B. REPLACING THE SRB BEAM
- C. REPLACING THE FITTING BY A INSITU REPAIR
- D. SHOT PEENING OF FITTING AND PAINTING

CLOSURE STATEMENT

LWTS 26, 32, 33, 35, AND 44 WILL BE REPAIRED BY REMOVING AND REPLACING FITTING BY OPENING UP THE INTERTANK CROSS BEAM. THE SAME FITTING WILL BE REINSTALLED AFTER IT HAS BEEN AGED 350 DEGREES-F FOR FOUR HOURS (REFERENCE INTEROFFICE MEMORANDUM 3540-87-030, R. HOKANSON)

TASK II CORRECTIVE ACTION

A. CORRECTION OF AFFECTED ETS FOR SRB FITTINGS

ITEM 1: REMOVE, REWORK (AGE) AND REINSTALL FORWARD SRB FITTING PER BO 1795. (CANCELLED. THIS BO WHEN APPROVED WILL BE TRACKED AND PERFORMED BY A MARS DISPOSITION)

B. SYSTEM CORRECTIVE ACTION

ITEM 1: SUPPLIERS, PROCESSORS, AND MMA PROCUREMENT QUALITY REPRESENTATIVES WILL BE MADE AWARE OF THE REQUIREMENTS OF STP 8002. TEST DATA VERIFICATION OF MAXIMUM PROPERTIES WILL BE ESTABLISHED AS A MANDATORY INSPECTION POINT

A. MMMA PERSONNEL
CLOSURE STATEMENT
"TIPS" ISSUED TO CLARIFY AND EMPHASIZE 7050 REQUIREMENTS (TIPS #2)
B. SUPPLIERS AND PROCESSORS NOTIFICATIONS ALONG WITH THE VERIFICATION OF MAXIMUM PROPERTIES MADE MANDATORY INSPECTION POINT
CLOSURE STATEMENT
ALL SUPPLIERS HAVE BEEN NOTIFIED. FUTURE SUPPLIERS WILL BE SENSITIZED DURING 5TH BUY START UP. (IOM 3761-87-064 AND 134)
ITEM 2: DEVELOP MATERIAL FLOW DIAGRAMS FOR PROCESS SENSITIVE HARDWARE
CLOSURE STATEMENT
THESE DIAGRAMS HAVE BEEN GENERATED AND ARE AVAILABLE TO CLARIFY THE PROCESSING
ITEM 3: MAF RECEIVING ACCEPTANCE PLANS (RAPS) WILL BE REVIEWED TO DETERMINE IF ANY CHANGES ARE NECESSARY
CLOSURE STATEMENT
ALL RAPS HAVE BEEN REVIEWED AND NEED CHANGES TO PREVENT FURTHER OCCURRENCES. THIS WILL BE CONDUCTED AS PART OF THE TD 813 STAND ALONE FORMAT CONVERSION. THIS HAS A TARGET DATE OF JUNE 1988 FOR COMPLETION UNTIL THEN, PAD 3740-061 HAS BEEN ISSUED TO COVER THE REQUIREMENTS (IOM 3743-87-135)
ITEM 4: REVIEW ALL PROCESS INSTRUCTIONS
CLOSURE STATEMENT
THE RE-REVIEW OF ALL SUPPLIER PROCESS INSTRUCTIONS IS NOW COMPLETE. 43% OF THE PI'S REQUIRE REVISION. THESE CHANGES HAVE BEEN FORWARDED TO THE SUPPLIERS AND THE PI'S WILL BE TRACKED BY PROCUREMENT QUALITY THROUGH RE-APPROVAL. (IOM 3761-87-233)
ITEM 5: REVIEW AND REVISE, AS NECESSARY, STM AND CRITICAL STANDARD DRAWINGS ASSOCIATED WITH METALS
CLOSURE STATEMENT
STM S168 AND Q250 WILL BE REVISED. OTHER SPECIFICATIONS WERE CHANGED TO INCORPORATE CLARIFICATIONS ON AN ON-GOING BASIS
ITEM 6: REVIEW PURCHASE DOCUMENTATION TO SEE IF ALL REQUIREMENTS ARE MET
A. REVIEW EACH CONTRACT VS. THE PURCHASE REQUISITION
B. REVIEW CONTRACTS TO SEE IF ALL ENGINEERING REQUIREMENTS ARE MET
(LETTER ISSUED STATING THAT ENGINEERING REQUIREMENTS TAKE PRECEDENCE OVER EXHIBIT A OF CONTRACT)
CLOSURE STATEMENT
REVIEW HAS BEEN ACCOMPLISHED AND AN ADMINISTRATIVE STATEMENT ISSUED CLARIFYING THE REQUIREMENTS (REFERENCE INTEROFFICE MEMORANDUM AP-0587-WRB-015, W. BOWEN)
ITEM 7: REVALIDATE ALL APPROVED SUPPLIER PROCESS INSTRUCTIONS CLOSURE STATEMENT THE SUPPLIERS PROCESS INSTRUCTIONS WILL BE REVALIDATED AS THE SUPPLIERS ARE RESTARTED FOR 5TH BUY
ITEM 8: EXAMINE THE FEASIBILITY OF CHANGING THE 7050 ALLOY PARTS TO REQUIRE SHOT PEENING AFTER FINAL MACHINING AS A PRODUCT ENHANCEMENT
CLOSURE STATEMENT
SHOT PEENING UNINSTALLED PARTS IS A WAY TO REDUCE SUSCEPTIBILITY TO SSC HOWEVER, IF THE PARTS ARE PROPERLY PROCESS, THIS STEP IS NOT NECESSARY (IOM 3573-87-159)
ITEM 9: PROVIDE SCHEDULE AND PLAN FOR IMPLEMENTATION OF SUPPLIER SENSITIZATION TO 7050 CRITERIA. SUBMIT THE PLAN TO RELIABILITY ASSURANCE. THIS SHALL COVER THE IMPLEMENTATION OF TASK I.D., ITEMS 2.B AND 8
CLOSURE STATEMENT
ALL SUPPLIERS AND MAF PERSONNEL WERE INDOCTRINATED ON 7050 PROBLEMS (INTEROFFICE MEMORANDUM 3761- 87-064)
ITEM 10: ISSUE PRELIMINARY ALERT ON 7050 HEAT TREATING PROBLEMS
CLOSURE STATEMENT
ALERT WRITTEN AND SENT TO L. HERKES ON 6/16/87
C. CLEARANCE OF DISCREPANT HARDWARE DISCOVERED BY HARDWARE REVIEW (TASK

I.A, ITEM 2)
ITEM 1: 7050 HARDWARE
A. REVIEW OF WEBER METALS PROCESSING AND DATA
CLOSURE STATEMENT
INVESTIGATION SHOWS THIS TO BE A NO ITEM. RETESTING IS ALLOWED BY SPECIFICATION (REFERENCE MARS T-91414)
B. GENERATE MARS AND FIND EFFECTIVITIES
CLOSURE STATEMENT
MARS GENERATED FOR THE DISCREPANT PARTS (7050 PROBLEM SUMMARY, REVISED 6/10/87)
ITEM 2: DETERMINE IF ANY ALLOY 7075 PARTS ARE SUSCEPTIBLE TO STRESS CORROSION CRACKING
CLOSURE STATEMENT
THERE ARE 500 + PARTS ON THE TANK, OF THOSE ONLY 23 ARE FRACTURE CRITICAL. THESE 23 WILL BE REVIEWED IN TASK II C.4. (IOM 3511- 87-039)
ITEM 3: THE VERTICAL STRUT SHALL BE INVESTIGATED TO DETERMINE THE PROPER ENGINEERING DISPOSITION OF THE STRUTS. THIS SHALL INCLUDE TENSILE TESTING, RESIDUAL STRESS MEASUREMENTS, AND GRAIN FLOW ANALYSIS
CLOSURE STATEMENT
THESE STRUTS HAVE BEEN DISPOSITIONED USE-AS-IS. (MARS T-91442 AND OTHERS. SEE 7050 PROBLEM SUMMARY)
ITEM 4: REVIEW THE 23 FRACTURE CRITICAL 7050 PARTS PER TANK. THIS WILL BE PERFORMED ON LWTS 16, 20, 21, 22, 24 THRU 53
CLOSURE STATEMENT
THIS WAS COMPLETED AND ALL EXCEPT 3 PARTS WERE FOUND TO BE ACCEPTABLE THE 3 UNACCEPTABLE PARTS WERE PLACED ON A MARS. (INTEROFFICE MEMO 3761-88-049)
TASK III. CAPS, CAUSE AND CORRECTIVE ACTION SUMMARY
THE BASIC CAUSE WAS THE SUPPLIERS' FAILURE TO PROPERLY INTERPRET THE SPECIFICATIONS, MONITOR THE PRODUCTION AND TESTING OF THE PARTS AND REVIEW ACCEPTANCE DOCUMENTATION. MMMA ALSO FAILED TO DETECT THE UNACCEPTABLE TEST VALUES
THE MAJOR CORRECTIVE ACTIONS TAKEN TO PRECLUDE REOCCURANCE WERE MAKING VENDOR AND MAF PERSONNEL AWARE OF THE 7050 REQUIREMENTS
ANOTHER SIGNIFICANT CORRECTIVE ACTION WAS THE RE-REVIEW AND REVISION IF NEEDED OF RAPS, STMS, CRITICAL STANDARD DRAWINGS, SUPPLIER PROCESS INSTRUCTIONS AND SUPPLIER CONTRACTUAL REQUIREMENTS. IN ADDITION, ALL SUPPLIER PROCESS INSTRUCTIONS WILL BE REVALIDATED AS 5TH BUY IS STARTED
THE GENERIC CONCERN WAS RESOLVED THROUGH A REVIEW OF THE CRITICAL 7075, 7050 AND INTERFACE HARDWARE ACCEPTANCE TEST RESULTS. AS A RESULT MANY MARS WERE WRITTEN TO IDENTIFY DISCREPANT HARDWARE (REFERENCE ATTACHED MATRIX) AND OBTAIN HARDWARE DISPOSITION. THE DISCREPANT SRB FITTINGS WILL BE REMOVED AND REHEAT TREATED IN ACCORDANCE WITH BO 1795
TASK IV CLEARANCE OF EFFECTIVITIES
A. FORWARD SRB FITTINGS:
    1. LWTS 24, 30, AND 40 ARE CLEARED OF ALL CONSTRAINTS. THIS IS BASED ON MARS T-62347 (ENGINEERING STRESS ANALYSIS)
    2. LWTS 26, 32, 33, 35, AND 44 ARE CLEARED OF ALL CONSTRAINTS TO LAUNCH. THESE WILL BE REPAIRED BY DISPOSITIONED MARS (TASK II.A.1)
    3. ALL OTHER EFFECTIVITIES CLEARED BASED ON ACCEPTABLE VALUES ON TEST REPORTS
B. VERTICAL STRUTS:
    1. LWTS 26, 28, 30, 31, 32, 33, 34, 37, AND 39 ARE CLEARED OF ALL CONSTRAINTS TO LAUNCH. THESE HAVE BEEN ACCEPTED UAI ON MARS
    2. ALL OTHER EFFECTIVITIES CLEARED BASED ON ACCEPTABLE VALUES ON TEST REPORTS
CAUSE AND CORRECTIVE ACTION SUMMARY:
1/26/88 UPDATE - SEE ATTACHMENT A OF MMC CAPS FOR 7050 PROBLEM SUMMARY

5/3/88 - THIS REPORT HAS BEEN DEFERRED FOR STS-26, PER NSTS 07700,
VOLUME XI AND NSTS 08126 PARAGRAPH 3.4.1, ITEM C WHICH STATES "PROBLEM
CONDITION DOES NOT EXIST IN THE FLIGHT HARDWARE AND IS CLEARLY SCREENED
BY ACCEPTANCE TEST, PREFLIGHT CHECKOUT, OR SPECIAL TEST."
THE DEFERRAL STATUS HAS BEEN APPROVED BY THE ET PROJECT MANAGER,
MR. G.P. BRIDWELL _____
THIS CLOSURE IS SUBMITTED TO MSFC FOR REVIEW AND APPROVAL

MSFC Response/Concurrence

ASSESSMENT ADDENDUM REPORT

MSFC Report#	**IFA#**	**Contractor RPT#**	**JSC#**	**KSC#**	**EICN#**
A10384	--	S-072	--	--	--

Asmnt Part#	**Asmnt Part Name**	**Asmnt Serial/Lot#**
80913000637-001/-002	FWD SRB FITTING	VARIOUS

HCRIT CD	**FCRIT CD**	**CAUSE CD**	**FAIL MODE**
--	1	MAW - MFG-ASY-WORK	UC - UNSAT

Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
4.5.50.1	1	A	1
--	--	--	--
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Correlated Part#	**Correlated Part#**	**Correlated Part#**
--	--	--

Associated LRU#	**Associated LRU#**	**Associated LRU#**
--	--	--

MAJOR DESIGN CHANGES

APRV DATE	**DESCRIPTION OF CHANGES**
--	--

ASSESSMENT TEXT

WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A10438	**In-Flight Anomaly Number** --	**Contractor Report Number** P-057	**JSC#** --	**KSC#** --
Problem Title FLARED TUBING - CONTAMINATION WAS OBSERVED INSIDE TUBING				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 3
HCRIT --	**Sys_Lvl** N	**Misc Codes** A B C D E F G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** EXTERNAL TANK	**PART#** 82601000000	**SER/LOT#** NOTED	**MANUFACTURER** MMC
HARDWARE LRU	**NOMENCLATURE** N/A	**PART#** N/A	**SER/LOT#** N/A	**MANUFACTURER** N/A
HARDWARE NCA	**NOMENCLATURE** TUBING	**PART#** 80921021035-19	**SER/LOT#** NOTED	**MANUFACTURER** MMC
Test/Operation M - MFG	**Prevailing Condtion** N - INSPECTION	**F / U** F	**Fail Mode** UC - UNSAT	**Cause** MP - MFG-PRC
System PROPULSION	**Defect** CN - CONTAM	**Material** N - HOLE	**Work Contact** M. CAMPBELL	**Fail Date** 10/29/1986
Received at MSFC 12/15/1986	**Date Isolated** --	**FMEA Reference** 2.8.14.2	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location MAF		**Symptom** UC - UNSAT		**Time Cycle** --
Effectivity Text LWTS 16, 20, 21, 22, 24/SUBS				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** --	**LVL 3 Close** --	**Remark / Action** --	
Investigation / Resolution Summary				
Last MSFC Update 11/04/1991	**CN RSLV SBMT** 02/03/1987	**Defer Date** --	**Add Date** --	**R/C Codes** 2 - MFG -- --
Assignee				
Design P. MULLER	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --
Approval				

Design	Chief Engineer	S & MA	Project	Project MGR
P. MULLER	J. NICHOLS	R. JACKSON	M. PESSIN	--

PAC Assignee	PAC Review Complete	MSFC Closure Date	Status	F/A Completion
J.EL-IBRAHIM	GM	04/09/1987	C - CLOSED	--

Problem Type	SEV	Program Name	REVL	OPRINC
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FUNC MOD	Software Effectivity	Software Fail CD	SUBTYPE	Software Closure CD
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RES PERSON L2	Approval Signature L3
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Related Document Type	Related Document ID
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Related Document Title
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Related Document Type	Related Document ID
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Related Document Title
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Related Document Type	Related Document ID
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Related Document Title
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Contractor Status Summary

Reliability/Quality Assurance Concerns, Recommendations:

Problem Description

S/N'S 153, 162 AND 163 DURING VISUAL INSPECTION OF A FLARED TUBE ASSEMBLY, CONTAMINATION WAS OBSERVED INSIDE THE TUBING IMMEDIATELY PAST THE FLARED END. THIS PATICULAR COMPONENT HAD BEEN THROUGH FINAL CLEANING AT MAF. TO DETERMINE THE EXTENT OF THIS CONDITION RELATIVE TO OTHER TUBE ASSEMBLIES, FIVE ADDITIONAL UNITS WERE SELECTED FROM STORES FOR INSPECTION. A SIMILAR CONDITION WAS FOUND ON THREE OF THE FIVE TUBES.ALL INSTALLED TUBING WAS PROCESSED USING THE SAME POLISHING AND CLEANING METHODS. THEREFORE, ALL VEHICLES ARE SUSPECT

Contractor Investigation/Resolution

R/A - ENGINEERING HAS DETERMINED THAT RESIDUAL LAPPING COMPOUND DOES NOT AFFECT THE ET PROPULSION SYSTEMS BY EITHER LOX/LH2 COMPATIBILITY OR PARTICULATE CONTAMINATION, THEREBY, EXONERATING ALL EXISTING TUBE ASSEMBLIES. FLARED TUBE ASSEMBLIES ARE POLISHED USING A FELT BOBBIN TURNED BY A HIGH SPEED ELECTRIC MOTOR. ALUMINUM OXIDE LAPPING COMPOUND APPLIED TO THE BOBBIN AIDS IN POLISHING THE FLARED SEALING SURFACE DURING POLISHING, THE PARTS ARE HEATED DUE TO FRICTION WHICH BAKES THE LAPPING COMPOUND GIVING IT A THICK PASTE-LIKE CONSISTENCY. THE PROCESS INSTRUCTIONS DIRECT THE TECHNICIAN TO WIPE AWAY ANY EXCESS LAPPING COMPOUND. THIS DOES NOT ENSURE THAT ALL OF THE COMPOUND IS REMOVED FROM THE TUBE'S INTERIOR. THE PRESSURE APPLIED DURING POLISHING EXTRUDES THE FELT BOBBIN INTO THE TUBE PUSHING THE RESIDUAL LAPPING COMPOUNDS DEEPER WITH EACH USE. DUE TO THE TUBE'S LENGTH OR BENDS, IT IS DIFFICULT OR

IMPOSSIBLE TO VISUALLY DETECT RESIDUAL LAPPING COMPOUND. INFORMAL TESTS CONDUCTED BY RELIABILITY ASSURANCE INDICATE THAT FLUSHING THE TUBE WITH HIGH STRENGTH SOLVENTS (MEK/FREON PCA) REMOVES ONLY A SMALL PORTION OF THE LAPPING COMPOUND. MECHANICAL WIPING IS REQUIRED TO REMOVE ALL VISUAL INDICATIONS. IF THE RESIDUAL LAPPING COMPOUND IS ALLOWED TO DRY PRIORTO FINAL CLEANING, THE REMOVAL PROCESS IS EXPECTED TO BE MORE DIFFICULT. LAB ANALYSIS WAS REQUESTED ON DISCREPANT TUBES REMOVED FROM INVENTORY STORES. A COMPARISON WAS MADE OF THE MATERIAL FOUND IN THE TUBES TO THE BOBBIN/LAPPING COMPOUND COMPOSITION. A MATCH OF THE MATERIALS WAS CONFIRMED (REFERENCE LAB REPORTS 86E027, 86M049 AND 86M046). EFFECTIVITIES: LWT'S 16, 20, 21, 22, 24 AND UP. 2/4/87: RESOLUTION: A HISTORICAL REVIEW REVEALED THAT POLISHING HAD NOT BEEN SUCCESSFUL IN REDUCING LEAKAGE, THEREFORE POLISHING WAS DELETED FROM THE FABRICATION PROCESS (REF. POD ET-3600-1863). ENGINEERING DETERMINED THAT RESIDUAL LAPPING COMPOUNDS DID NOT AFFECT ET PROPULSION SYSTEMS, EXONERATING ALL EXISTING TUBE ASSEMBLIES (REF. INTEROFFICE MEMORANDUM 3573-87-002). NO FURTHER ACTION IS REQUIRED. THIS PROBLEM IS SUBMITTED TO MSFC FOR CLOSURE REVIEW AND APPROVAL

MSFC Response/Concurrence

ASSESSMENT ADDENDUM REPORT

MSFC Report#	**IFA#**	**Contractor RPT#**	**JSC#**	**KSC#**	**EICN#**
A10438	--	P-057	--	--	--

Asmnt Part#	**Asmnt Part Name**	**Asmnt Serial/Lot#**
80921021035-19	TUBING	153, 162, & 163

HCRIT CD	**FCRIT CD**	**CAUSE CD**	**FAIL MODE**
--	3	MP - MFG-PRC	UC - UNSAT
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
2.3.15.1	1	N/A	N/A
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
--	--	--	--
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
--	--	--	--

Correlated Part#	**Correlated Part#**	**Correlated Part#**
--	--	--

Associated LRU#	**Associated LRU#**	**Associated LRU#**
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MAJOR DESIGN CHANGES

APRV DATE	**DESCRIPTION OF CHANGES**
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ASSESSMENT TEXT

MSFC PRACA : 2003-02-12 08:41

WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A10482	**In-Flight Anomaly Number** --	**Contractor Report Number** T-056	**JSC#** --	**KSC#** --
Problem Title LWT-30 HAD BLISTER-LIKE CONDITION IN THE BX-250 FOAM				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 3
HCRIT --	**Sys_Lvl** N	**Misc Codes** A B C D E F G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** BX-250 FOAM	**PART#** 80973018414	**SER/LOT#** N/A	**MANUFACTURER** MMC
HARDWARE LRU	**NOMENCLATURE** INTERTANK	**PART#** 80903000000	**SER/LOT#** N/A	**MANUFACTURER** N/A
HARDWARE NCA	**NOMENCLATURE** BX-520 FOAM	**PART#** 80973018414	**SER/LOT#** N/A	**MANUFACTURER** MMC
Test/Operation M - MFG	**Prevailing Condtion** N - INSPECTION	**F / U** F	**Fail Mode** MSI - INSULATION	**Cause** MAP - MFG-ASY-INST
System TPS	**Defect** CX - VOID	**Material** F - INSUL	**Work Contact** W. JOHNSON	**Fail Date** 07/22/1985
Received at MSFC 01/09/1987	**Date Isolated** --	**FMEA Reference** 5.6.1.2	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location MAF		**Symptom** UC - UNSAT		**Time Cycle** --
Effectivity Text NONE				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** --	**LVL 3 Close** --	**Remark / Action** --	
Investigation / Resolution Summary				
Last MSFC Update 01/15/1992	**CN RSLV SBMT** 11/06/1987	**Defer Date** --	**Add Date** --	**R/C Codes** 5 - TRNG -- --
Assignee				
Design F. HUNEIDI	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** J. CAVALARIS	**Project MGR** --
Approval				
Design F. HUNEIDI	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** J. CAVALARIS	**Project MGR** --

PAC Assignee	PAC Review Complete	MSFC Closure Date	Status	F/A Completion
J.EL-IBRAHIM	JE	12/03/1987	C - CLOSED	--

Problem Type	SEV	Program Name	REVL	OPRINC
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FUNC MOD	Software Effectivity	Software Fail CD	SUBTYPE	Software Closure CD
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RES PERSON L2	Approval Signature L3
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Related Document Type	Related Document ID
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Related Document Title
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Related Document Type	Related Document ID
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Related Document Type	Related Document ID
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Contractor Status Summary

Reliability/Quality Assurance Concerns, Recommendations:

Problem Description

REF DOC: MMC MARS T-76521 ON JULY 22, 1985, DURING AN INSPECTION OF THE LWT-30 INTERTANK (POST CPR FOAM PAPER SPRAY), A "BLISTER-LIKE" CONDITION WAS OBSERVED IN THE BX-250 FOAM. THIS CONDITION WAS REPEATED ON LWT'S 31 AND 32 INTERTANKS

Contractor Investigation/Resolution

R/A - LWT-30, -31, AND -32 WERE REPAIRED PER MARS T-76521, T-85078, AND T-85070, RESPECTIVELY. 1/9/87 - DISCREPANT BX-250 CONDITION WAS A RESULT OF AN IMPROPER MIXTURE (OFF-RATIO) OF "A" AND "B" FOAM SPRAY COMPONENTS. 1/9/87 BACKGROUND - A. ON JULY 22, 1985, DURING AN INSPECTION OF THE LWT-30 INTERTANK (POST CPR FOAM PAPER SPRAY) A "BLISTER/SWOLLEN" CONDITION WAS OBSERVED IN THE BX-250 FOAM (REF. MARS T-75621). B. AFTER THE INTERTANK BX-250 FOAM APPLICATION WAS COMPLETED PER ENGINEERING DRAWING 80973018414 AND ASSOCIATED PROCESS DOCUMENTS, IT WAS PLACED IN CELL "H" FOR CPR APPLICATION. A CPR-488 FOAM PAPER SPRAY WAS THEN CONDUCTED OVER THE BX-250 MATERIAL. APPLICATION TEMPERATURES RANGED FROM 184 TO 226 DEGREES F. AFTER THE REMOVAL OF THE CPR PAPER SPRAY, THE ABNORMAL BX-250 CONDITION WAS SITED. THIS CONDITION WAS ALSO SIMILAR ON LWT-31, AND 32. FAILURE ANALYSIS T-75621 INDICATES THAT THIS ANOMALY RESULTED FROM AN IMPROPER MIXTURE ("OFF-RATIO") OF FOAM SPRAY COMPONENTS. THE "A" COMPONENT OF THE TWO COMPONENTS (A AND B) SYSTEM WAS "BLED- OFF" TO COMPENSATE FOR AN IMBALANCE OF PROPORTIONER SPRAY PRESSURE. 5/28/87 - STATUS UPDATE - NO CHANGE ECD 6/30/87. 11/10/87 - CLOSURE UPDATE - REFERENCE MMC CAPS T-056 TASK I FOAM PROCESSES/EQUIPMENT INVESTIGATION THIS TASK REQUIRES

THE SUBMITTAL TO RELIABILITY ASSURANCE, COPIES OF PROCESS DOCUMENTS (AND ASSO- CIATED EQUIPMENT REQUIREMENTS) FOR THE SPRAY APPLICATION OF NCFI, CPR, PDL, AND BX-250 FOAMS. IN ADDITION, PROBLEM HISTORIES (WHICH INDIVIDUAL DEPARTMENTS ARE COGNIZANT OF) SHALL BE SUBMITTED. THIS INFORMATION SHALL BE REVIEWED AND CATEGORIZED PRIOR TO DETERMINING THE ADDITIONAL TASKS FOR THE RESOLUTION OF THIS CAPS. A. ENGINEERING SPECIFICATION - 1512, 1513, 1518, 1523 B. PROCESS INSTRUCTIONS - 1512, 1513, 1518, 1523 C. MANUFACTURING PROCESS PLANS D. MANUFACTURING OPERATION PROCEDURES E. TOOLING INSTRUCTION/DESIGN F. PRODUCTION OPERATIONS - OPERATION/MAINTENANCE PROCEDURES CLOSURE STATEMENT ALL NECESSARY DOCUMENTS AND PROBLEM HISTORIES HAVE BEEN SUBMITTED TO RELIABILITY ASSURANCE. AN IN DEPTH REVIEW OF THESE ITEMS REVEALED THAT SYSTEM AMELIORATION IS NEEDED IN THE FORM OF UPGRADING FOAM OPERATOR SKILLS AND OVERALL EQUIPMENT EVALUATION. TASK II OF THIS CAPS WILL ADDRESS CORREC- TIVE ACTION. TASK CLOSED *TASK II CORRECTIVE ACTION A UPGRADE OPERATOR SKILL LEVELS INVESTIGATIONS HAVE SHOWN THAT WHEN A SPRAY FOAM APPLICATOR IS KNOWLEDGEABLE OF THE OPERATING EQUIPMENT, MATERIALS, AND APPLICATION PRINCIPLES, LATENT DEFECTS CAN BE PREVENTED 1. DEVELOPMENT OF A VIABLE FOAM APPLICATOR TRAINING (CERTIFICATION) COURSE IN CONJUNCTION WITH THE PRIME EQUIPMENT VENDOR (GUSMER CORPORATION). 2. TAILOR/ENHANCE THE TRAINING COURSE TO ALLOW FOR GUSMER EQUIPMENT MODIFICATIONS PECULIARIZED BY MMMSS DESIGN. *CLOSURE STATEMENT A FOUR DAY TRAINING COURSE WAS GIVEN TO MMMSS PRODUCTION FOAM OPERATORS AND SUPERVISORS BY A GUSMER CORPORATION REPRESENTATIVE. THE SYLLABUS CONSISTED OF EQUIPMENT COMPONENT ANALYSIS, PRAC- TICAL APPLICATIONS AND TROUBLESHOOTING, BASIC FIELD KNOWLEDGE OF RELATED CHEMISTRY, AND KNOWLEDGE OF PROPER SPRAY TECHNIQUES AND PROCEDURES EIGHT INDIVIDUALS (A TOTAL OF 25 INDIVIDUALS PARTICI- PATED) FAILED THE EXAMINATION GIVEN AT THE COURSE COMPLETION (CORRECTIVE ACTION WILL BE ADDED AS A TASK, HEREIN). THE MMMSS TRAINING DEPARTMENT HAS DEVELOPED A CERTIFICATION COURSE BASED ON MMMSS PROCEDURES AND OBSERVATION OF GUSMER'S CURRICULUM (REFERENCE INTEROFFICE MEMORANDUM 3084-87-026, AND GUSMER CORPORATION CORRESPONDENCE TO WM. JOHNSON; DATED MAY 7, 1987) ITEM CLOSED B. PROCEDURE A REVIEW/REVISION OF ALL STP/PI FOAM DOCUMENTS FOR CONSISTENCY AND CONTROL. CLOSURE STATEMENT STP/PI CONTROLS WERE FOUND TO BE ADEQUATE FOR THESE DOCUMENTS WHICH ARE NOT PART PECULIAR DETAILEDSPRAY INSTRUCTIONS ARE FURNISHED IN THE MPP SPRAY SCHEDULES FOR EACH PARTICULAR APPLICATION. IT WAS AGREED THAT A STATEMENT COULD BE ADDED TO THE ABOVE PROCESS INSTRUCTIONS DIRECTING THAT PROPORTIONER NEEDLE VALVES NOT BE ADJUSTED AFTER PRODUCTION SPRAY HAS BEEN STARTED THIS WILL BE DONE AT THE NEXT SCHEDULED REVISIONS TO PIS 1503, 1512, 1513, AND 1523. A PRODUCTION TIP WAS ISSUED IN DECEMBER, 1986 TO CALL ATTENTION TO THIS ITEM (REFERENCE INTEROFFICE MEMORANDUM 3693-87- 177) ITEM CLOSED C. EQUIPMENT EVALUATION 1. OFF-RATIO FOAM DETERMINATION/MEASUREMENT EVALUATE THE DETERMINATION OF IMPROPER SPRAY RATIOS THROUGH THE USE OF FLOW METERS, MANI- FOLDS, ETC. EVALUATE THE USAGE OF WARNING ALARMS; GO/NO-GO GAUGES, ETC. METHOD ACCURACY SHALL BE A FOCAL POINT. CLOSURE STATEMENT MEMOS 3572-87-123 AND 3614-87-192 SUMMARIZE THE RESULTS OF THE EVALUATION; WHICH CONCLUDED THAT THE ACCURACY OF THE EXISTING PISTON TYPE PROPORTIONERS COULD NOT BE GREATLY IMPROVED. A NEW TECHNICAL DIRECTIVE, ENTITLED "SOFI PROCESS IMPROVEMENTS" (TD-675), WILL BEGIN IN FY 88. IT WILL DEVELOP A LONG TERM EQUIPMENT UPGRADE PROGRAM FOR SOFI PROCESSES. ONE SPECIFIC ELEMENT OF THIS PROGRAM, CON- DUCTED AT MSFC, (RADIAL PUMPS AND FLOW METERS) DEMONSTRATED NOTABLY IMPROVED FOAM RATIO CONTROL (REF. IOM 3691-87-MJ-118). ITEM CLOSED 2. EVALUATION OF SPRAY GUN INITIAL INVESTIGATIONS INDICATE INDISCRIMINATE PROBLEMS WITH SPRAY GUN EQUIPMENT, SPRAY PATTERN ESTABLISHMENT, MIXING MODULE, CONTROL, ETC EVALUATE THE GUSMER MODEL GX7 FOAM APPLICATION GUN AGAINST THE EXISTING EQUIPMENT. PROVIDE A PROS VERSUS CONS LIST IN CONJUNCTION WITH EX- PECTED FAILURES, OPERATOR COMPREHENSION, AND FINISHED PRODUCT RESULTS CLOSURE STATEMENT A SPRAY GUN COMPARISON STUDY WAS CONDUCTED ON THE

GUSMER MODEL GX7 SPRAY UNIT VERSUS THE GUSMER AR (CURRENTLY UTILIZED) COMPARISON PARAMETERS WERE MATERIAL OUTPUT, MATERIAL QUALITY, PATTERN STABILITY, PRESSURE FLUCTUATION, MULTIPLE FIRING CAPABILITY, EASE OF OPERATION/MAINTENANCE, AND OPERATOR TRAINING REQUIREMENTS. PRELIMINARY DATA INDICATES THAT THE GX7 GUN HAS THE POTENTIAL TO OUTPERFORM THE PRESENT 1:1 RATIO SPRAY GUNS USED IN PRODUCTION FOR OVERALL RELIABILITY IN MEETING PRODUCTION NEEDS AND THE END ITEM (SOFI) ENGINEERING SPECIFICATIONS (REFERENCE TPS MATE- RIALS JOB #2645 AND TEST RESULTS) A MORE DETAILED EVALUATION OF A UNIVERSAL SPRAY GUN SYSTEM WILL BE ADDRESSED AS A TASK, HEREIN (REF. SECT. F., ITEM #2). ITEM CLOSED 3 PERIODIC MAINTENANCE EVALUATE PRESENT SYSTEM OF EQUIPMENT OVERHAUL AND PERIODIC MAINTENANCE. DEVELOP A REALISTIC PREVENTIVE MAINTENANCE PLAN WHICH WILL ENCOMPASS: A. REDUCTION OF EQUIPMENT MAINTENANCE FROM ANNUALLY TO QUARTERLY, SEMI-ANNUALLY, OR TRI- ANNUALLY. B. MAINTENANCE OF BACKUP SYSTEMS C. IMPLEMENTATION PLAN CLOSURE STATEMENT REVIEW OF THE EXISTING PERIODIC MAINTENANCE SCHEDULE RESULTED IN A CHANGE FROM AN ANNUAL/VISUAL CHECK TO A QUARTERLY SPECIFIC FUNCTION INSPECTION (REF MEMOS 3614-87-287 AND 3614-87-288). ITEM CLOSED D. FOAM OPERATOR SKILLS CORRECTIVE ACTION SEVERAL PRODUCTION FOAM OPERATORS FAILED TO ACHIEVE AN ACCEPTABLE GRADE AS A RESULT OF A FOAM OPERATOR TRAINING COURSE GIVEN AT MAF. PRODUCTION OPERATIONS MANAGEMENT HAS COMMITTED TO ADDITIONAL TRAINING FOR THESE INDIVIDUALS. AT THE COMPLETION OF THIS ADDITIONAL INSTRUCTION, THE INDIVIDUALS WILL BE RE-EXAMINED. CLOSURE STATEMENT PRODUCTION FOAM OPERATORS WERE TRAINED, RE-EXAMINED BY GUSMER CORPORATION AND ACHIEVED ACCEPTABLE GRADES. ALL OPERATORS HAVE NOW ACHIEVED ACCEPTABLES SCORES (REFERENCE GUSMER CORPORATION 0023 DENCE TO B. JOHNSON, DATED JULY 21, 1987). ITEM CLOSED E. FACILITY - EQUIPMENT/SURPLUS/INVENTORY THIS TASK SHALL EVALUATE THE FOAM EQUIPMENT STORAGE AND REPAIR AREA, EQUIPMENT SURPLUS, AND THE INVENTORY OF ALL EQUIPMENT AND SPARE PARTS. 1. IDENTIFY (AND PLAN) STORAGE SPACE FOR FOAM EQUIPMENT AND SPARE PARTS. MAINTAIN ADEQUATE SEPARATION BETWEEN USED AND NEW MATERIALS (I.E., SOLUTION/SOLVENT CLEANING AREAS FOR SPRAY GUNS/PARTS - STORAGE OF SYSTEM READY EQUIPMENT - STORAGE OF SURPLUS). CLOSURE STATEMENT A STUDY WAS MADE FOR THE FOAM EQUIPMENT STORAGE AND REPAIR AREAS. BASED ON THIS STUDY, RFF NO. C09-0093 WAS SUBMITTED TO PURCHASE AND INSTALL THE DECKING, SHELVING, LIGHTS, ETC.; THAT WERE IDENTIFIED AS NECESSARY TO CORRECT AND IMPROVE THE PRESENT OPERATION (REF. MEMO 3100-87-1486). ITEM CLOSED 2. COMPUTER/MECHANIZED SYSTEM FOR INVENTORY CONTROL CLOSURE STATEMENT AN IBM-PC COMPUTER HAS BEEN PROCURED (ON-LINE 9/1/87) FOR THE COMPILATION OF INVENTORY PERSONNEL SHALL BE TRAINED AND THE SOFTWARE REQUIREMENTS IDENTIFIED (INVENTORY INPUT/ ASSESSEMENT SPECIFICATIONS). THIS SYSTEM WILL GIVE ADEQUATE EQUIPMENT AND SPARE PARTS CONTROL FOR THE FOAM PROPORTIONER/SPRAY GUN STORAGE AREA (REFERENCE INTEROFFICE MEMORANDUM 3652/EH/87-182 AND INFORMATION SYSTEMS SERVICE REQUEST CONTROL #53237, USER REFERENCE #IE-768). ITEM CLOSED F. UNIVERSAL SPRAY GUN EVALUATION PRELIMINARY TEST DATA (USING GUSMER GX7 SPRAY GUN) INDICATES THAT ONE SPRAY GUN MAY BE USED TO REPLACE ALL EXISTING UNITS. THIS TASK WILL DEVELOP A PLAN TO FURTHER EVALUATE/VERIFY THE INITIAL ENGINEERING DATA IT IS EXPECTED THAT A MORE RELIABLE, SINGLE SPRAY UNIT WILL GREATLY REDUCE FOAM FAILURES AND AUTOMATIC FOAM SPRAY ABORTIONS. 1 PROCUREMENT/EVALUATION OF SIMILAR GUNS. CLOSURE STATEMENT FEASIBILITY OF A UNIVERSAL SPRAY GUN WILL BE BASED ON THE GUSMER GX7 MODEL AS A PATHFINDER FOR THE PURPOSES OF THIS CAPS; SIMILAR UNITS MAY BE EVALUATED (OUTSIDE THE SCOPE OF THIS CAPS) SHOULD THE UNIVERSAL GUN CONCEPT BE DEEMED VIABLE. GUSMER CORPORATION HAS EXTENDED THE CON- SIGNMENT OF THE GX7 UNIT FOR 90 DAYS (REF. GUSMER CORPORATION CORRESPONDENCE TO R. WADSWORTH DATED 6/22/87). ITEM CLOSED 2. TEST PLAN FOR SPRAY GUN EVALUATION CLOSURE STATEMENT A TEST PLAN TO EVALUATE "UNIVERSAL" SPRAY GUN CANDIDATES, HAS BEEN APPROVED AND INITIATED (REF IOM 3691-87-DAC-025 AND ADVANCED MANUFACTURING TECHNOLOGY TEST PLAN 3691-87-DAC-002). IN ADDITION, A PRODUCTION OPERATIONS DIRECTIVE

(ET-3600-1968) WILL DIRECT THE EFFORT TO IMPROVE THE INCUMBENT SPRAY GUNS IN CONJUNCTION WITH THE AMT PARALLEL EFFORT. ITEM CLOSED TASK CLOSED TASK III CLEARANCE OF EFFECTIVITIES NO CONSTRAINTS - THIS IS A PRODUCTION CONCERN ONLY LWTS 30, 31, AND 32 WERE REPAIRED PER MARS T-76521, T-85078, AND T-85070, RESPECTIVELY. THE "BLISTER/SWOLLEN" FOAM ANOMALY IS VISUALLY DETECTABLE DURING THE INTERTANK FOAM APPLICATION PROCESSING. THIS DISCREPANCY HAS ALSO BEEN OBSERVED ON THE LWT-40 INTERTANK (REFERENCE MARS T-84749). TASK IV CAUSE/CORRECTIVE ACTION SUMMARY CAPS T-056 WAS INITIATED TO DETERMINE AN EFFECTIVE RECURRENCE CONTROL MODE TO PRECLUDE THE APPLICATION OF OFF-RATIO FOAM ON THE EXTERNAL TANK SUBSTRATES. FOLLOWING A FOAM PROCESS (AND ASSOCIATED EQUIPMENT) INVESTIGATION, CORRECTIVE ACTION/SYSTEM AMELIORATION WAS FOCUSED ON THE OPERATOR/TECHNICIAN SKILL LEVELS, FOAM PROCESS PROCEDURES, FOAM APPLICATION SUPPORT EQUIPMENT, AND THE CARE AND CONTROL OF FOAM EQUIPMENT. OPERATOR/TECHNICIAN SKILLS IN ORDER TO FACILITATE AN OVERALL FOAM PROCESSING AWARENESS, A FOAM APPLICATION COURSE WAS CON- DUCTED BY GUSMER CORPORATION AT THE MICHOUD ASSEMBLY FACILITY FOR THE PRODUCTION TPS TECHNICIANS AND SUPERVISION. THE COURSE CURRICULUM CONSISTED OF EQUIPMENT COMPONENT ANALYSIS, PRACTICAL APPLICATIONS AND TROUBLESHOOTING, BASIC FIELD KNOWLEDGE OF RELATED CHEMISTRY, AND PROPER SPRAY TECHNIQUES AND PROCEDURES. ALL OF THE PRODUCTION TPS TECHNICIANS (WHO COMPLETED THE COURSE RE- QUIREMENTS) WERE CERTIFIED BY THE GUSMER CORPORATION AND THE MANNED SPACE SYSTEMS' TRAINING DEPARTMENT. THE GUSMER CORPORATION CURRICULUM, WAS WITNESSED BY THE MANNED SPACE SYSTEMS' TRAINING DEPARTMENT; AND ADOPTED AS AN ANNUAL CERTIFICATION COURSE. FOAM PROCESS PROCEDURES THE APPLICABLE STP/PI FOAM DOCUMENTS WERE REVIEWED FOR PROCESS ADEQUACY. IT WAS DETERMINED THAT THE PROCEDURAL SYSTEM WAS SUFFICIENT TO CONTROL THE APPLICATION OF FOAM PRODUCTS TO THE EXTERNAL TANKS (AS SPECIFIED PER THE ENGINEERING AND QUALITY REQUIREMENTS). IN ADDITION, HOWEVER, A (WARNING) STATEMENT TO ADDRESS THE ADJUSTMENT OF VALVES DURING THE SPRAY APPLICATION WILL BE ADDED TO THE APPLICABLE PROCESS INSTRUCTIONS AT THE NEXT SCHEDULED UPDATE (IN THE INTERIM, A PRODUCTION TIP WAS INITIATED FOR DIRECTION). THE ADJUSTMENT OF THE PROPORTIONER VALVES, DURING THE AUTOMATIC SPRAY OPERATIONS, RESULTED IN AN OFF-RATIO CONDITION ON THE LWT-31 INTERTANK. FOAM APPLICATION SUPPORT EQUIPMENT AN EVALUATION OF THE EXISTING SOFI PROCESS EQUIPMENT CONCLUDED THAT THE PRESENT SYSTEM COULD NOT BE IMPROVED WITH "BAND-AID" TYPE RESOLUTIONS HOWEVER, THROUGH THE USE OF PAST FAILURES, AND PRESENT TECHNOLOGY, THE ENTIRE SYSTEM CAN BE ENHANCED TO PRODUCE, CONSISTENTLY, CONFORMING FOAM APPLICATIONS. CONSEQUENTLY, A TECHNICAL DIRECTIVE WAS INITIATED TO DEVELOP/DESIGN EQUIPMENT UPGRADES FOR THE SOFI PROCESSES. THE INTERIM IMPROVEMENTS WERE THE OPTIMIZATION OF THE SOFI SPRAY GUN SYSTEMS AND THE UPGRADE OF THE FOAM PROCESS EQUIPMENT MAINTENANCE AND CONTROL EQUIPMENT CARE AND CONTROL THE ON-SET OF "RATE-PRODUCTION" RESULTED IN ADDITIONAL FOAM EQUIPMENT (THE STOCKPILING OF FORMU- LATORS/PROPORTIONERS, SPRAY GUNS, SPARE PARTS, ETC. TO SUPPORT THE "RATE PRODUCTION" MATERIAL/ EQUIPMENT DEMAND) FOR THE MAF PRODUCTION SOFI EQUIPMENT AREA. A REDUCTION IN PRODUCTION ACTIVITY HOWEVER, CREATED A SURPLUS IN EQUIPMENT AND PARTS. TO PRECLUDE THE POSSIBILITY OF ANOMALIES RESULTING FROM HOUSEKEEPING (SURPLUS MATERIAL IN DISARRAY), A SYSTEM WAS INITIATED TO PROVIDE IN- VENTORY CONTROL, AND ARRANGE/TIDY THE EQUIPMENT STORAGE/REPAIR AREA. CONCLUSION THE APPLICATION OF OFF-RATIO FOAM ONTO AN EXTERNAL TANK SUBSTRATE CAN ONLY BE PRECLUDED BY EQUIPMENTDESIGN. ADVANCED MANUFACTURING TECHNOLOGY IS PRESENTLY WORKING A LONG TERM PLAN TO DEVISE SUCH A SYSTEM. IN THE INTERIM, SYSTEM AMEILORATION WILL BE AFFECTED THROUGH THE EDUCATION OF PRODUCTION WORKERS, MAINTAINING ADEQUATE CONTROL OF EQUIPMENT AND ASSOCIATED SYSTEM PROCEDURES, AND THE IM- PROVEMENT OF RELATED SOFI TOOLING (SPRAY GUNS). UNTIL A NEW SYSTEM (DESIGNED TO PRECLUDE THE APPLICATION OF OFF-RATIO FOAM ONTO THE TANK SUBSTRATES) IS BROUGHT ON-LINE, THE INTERIM CORRECTIVE ACTION SHOULD PRECLUDE THE APPLICATION

OF ANOMALOUS MATERIAL ONTO THE EXTERNAL TANK. TASK CLOSED
MSFC Response/Concurrence

ASSESSMENT ADDENDUM REPORT

MSFC Report# A10482	**IFA#** --	**Contractor RPT#** T-056	**JSC#** --	**KSC#** --	**EICN#** --
Asmnt Part# 80973018414	**Asmnt Part Name** BX-520 FOAM	**Asmnt Serial/Lot#** N/A			
HCRIT CD --	**FCRIT CD** 3	**CAUSE CD** MAP - MFG-ASY-INST	**FAIL MODE** MI - INSULATION		
Asmnt FMEA 5.6.1.2	**Asmnt FM** 2	**FMEA CSE** A	**FMEA SCSE** 1		
Asmnt FMEA --	**Asmnt FM** --	**FMEA CSE** --	**FMEA SCSE** --		
Asmnt FMEA --	**Asmnt FM** --	**FMEA CSE** --	**FMEA SCSE** --		
Correlated Part# --	**Correlated Part#** --	**Correlated Part#** --			
Associated LRU# --	**Associated LRU#** --	**Associated LRU#** --			
MAJOR DESIGN CHANGES					
APRV DATE --	**DESCRIPTION OF CHANGES** --				
ASSESSMENT TEXT					

WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A10499	**In-Flight Anomaly Number** --	**Contractor Report Number** E-104	**JSC#** --	**KSC#** --
Problem Title APS CIRCUIT ANALYZERS NOT PROPERLY CALIBRATED				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 3
HCRIT --	**Sys_Lvl** N	**Misc Codes** A B C D E F G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** ET COMPLETE	**PART#** 80901010000	**SER/LOT#** N/A	**MANUFACTURER** MMC
HARDWARE LRU	**NOMENCLATURE** N/A	**PART#** N/A	**SER/LOT#** N/A	**MANUFACTURER** N/A
HARDWARE NCA	**NOMENCLATURE** ET COMPLETE	**PART#** 80901010000	**SER/LOT#** N/A	**MANUFACTURER** MMC
Test/Operation M - MFG	**Prevailing Condtion** --	**F / U** UC	**Fail Mode** --	**Cause** MNP - MFG-ISP-INST
System ELECTRICAL	**Defect** --	**Material** --	**Work Contact** J. ADAMS	**Fail Date** 10/31/1986
Received at MSFC 01/13/1987	**Date Isolated** --	**FMEA Reference** 3.0	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location MAF		**Symptom** --		**Time Cycle** --
Effectivity Text LWTS 16, 20, 21, 22, 24/SUBS				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** --	**LVL 3 Close** --	**Remark / Action** --	
Investigation / Resolution Summary				
Last MSFC Update 04/29/1988	**CN RSLV SBMT** 09/08/1987	**Defer Date** --	**Add Date** --	**R/C Codes** 4 - TEST -- --
Assignee				
Design P. MULLER	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --
Approval				
Design P. MULLER	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --

PAC Assignee	PAC Review Complete	MSFC Closure Date	Status	F/A Completion
J.EL-IBRAHIM	JE	11/04/1987	C - CLOSED	--

Problem Type	SEV	Program Name	REVL	OPRINC
--	--	--	--	--

FUNC MOD	Software Effectivity	Software Fail CD	SUBTYPE	Software Closure CD
--	-- -- -- -- --	--	--	--

RES PERSON L2	Approval Signature L3
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Related Document Type	Related Document ID
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Related Document Title
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Related Document Type	Related Document ID
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Related Document Title
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Related Document Type	Related Document ID
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Related Document Title
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Contractor Status Summary

Reliability/Quality Assurance Concerns, Recommendations:

Problem Description

REF: DOCUMENT MMC MARS T-92176 THE APS CIRCUIT ANALYZERS HAVE NOT BEEN PROPERLY CALIBRATED FOR THE 2 MEGOHM ISOLATION RESISTANCE TESTS. THE CIRCUIT ANALYZER 2 MEGOHM FUNCTION IS USED ONLY FOR FINAL ACCEPTANCE TESTING OF THE AFT ET/ORBITER ATTACH STRUCTURE HEATERS IN MAF BUILDING 420. THE HEATERS ARE FOR GROUND USE ONLY AND ARE LISTED AS CRITICALITY 3 IN THE FMEA FOR ALL FAILURE MODES

Contractor Investigation/Resolution

R/C - TEST PROCEDURES HAVE BEEN REVISED TO PROVIDE THE PROPER ACCURACY DURING CONTINUITY TESTS OF THE BIPOD HEATER CIRCUITS BY MMC. 1/14/87 PROBLEM CAUSE - THE CIRCUIT ANALYZER CALIBRATION PROCEDURES WERE NOT UPDATED TO CHECK THE ISOLATION RESISTANCE FUNCTION AT 2 MEGOHMS WHEN THE VALUE WAS SPECIFIED FOR THE HEATERS BEGINNING WITH EFFECTIVITY LWT-1. 1/14/87 BACKGROUND INFORMATION - EFFECTIVE LWT-1, THE ISOLATION RESISTANCE VALUE FOR THE FIVE LOX AND LH2 FEEDLINE SUPPORT BRACKET HEATER CRICUITS WAS SPECIFIED AS 2 MEGOHMS AT 500 VDC IN TM04. DURING A REVIEW OF TWO RECENT IN-PROCESS HEATER CIRCUITS FAILURES, WHICH HAD RESULTED FROM WIRING DAMAGE, PERSONNEL FROM TEST OPERATIONS, DEPT 3613, MENTIONED THAT THE CIRCUIT ANALYZERS WERE NOT CURRENTLY CALIBRATED AT THE 2 MEGOHM VALUE. AS A RESULT, THE CIRCUIT ANALYZER BEING USED FOR THE ACCEPTANCE TESTS ON LWT-36 WAS IMMEDIATELY CHECKED AND FOUND TO BE DEFECTIVE AT 2 MEGOHMS ONLY. THE ANALYZER WAS REPAIRED AND CALIBRATED. LWT-36 WAS RETESTED PER MARS T-92176 AND FOUND TO BE ACCEPTABLE. THE DEFECTIVE CIRCUIT ANALYZER PART HAD BEEN INSTALLED PRIOR TO THE START OF TESTS ON LWT-36 AND HAD NOT BEEN USED ON ANY

OTHER ET. THE CIRCUIT ANALYZERS ARE CERTIFIED/CALIBRATED FOR USE AS A UNIT AND VARIOUS CIRCUIT BOARDS ARE SWAPPED OUT AND REWORKED FROM TIME TO TIME. THE TYPE OF BOARD WHICH WAS FOUND TO BE DEFECTIVE HAS BEEN REWORKED ON PREVIOUS OCCASIONS AND THE MAINTENANCE RECORDS ARE NOT WELL DETAILED AT THAT PART LEVEL. 7/31/87 - UPDATE TASK I PROBLEM INVESTIGATION A. QUALITY ENGINEERING, DEPARTMENT 3743, IS REVIEWING THE MANUFACTURERS SPECIFICATIONS OF THE TEST EQUIPMENT USED TO MEASURE TM04 PARAMETERS. THE GOAL IS TO ASSURE THAT THE TEST EQUIPMENT IS CAPABLE OF SUFFICIENT ACCURACY TO MEET THE REQUIREMENTS OF MMC-ET-RA03-C, CHAPTER 4, PARAGRAPH 8.3. RA03 STATES THAT THE TEST METHODS MUST BE TEN TIMES MORE ACCURATE THAN THE TOLERANCE OF THE PARAMETER BEING MEASURED CLOSURE STATEMENT ONLY ONE PROBLEM AREA WAS FOUND. DURING FINAL ACCEPTANCE OF THE ET/ORBITER BIPOD SWIVEL FITTING HEATERS, 311H01 AND 311H02, CONTINUITY MEASUREMENTS WERE BEING PERFORMED TO +/- 2% ACCURACY. THE TEST SHOULD HAVE BEEN PERFORMED TO +/- .75% ACCURACY (REFERENCE INTEROFFICE MEMORANDUM 3743- 87-067). TASK I.D. WAS OPENED TO IDENTIFY THE IMPACT. TASK CLOSED B. TEST OPERATIONS. DEPARTMENT 3613, IS REVIEWING THE CALIBRATION PROCEDURES OF ALL TEST EQUIP- MENT USED TO MEASURE TM04 PARAMETERS. THE GOAL IS TO ASSURE THAT THE TEST EQUIPMENT HAS PROVEN ACCURACY, TO THE MANUFACTURER'S SPECIFICATIONS, AT ALL VALUES USED IN TM04 REQUIRED TESTS. CLOSURE STATEMENT ALL TEST EQUIPMENT WAS FOUND TO BE PROPERLY CALIBRATED (REFERENCE INTEROFFICE MEMORANDUM 3613- 87-055). TASK CLOSED C. ELECTRICAL ENGINEERING, DEPARTMENT 3513, IS EVALUATING THE EFFECT OF THE CIRCUIT ANALYZERS NOT HAVING BEEN CALIBRATED AT 2 MEGOHM TO DETERMINE IF ANY RETESTING OF DELIVERED ETS WILL BE NECES- SARY. CLOSURE STATEMENT IT WAS DETERMINED THAT ALL AFFECTED ETS MUST BE RETESTED (REFERENCE INTEROFFICE MEMORANDUM 3513- 87-014). SEE TASK II.B FOR CORRECTIVE ACTION. TASK CLOSED D. RELIABILITY ASSURANCE, DEPARTMENT 3741, AND ELECTRICAL ENGINEERING, DEPARTMENT 3513, EVALUATED THE EFFECTS OF THE BIPOD HEATER CONTINUITY TESTS HAVING BEEN PERFORMED TO +/- 2% ACCURACY, IN- STEAD OF THE REQUIRED +/- .75%. THE NET EFFECT WAS TO INCREASE THE POSSIBLE ERROR FROM +/- .6 OHM TO +/- 1.6 OHM. A REVIEW OF THE OI ALL SYSTEMS TEST RESULTS FOR ALL ETS FOUND THAT ONLY LWT 22, 26, AND 27 HAD RESISTANCES THAT WERE AT THE LIMITS OF THE TEST VALUES. ALL OTHER ETS HAD RESISTANCE VALUES SUCH THAT THE WORST CAUSE ACCURACY IN THE TEST EQUIPMENT WOULD NOT CAUSE THE RESISTANCE VALUES TO BE UNACCEPTABLE LWTS 22, 26, AND 27 WERE DOCUMENTED ON MARS (REFERENCE INTEROFFICE MEMORANDUM 3741-87-100). SEE TASKS II.C AND II.D. TASK CLOSED TASK II CORRECTIVE ACTION A. TEST OPERATIONS, DEPARTMENT 3613, IS REVISING THE CALIBRATION PROCEDURES FOR ALL CIRCUIT ANALY- ZERS WHICH ARE USED TO TAKE TM04 DATA AT 2 MEGOHMS TO PROVIDE CALIBRATION AT THAT VALUE. THE WEEKLY CALIBRATION CHECKS, TEST PROCEDURE 13A150-AT, PCN 17, WAS REVISED LWTS-36/SUBSEQUENT. CLOSURE STATEMENT ALL AFFECTED TEST PROCEDURES HAVE BEEN REVISED (REFERENCE INTEROFFICE MEMORANDUM 3613-87-042). TASK CLOSED B. DC&R E-87-004 WAS ISSUED TO RETEST THE LOX AND LH2 FEEDLINE BRACKET HEATERS ON THOSE ETS WHICH HAVE BEEN TESTED BEFORE THE APS CIRCUIT ANALYZER CALIBRATION WAS CORRECTED BY TASK II.A TASK CLOSED. C. MARS WERE WRITTEN AGAINST THE THREE ETS WHICH HAD BIPOD HEATER RESISTANCES WHICH WERE SUSPECT. ITEM CLOSED LWT-22 - MARS T-96004 LWT-26 - MARS T-96005 LWT-27 - MARS T-96006 D. TEST OPERATIONS, DEPARTMENT 3613, IS REVISING ALL TEST PROCEDURES WHICH USE THE APS CIRCUIT ANA- LYZER TO TEST THE BIPOD HEATERS. THE REVISIONS WILL PROVIDE SUFFICIENT ACCURACY TO MEET THE RE- QUIREMENTS OF BOTH MMC-ET-RA03-C AND MMC-ET-TM04K-B. THE CHANGES TO THE ET ALL SYSTEMS TEST WILL BE EFFECTIVE WITH LWT-39. ITEM CLOSED. THE FOUR ACCEPTANCE TEST PROCEDURES USED FOR TM04 REQUIRED MEASUREMENTS OF THE BIPOD HEATER CIRCUITSCONTINUITY WERE REVISED TO PROVIDE SUFFICIENT ACCURACY. THE CHANGES ARE EFFECTIVE WITH LWT-39 FOR THE OI ALL SYSTEMS TEST. THE CHANGE LEVEL OF THE PROCEDURES ARE LISTED BELOW. 1. TP-6C104-AT, PCN 18, OI RESISTANCE AND ISOLATION TEST, CELL 1 2. TP-6C204-AT, PCN 32, OI RESISTANCE AND ISOLATION TEST, CELL 2 3. TP-6D101-AT, ALTERNATE 18, OI

ALL SYSTEMS TEST, CELL 1 4. TP-6D201-AT, PCN 35, OI ALL SYSTEMS TEST, CELL 2 TASK III CLEARANCE OF EFFECTIVITIES A. FEEDLINE BRACKET HEATER CIRCUITS: 1. LWTS 16, 20, 21, 22, 24, 25, 26, 27, 29, 31, 32, 33, AND 35: THERE ARE NO CONSTRAINTS. THE HEATER CIRCUITS ARE TO BE RETESTED IN ACCORDANCE WITH DC&R E-87-004. 2. LWTS 28, 30, AND 36/SUBSEQUENT: THERE ARE NO CONSTRAINTS. THE HEATER CIRCUITS WERE TESTED AFTER THE CORRECTION OF THE CALI- BRATION PROCEDURES FOR THE CIRCUIT ANALYZERS LWTS 28 AND 30 HAVE BEEN RETESTED AS PART OF THE CORRECTIVE ACTIONS FOR CAPS E-098. ITEM CLOSED B. BIPOD SWIVEL FITTING HEATER CIRCUITS: 1 LWTS 16, 20, 21, 24, 25, AND 28 THROUGH 38: THERE ARE NO CONSTRAINTS THE TEST RESULTS OBTAINED DURING THE OI ALL SYSTEMS TEST OF THE ET FINAL ACCEPTANCE TESTING SHOW THAT THE HEATER CIRCUITS ARE ACCEPTABLE THE RESISTANCE VALUES HAVE SUFFICIENT MARGIN FROM THE SPECIFICATION LIMITS THAT TEST EQUIPMENT ERROR COULD PASS DEFECTIVE HARDWARE. 2. LWTS 22, 26, AND 27: THERE ARE NO CONSTRAINTS. THE SUSPECT TEST RESULTS HAVE BEEN RESOLVED BY MARS T- 96004, T- 96005, AND T-96006 WHICH HAVE BEEN WRITTEN AGAINST THE LWT 22, 26, AND 27 RESPECTIVELY. 3. LWTS 39/SUBSEQUENT: THERE ARE NO CONSTRAINTS. THE ET FINAL ACCEPTANCE TESTS WILL BE REVISED TO PROVE THE RE- QUIRED ACCURACY. SEE TASK II.D. *TASK IV CAPS CLOSURE SUMMARY THE APS OMNITESTER CIRCUIT ANALYZER WAS NOT PROPERLY CALIBRATED AT THE ISOLATION RESISTANCE TEST VALUE OF 2 MEGOHMS. THE CALIBRATION PROCEDURES WERE REVISED AND A DC&R WAS ISSUED FOR ALL ETS WHICHWERE NOT TESTED WITH PROPERLY CALIBRATED EQUIPMENT. A REVIEW OF ALL TEST EQUIPMENT CAPABILITIES AND THE ASSOCIATED CALIBRATION PROCEDURES, WHICH TAKE TM04 DATA, WAS PERFORMED. A SINGLE PROBLEM WAS FOUND; THE BIPOD HEATER CIRCUITS WERE NOT CHECKED WITH PROPER ACCURACY DURING CONTINUITY TESTS. THE TEST PROCEDURES WERE REVISED TO PROVIDE THE PRO- PER ACCURACY. THE TEST DATA OF ALL DELIVERED ETS WAS REVIEWED AND THOSE WITH INSUFFICIENT MARGIN BETWEEN THE VALUES MEASURED AND THE REQUIREMENTS, TO ASSURE THAT THE HEATERS WERE ACCEPTABLE, WERE DOCUMENTED ON MARS. THIS PROBLEM IS SUBMITTED TO MSFC FOR CLOSURE REVIEW AND APPROVAL

MSFC Response/Concurrence

ASSESSMENT ADDENDUM REPORT

MSFC Report#	**IFA#**	**Contractor RPT#**	**JSC#**	**KSC#**	**EICN#**
A10499	--	E-104	--	--	--

Asmnt Part#	**Asmnt Part Name**	**Asmnt Serial/Lot#**
80901010000	ET COMPLETE	--

HCRIT CD	**FCRIT CD**	**CAUSE CD**	**FAIL MODE**
--	3	MNP - MFG-ISP-INST	--

Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
N/A	N/A	N/A	N/A
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
--	--	--	--
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
--	--	--	--

Correlated Part#	**Correlated Part#**	**Correlated Part#**
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Associated LRU#	**Associated LRU#**	**Associated LRU#**
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MAJOR DESIGN CHANGES

APRV DATE	DESCRIPTION OF CHANGES
--	--

ASSESSMENT TEXT

WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A10534	**In-Flight Anomaly Number** --	**Contractor Report Number** E-106-1	**JSC#** --	**KSC#** --
Problem Title LH2 ULLAGE PRESSURE TRANSDUCER FAILED RESISTANCE TEST				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 1R
HCRIT 1	**Sys_Lvl** N	**Misc Codes** A B C D E F G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** LH2 ULL PRES TRNSDCR	**PART#** PD740098-089	**SER/LOT#** 2096	**MANUFACTURER** GULTON
HARDWARE LRU	**NOMENCLATURE** N/A	**PART#** N/A	**SER/LOT#** N/A	**MANUFACTURER** N/A
HARDWARE NCA	**NOMENCLATURE** LH2 ULL PRES TRNSDCR	**PART#** PD7400098-089	**SER/LOT#** 2096	**MANUFACTURER** GULTON
Test/Operation A - ATP	**Prevailing Condtion** S - SHIPPING	**F / U** F	**Fail Mode** EV - NOT-TO-SPEC	**Cause** ES - EI-SHIP
System ELECTRICAL	**Defect** --	**Material** A - CIRC T	**Work Contact** J. ADAMS	**Fail Date** 09/04/1986
Received at MSFC 02/13/1987	**Date Isolated** --	**FMEA Reference** 3.4.1.2	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location GULTON		**Symptom** EN - OPEN		**Time Cycle** N/A
Effectivity Text LWTS 16, 20, 21, 22, 24/SUBS				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** --	**LVL 3 Close** --	**Remark / Action** --	
Investigation / Resolution Summary				
Last MSFC Update 02/13/1995	**CN RSLV SBMT** 09/16/1987	**Defer Date** --	**Add Date** --	**R/C Codes** 2 - MFG -- --
Assignee				
Design P. MULLER	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --

Approval				
Design P. MULLER	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --
PAC Assignee J.EL-IBRAHIM	**PAC Review Complete** JE	**MSFC Closure Date** 11/06/1987	**Status** C - CLOSED	**F/A Completion** --
Problem Type --	**SEV** --	**Program Name** --	**REVL** --	**OPRINC** --

FUNC MOD	Software Effectivity	Software Fail CD	SUBTYPE	Software Closure CD
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RES PERSON L2	Approval Signature L3
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Related Document Type	Related Document ID
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Related Document Title
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Related Document Type	Related Document ID
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Related Document Title
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Related Document Type	Related Document ID
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Related Document Title
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Contractor Status Summary

Reliability/Quality Assurance Concerns, Recommendations:

Problem Description

TRANSDUCER HAD A WIPER TO RESISTIVE ELEMENT CONTACT RESISTANCE OF 96 OHMS. THE MAXIMUM ALLOWABLE RESISTANCE IS 25 OHMS (REFERENCE MARS T-34352). REF. CAPS E-091, E-101, AND E-082

Contractor Investigation/Resolution

R/A - ADDITIONAL INSPECTION STEPS HAVE BEEN ADDED TO REDUCE THE FREQUENCY OF OCCURRENCE. LAUNCH CONSTRAINT - NONE, THE FAILURE OCCURRED DURING ACCEPTANCE TESTING AT THE VENDOR. ALL PRESSURE TRANSDUCERS ARE TESTED AGAIN WHEN INSTALLED IN AN ET. THIS STATEMENT WAS COORDINATED WITH ET PROJECT MANAGER G. P. BRIDWELL..... 02/12/87 - BACKGROUND INFORMATION- THE TRANSDUCER FAILED TO MEET REQUIREMENTS OF THE VENDOR ACCEPTANCE TEST PLAN. IT IS EXPECTED THAT A LIMITED NUMBER OF TRANSDUCERS WILL FAIL THE WIPER-TO-ELEMENCONTACT RESISTANCE SPECIFICATION DUE TO THE SENSITIVITY OF THE UNITS TO DUST AND CONTAMINATION IN THE MANUFACTURING ENVIRONMENT. IT IS ALSO EXPECTED THAT SOME TRANSDUCERS WILL HAVE AN UNACCEPTABLE OUTPUT VOLTAGE VERSUS PRESSURE DUE TO THE STRINGENT REQUIREMENT OF MAXIMUM ALLOWABLE ERROR OF +/- 1% IN THE FLIGHT OPERATING BAND. FAILURE ANALYSIS AND TESTING ECP IS 4/30/87. 9/17/87 CLOSURE UPDATE (REFERENCE MMC CAPS E-106B): TASK I FAILURE INVESTIGATION FAILURE ANALYSIS THE ANALYSIS WAS PERFORMED BY THE VENDOR AT THE DIRECTION OF MMC RELIABILITY ASSURANCE. REFERENCE

MARS T-34352. CLOSURE STATEMENT THE PROBABLE CAUSE OF FAILURE WAS CONTAMINATION OF THE TRANSDUCER INTERNAL MECHANISM. TASK II CORRECTIVE ACTION NO CORRECTIVE ACTION IS REQUIRED. THIS FAILURE IS CONSIDERED NORMAL PRODUCTION FALLOUT. THE VENDOR'S WORKER TRAINING AND MANUFACTURING PLANS ALREADY ADDRESS THE CAUSES OF THESE FAILURES HOWEVER, OCCASIONAL FAILURES ARE EXPECTED DUE TO THE NATURE OF THE TRANSDUCER DESIGN AND THE LIMITATIONS OF THE VENDOR'S FACILITIES CORRECTIVE ACTIONS, PREVIOUSLY DEVELOPED AS PART OF CAPS E-082, ARE EXPECTED TO REDUCE THE NUMBER OF CONTAMINATION CAUSED FAILURES. TASK III CLEARANCE OF EFFECTIVITIES THERE ARE NO CONSTRAINTS. THE FAILURE WAS DETECTED DURING VENDOR ACCEPTANCE TESTING. FAILURES FROM THIS CAUSE ARE CONSIDERED NORMAL PRODUCTION FALLOUT. TASK IV CAPS CLOSURE SUMMARY THE TRANSDUCER FAILED DURING VENDOR ACCEPTANCE TESTS. FAILURE ANALYSIS FOUND THE PROBABLE CAUSE TO BE OF A TYPE CONSIDERED TO BE NORMAL PRODUCTION FALLOUT. NO CORRECTIVE ACTIONS ARE REQUIRED. CORRECTIVE ACTIONS, PREVIOUSLY DEVELOPED AS PART OF CAPS E-082, ARE EXPECTED TO REDUCE THE NUMBER OF CONTAMINATION CAUSED FAILURES

MSFC Response/Concurrence

ASSESSMENT ADDENDUM REPORT

MSFC Report#	**IFA#**	**Contractor RPT#**	**JSC#**	**KSC#**	**EICN#**
A10534	--	E-106-1	--	--	--

Asmnt Part#	**Asmnt Part Name**	**Asmnt Serial/Lot#**
PD7400098-089	LH2 ULL PRES TRNSDCR	2096

HCRIT CD	**FCRIT CD**	**CAUSE CD**	**FAIL MODE**
--	1R	ES - EI-SHIP	EN - OPEN
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
3.4.1.2	2	G	1
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
--	--	--	--
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
--	--	--	--

Correlated Part#	**Correlated Part#**	**Correlated Part#**
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Associated LRU#	**Associated LRU#**	**Associated LRU#**
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MAJOR DESIGN CHANGES

APRV DATE	**DESCRIPTION OF CHANGES**
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ASSESSMENT TEXT

WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A10538	**In-Flight Anomaly Number** --	**Contractor Report Number** E-106-2	**JSC#** --	**KSC#** --
Problem Title LH2 ULLAGE PRESSURE TRANSDUCER FAILED OUTPUT TEST				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 1R
HCRIT 1	**Sys_Lvl** N	**Misc Codes** A B C D E F G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** LH2 ULL PRES TRNSDCR	**PART#** PD74000998-079	**SER/LOT#** 1549	**MANUFACTURER** GULTON
HARDWARE LRU	**NOMENCLATURE** N/A	**PART#** N/A	**SER/LOT#** N/A	**MANUFACTURER** N/A
HARDWARE NCA	**NOMENCLATURE** LH2 ULL PRES TRANSDC	**PART#** PD7400098-079	**SER/LOT#** 1549	**MANUFACTURER** GULTON
Test/Operation A - ATP	**Prevailing Condtion** S - SHIPPING	**F / U** F	**Fail Mode** EV - NOT-TO-SPEC	**Cause** ES - EI-SHIP
System ELECTRICAL	**Defect** --	**Material** C - EEE	**Work Contact** J. ADAMS	**Fail Date** 12/09/1986
Received at MSFC 02/13/1987	**Date Isolated** --	**FMEA Reference** 3.4.1.2	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location GULTON		**Symptom** EG - SIG HI OR LO		**Time Cycle** --
Effectivity Text LWTS 16, 20, 21, 22, 24/SUBS				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** --	**LVL 3 Close** --	**Remark / Action** --	
Investigation / Resolution Summary				
Last MSFC Update 02/13/1995	**CN RSLV SBMT** 09/16/1987	**Defer Date** --	**Add Date** --	**R/C Codes** 2 - MFG -- --
Assignee				
Design P. MULLER	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --

Approval				
Design P. MULLER	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --
PAC Assignee J.EL-IBRAHIM	**PAC Review Complete** JE	**MSFC Closure Date** 11/06/1987	**Status** C - CLOSED	**F/A Completion** --
Problem Type --	**SEV** --	**Program Name** --	**REVL** --	**OPRINC** --

FUNC MOD	Software Effectivity	Software Fail CD	SUBTYPE	Software Closure CD
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RES PERSON L2	Approval Signature L3
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Related Document Type	Related Document ID
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Related Document Title
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Related Document Type	Related Document ID
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Related Document Title
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Related Document Type	Related Document ID
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Related Document Title
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Contractor Status Summary

Reliability/Quality Assurance Concerns, Recommendations:

Problem Description

TRANSDUCER HAD AN OUTPUT VOLTAGE VERSUS PRESSURE ERROR OF 71 MILLIVOLTS (LOW) AT 22 PSID. THE MAXIMUM ALLOWABLE ERROR IS 50 MILLIVOLTS. REF CAPS E-091, E-101 AND E-082

Contractor Investigation/Resolution

R/A - ADDITIONAL INSPECTION STEPS HAVE BEEN ADDED TO REDUCE THE FREQUENCY OF OCCURRENCE. LAUNCH CONSTRAINT - NONE, THE FAILURE OCCURED DURING ACCEPTANCE TESTING AT THE VENDOR. ALL PRESSURETRANSDUCERS ARE TESTED AGAIN WHEN INSTALLED IN AN ET. THIS STATEMENT WAS COORDINATED WITH ET PROJECT MANAGER G. P. BRIDWELL..... 02-12-87 - BACKGROUND INFORMATION - THE TRANSDUCER FAILED TO MEET REQUIREMENTS OF THE VENDOR ACCEP- TANCE TEST PLAN. IT IS EXPECTED THAT SOME TRANSDUCERS WILL HAVE AN UNACCEPTABLE OUTPUT VOLTAGE VERSUS PRESSURE DUE TO THE STRINGENT REQUIREMENT OF A MAXIMUM ALLOWABLE ERROR OF +/- 1% IN THE FLIGHT PRESSURE OPERATING BAND. FAILURE ANALYSIS AND TESTING ECD IS 4/30/87 5/28/87 - STATUS UPDATE - NO CHANGE. FAILURE ANALYSIS ECD 6/12/87 9/17/87 CLOSURE UPDATE (REF. MMC CAPS E-106B): TASK I FAILURE ANALYSIS T-35914 ANALYSIS WAS PERFORMED BY THE VENDOR AT THE DIRECTION OF MMC RELIABILITY ASSURANCE. CLOSURE STATEMENT THE PROBABLE CAUSE WAS INADVERTENT DROPPING/MISHANDLING OF THE TRANSDUCER BY VENDOR PERSONNEL TASK II CORRECTIVE ACTION NO CORRECTIVE ACTION IS REQUIRED. THIS

FAILURE IS CONSIDERED NORMAL PRODUCTION FALLOUT. THE VENDOR'S WORKER TRAINING AND MANUFACTURING PLANS ALREADY ADDRESS THE CAUSES OF THESE FAILURES. HOWEVER, OCCASIONAL FAILURES ARE EXPECTED DUE TO THE NATURE OF THE TRANSDUCER DESIGN AND THE LIMITATIONS OF THE VENDOR'S FACILITIES. CORRECTIVE ACTIONS, PREVIOUSLY DEVELOPED AS PART OF CAPS E-082, ARE EXPECTED TO REDUCE THE NUMBER OF CONTAMINATION CAUSED FAILURES. TASK CLOSED TASK III CLEARANCE OF EFFECTIVITIES THERE ARE NO CONSTRAINTS. THE FAILURES WERE DETECTED DURING VENDOR ACCEPTANCE TESTING. FAILURES FROM THESE CAUSES ARE CONSIDERED NORMAL PRODUCTION FALLOUT. TASK CLOSED TASK IV CAPS CLOSURE SUMMARY THE TRANSDUCER FAILED DURING VENDOR ACCEPTANCE TESTS. FAILURE ANALYSIS FOUND THE PROBABLE CAUSE TO BE OF A TYPE CONSIDERED TO BE NORMAL PRODUCTION FALLOUT. NO CORRECTIVE ACTIONS ARE REQUIRED. CORRECTIVE ACTIONS, PREVIOUSLY DEVELOPED AS PART OF CAPS E-082, ARE EXPECTED TO REDUCE THE NUMBER OF CONTAMINATION CAUSED FAILURES. THIS PROBLEM IS SUBMITTED TO MSFC FOR CLOSURE REVIEW AND APPROVAL

MSFC Response/Concurrence

ASSESSMENT ADDENDUM REPORT

MSFC Report#	**IFA#**	**Contractor RPT#**	**JSC#**	**KSC#**	**EICN#**
A10538	--	E-106-2	--	--	--

Asmnt Part#	**Asmnt Part Name**	**Asmnt Serial/Lot#**
PD7400098-079	LH2 ULL PRES TRNSDCR	1549

HCRIT CD	**FCRIT CD**	**CAUSE CD**	**FAIL MODE**
--	1R	ES - EI-SHIP	EG - SIG HI OR LO
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
3.4.1.2	2	G	1
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
--	--	--	--
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
--	--	--	--

Correlated Part#	**Correlated Part#**	**Correlated Part#**
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Associated LRU#	**Associated LRU#**	**Associated LRU#**
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MAJOR DESIGN CHANGES

APRV DATE	**DESCRIPTION OF CHANGES**
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ASSESSMENT TEXT

WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A10582	**In-Flight Anomaly Number** --	**Contractor Report Number** P-058-1	**JSC#** --	**KSC#** --
Problem Title PYRO TUMBLE VALVE CONTAMINATION ON LWT-39				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 1
HCRIT --	**Sys_Lvl** N	**Misc Codes** A B C D E F G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** ET	**PART#** 82601000000	**SER/LOT#** NOTED	**MANUFACTURER** MMC
HARDWARE LRU	**NOMENCLATURE** N/A	**PART#** N/A	**SER/LOT#** N/A	**MANUFACTURER** N/A
HARDWARE NCA	**NOMENCLATURE** PYRO VALVE	**PART#** PD7400193-020	**SER/LOT#** 421	**MANUFACTURER** PYRONETICS
Test/Operation M - MFG	**Prevailing Condtion** --	**F / U** F	**Fail Mode** ME - RANDOM	**Cause** MN - MFG-ISP
System PROPULSION	**Defect** CN - CONTAM	**Material** N - HOLE	**Work Contact** C. CAMPBELL	**Fail Date** 02/04/1987
Received at MSFC 03/09/1987	**Date Isolated** --	**FMEA Reference** 2.7.1	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location MAF		**Symptom** UC - UNSAT		**Time Cycle** --
Effectivity Text LWTS 16, 20, 21, 22, 24/SUBS				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** --	**LVL 3 Close** --	**Remark / Action** --	
Investigation / Resolution Summary				
Last MSFC Update 11/04/1991	**CN RSLV SBMT** --	**Defer Date** --	**Add Date** --	**R/C Codes** 2 - MFG -- --
Assignee				
Design P. MULLER	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --
Approval				
Design	**Chief Engineer**	**S & MA**	**Project**	**Project MGR**

P. MULLER	J. NICHOLS	R. JACKSON	M. PESSIN	--
PAC Assignee J.EL-IBRAHIM	**PAC Review Complete** JE	**MSFC Closure Date** 09/24/1987	**Status** C - CLOSED	**F/A Completion** --
Problem Type --	**SEV** --	**Program Name** --	**REVL** --	**OPRINC** --
FUNC MOD --	**Software Effectivity** -- -- -- -- --	**Software Fail CD** --	**SUBTYPE** --	**Software Closure CD** --
RES PERSON L2 --	**Approval Signature L3** --			
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Contractor Status Summary				
Reliability/Quality Assurance Concerns, Recommendations:				

Problem Description

DURING INSTALLATION OF A TUMBLE VALVE ON LWT-39, A REDDISH CONTAMINATION WAS MARGINALLY VISIBLE IN THE FLANGE FACE LEAK PORT OPENING. AN ATTEMPT WAS MADE TO PRESSURIZE THE PORT AND REMOVE THE CONTAMINATION FOR ANALYSIS. A PRESSURE OF 43 PSI WAS APPLIED WITHOUT SUCCESS. THE SUBSTANCE BLOCKED ALL GAS FLOW. LWT AFFECTED ARE 16, 20, 21, 22, 24, AND UP

Contractor Investigation/Resolution

R/C MMC HAS DEVELOPED A TOOL TO INSPECT ALL PROPELLENT FLANGE INSTALLATION PLANS TO INSPECT ALL LEAKPORTS IMMEDIATELY PRIOR TO ASSEMBLY. LEAK PORT VERIFICATION IS ALSO REQUIRED AT ALL VENDORS. THE CONTAMINATION MATERIAL WAS IDENTIFIED AS A POLYMER COMPOUND USED BY THE VENDOR TO MASK POR- TIONS OF THE FLANGE DURING CADMIUM PLATING. THE COMPOUND IS MANUFACTURED AND MARKETED UNDER THE TRADE NAME MICRO SHIELD STOP-OFF LACQUER. A SAMPLE OF THE RED MATERIAL FOUND ON VALVE S/N 421, WAS SUBMITTED TO THE LAB AND WAS CONFIRMED TO BE STOP-OFF LACQUER (REF LAB REPORT #87A39) DC&R WAS ISSUED TO INPECT 13 VALVES IN INVENTORY STORES. ONE VALVE, S/N 428, WAS FOUND TO HAVE THE LEAK PORT BLOCKED WITH THE MASKING MATERIAL. THIS WAS DETERMINED BY TRYING TO PASS FREON THROUGH THE LEAK PORT AND BY PRESSURIZING THE PORT WITH HELIUM TO 6 PSI. BASED UPON INITIAL INVESTIGATIONS, MAF HAS IMPLEMENTED AN INSPECTION STEP AT ALL SEAL INSTALLATIONS TO VERIFY LEAK PORT OPERATION IMMEDIATELY PRIOR TO FLANGE ASSEMBLY, AND TO INSPECT TUMBLE VALVES ON LWTS 16, 20, 21, 22, 24 THRU 36, AND 38. 3/26/87 PRB STATUS - TUMBLE

VALVE ON LWT-39 WAS FOUND TO BE BLOCKED DUE TO CONTAMINATION IN THE FLANGE FACE LEAK PORT OPENING. LWT AFFECTED ARE 16, 20, 21, 22, 24 AND UP. AS A FAILURE/PROBLEM INVESTIGATION MAF IS (1) TO VERIFY LEAK PORTS ARE OPEN AND FUNCTIONAL WITHOUT DISASSEMBLY, (2) TO CONDUCT A MARS HISTORY REVIEW TO DETERMINE IF THERE HAVE BEEN INSTANCES OF LEAK PORT BLOCKAGE ON ANY HARDWARE HAVING LEAK PORTS, (3) TO IDENTIFY ALL ET PART NUMBERS WHICH CONTAIN LEAK PORTS AND (4) TO EVALUATE DESIGN TO DETERMINE IF ANY OTHER CHARACTERISTICS OF FLANGE CONFIGURATION COULD MASK SEAL LEAKAGE. ECD 4/17/87. MAF WILL ISSUE A PRELIMINARY ALERT AND IT WILL BE COORDINATED WITH MSFC. 4/28/87 STATUS UPDATE (REF. MMC CAPS OPEN ITEMS SUMMARY DATED 4/21/87) - ET CLEARANCES: - LWTS 16, 20, 22, 24 THROUGH 32 WERE NOT PROCESSED IN A MANNER TO CREATE BLOCKAGE. - LWTS 33 THROUGH 36 ARE PENDING DC&R P-87-003 INSPECTIONS. - LWT-37 PYRO VALVE (S/N 418) WAS INSPECTED BY SUSPECT MARS T-93195 AND REPLACED WITH A GOOD VALVE. - LWTS 38 AND 39 VALVES WERE INSPECTED BY SUSPECT MARS AND REPLACED WITH GOOD VALVES. - LWT-40 AND SUBSEQUENT WILL RECEIVE VALVES ACCEPTED BY DC&R INSPECTIONS OR MPP INSPECTIONS. ESTIMATED COMPLETION DATE IS 05/8/87. 5/28/87 - PRB STATUS - NO CHANGE. ECD 6/8/87 8/25/87 CLOSURE UPDATE - REF CAPS P-058B GENERAL: A. THE FOLLOWING TASKS WILL DETERMINE CAUSE FOR LEAK PORT BLOCKAGE AND ADDRESS THE ACTIONS REQUIRED TO ELIMINATE THE CONDITION FROM FUTURE VALVE DELIVERIES. B. CLEARANCE OF PREVIOUSLY INSTALLED VALVES, WHICH MAY HAVE LEAK PORT BLOCKAGE, WILL BE ADDRESSED BY THIS CAPS. TASK I FAILURE/PROBLEM INVESTIGATION VALVE, S/N 421, WAS EXAMINED BY RELIABILITY ASSURANCE TO DETERMINE THE NATURE OF THE CONTAMINATION. THE MATERIAL WAS A RED SEMI-TRANSPARENT SUBSTANCE WHICH HAD THE APPEARANCE OF HAVING AT ONE TIME BEEN IN A LIQUID STATE. THE CONTAMINATION WAS IDENTIFIED AS A POLYMER COMPOUND USED BY THE VENDOR TO MASK PORTIONS OF THE FLANGE DURING CADMIUM PLATING. THE COMPOUND IS MANUFACTURED AND MARKETED UNDER THE TRADE NAME MICRO SHIELD STOP-OFF LACQUER. A SAMPLE OF THE RED MATERIAL FOUND ON VALVE S/N421, WAS SUBMITTED TO THE LAB AND WAS CONFIRMED TO BE STOP-OFF LACQUER (REFERENCE LAB REPORT #87A039 DC&R P-87-001 WAS ISSUED TO INSPECT 13 VALVES IN INVENTORY STORES. ONE VALVE, S/N 428, WAS FOUND TO HAVE THE LEAK PORT BLOCKED WITH THE MASKING MATERIAL. THIS WAS DETERMINED BY TRYING TO PASS FREON THROUGH THE LEAK PORT AND BY PRESSURIZING THE PORT WITH HELIUM TO 6 PSI. A SUSPECT MARS WAS WRITTEN ON LWT-37 AND THE TUMBLE VALVE (S/N 418) WAS REMOVED. THE LEAK PORT WAS BLOCKED WITH THE MASKING MATERIAL. THE FOLLOWING ACTIONS SHALL BE ACCOMPLISHED: A. PROCUREMENT QUALITY REPORTS NO FINAL ASSEMBLY LEVEL VERIFICATION OF LEAK PORT CLEARANCE FROM ANY VENDORS (REFERENCE INTEROFFICE MEMORANDUM 3761-87-033). ALL COMPONENTS NOT CLEANED AT MAF WHICH DO NOT HAVE VENDOR VERIFICATION FOR UNOBSTRUCTED LEAK PORTS ARE SUSPECT. COMPONENTS ARE AS FOLLOWS: O TUMBLE VALVE O DIFFUSER PLATE O LH2 FEEDLINE O HELIUM INJECT PLATE O LH2 RECIRCULATION LINE O ECO SENSOR BOSS O L02 FEEDLINES (STAINLESS) O GUCP VENT DISCONNECT B. TWO INSTANCES OF LEAK PORT BLOCKAGE WERE FOUND BY THE REVIEW. THESE CONSISTED OF TWO L02 FEED- LINE ELBOWS FROM DIFFERENT VENDORS. ONE BLOCKAGE WAS THE RESULT OF INCOMPLETE DRILLING AND WAS FOUND BY MMMA CLEAN ROOM PERSONNEL. THE SECOND FEEDLINE WAS PROCESSED BY AN OUTSIDE CLEANING VENDOR AND WAS BLOCKED WITH AN UNDETERMINED CONTAMINATION. THE CONTAMINATION WAS FOUND BY MMMA FINAL ASSEMBLY INSPECTION PERSONNEL (REFERENCE MARS T-64177 AND T-78663). C QUALITY ENGINEERING REPORTS THAT THERE ARE NO VERIFICATION POINTS AT MMMA TO ASSURE LEAK PORTS ARE OPEN. HOWEVER, CLEAN ROOM PERSONNEL REVEALED THAT IT IS STANDARD PRACTICE TO PASS .020 SAFETY WIRE AND FLUSH PORTS PRIOR TO FINAL CLEANING. THE PERSONNEL INDICATE THAT THIS IS A RESULT OF THE SIGNIFICANT NUMBER OF PARTS RECEIVED FOR CLEANING WITH LEAK PORT BLOCKAGE (RE- FERENCE INTEROFFICE MEMORANDUM 3741-87-062). D. THIS ACTION HAS BEEN COMPLETED BY ENGINEERING AND THE DATA PROVIDED TO RELIABILITY ASSURANCE. E. TOOLING HAS BEEN FABRICATED AND APPROVED FOR ET USAGE (REFERENCE T90Z0055). F. ENGINEERING EVALUATE DESIGN TO DETERMINE IF ANY OTHER CHARACTERISTICS OF FLANGE

CONFIGURATION COULD MASK SEAL LEAKAGE. CLOSURE STATEMENT: EVALUATIONS ARE COMPLETE (REFERENCE ENGINEERING TEST MMMA 3514-87-168). G. DC&R P-87-004 AND P-87-005 WERE ISSUED TO INSPECT STOCK HARDWARE. COMPONENTS FOUND WITH ELEVATED MEDIANS WERE TESTED UNDER TASK I.I ANS WERE CONFINED TO THOSE SUPPLIED BY ARROWHEAD PRODUCTS. FOUR LEAK PORTS WERE FOUND BLOCKED. ONE LEAK PORT WAS BLOCKED ON AN ARROWHEAD PRO- DUCTS FEEDLINE. THE REMAINING THREE BLOCKED PORTS WERE ON LH2 DIFFUSER MOUNTING PLATES MANU- FACTURED BY HAR-MAC. THE MATERIAL WHICH WAS BLOCKING THE LEAK PORTS WAS IDENTIFIED AS A SILICON COMPOUND (REFERENCE LAB REPORTS 87G069 AND 87G037). H. PROPELLANT FLANGES ON MPTA WERE AVAILABLE FOR INSPECTION. MEDIAN ELEVATION AND LEAK PORT BLOCKAGE WERE INVESTIGATED ON TEST PREPARATION SHEET E0009-514. NO ELEVATED MEDIANS WERE FOUND, HOWEVER, ONE SARGENT AIRITE FEEDLINE WAS FOUND TO BE BLOCKED WITH THE REMNANTS OF A .030" DRILL BIT. THE BIT HAD APPARENTLY BEEN BROKEN OFF DURING THE INITIAL MACHINING PROCESS AND WAS NOT DETECTED (REFERENCE MARS T-82645). TASK I TESTS WERE CONDUCTED ON SELECTED HARDWARE OBTAINED UNDER TASK I.G. THESE COMPONENTS DISPLAYED LEAK PORT MEDIANS WHICH WERE ELEVATED .001" TO .006" ABOVE THE PLANE ESTABLISHED BY THE BOLT FLANGE FACE.TESTING WITH A BLANKOFF PLATE WAS PERFORMED WITHOUT SEALS INSTALLED AND WITH DAMAGED SEALS INSTALLED THIS WAS DONE TO DETERMINE THE AMOUNT OF GAS FLOW AVAILABLE PAST THE MEDIAN AND DEMON- STRATE THE ABILITY TO DETECT SEAL LEAKAGE (REFERENCE MARS T-94983 AND T-86695). CONCLUSIONS ARE THAT THE TEST GASES ARE RESTRICTED OR BLOCKED BY THE FLANGE MEDIAN BELOW EXISTING TM04 LEAKAGE RE- QUIREMENTS. THIS HAS THE EFFECT OF CONCEALING UNACCEPTABLE LEAKAGE/DAMAGE OF THE PRIMARY SEAL DURING ATP TESTING. ADDITIONAL RESTRICTIONS ARE APPARENTLY INTRODUCED BY THE SEAL BODY. THERE SHOULD HAVE BEEN NO ADDITIONAL RESTRICTION AS THE SEAL'S PRIMARY LIP HAD BEEN DAMAGED TO ALLOW UN- LIMITED FLOW. EXAMINATION OF A FLANGE JOINT CROSS SECTION REVEALED THAT THE TEST GASES MAY FACE FLOW RESTRICTION/BLOCKAGE AT 3 LOCATIONS BEFORE REACHING THE PRIMARY SEALING LIP. ENGINEERING IS CONTINUING TESTS ON SPECIALLY FABRICATED FLANGES (REFERENCE TASK I.F) TASK II CORRECTION ACTION A. BASED UPON INITIAL INVESTIGATIONS, WHICH INDICATE THE POTENTIAL EXISTS FOR UNDETECTED LEAK PORT BLOCKAGE, QUALITY ENGINEERING AND MANUFACTURING PLANNING HAVE IMPLEMENTED AN INSPECTION STEP AT ALL SEAL INSTALLATIONS TO VERIFY LEAK PORT OPERATION IMMEDIATELY PRIOR TO FLANGE ASSEMBLY. B. SCADS HAVE BEEN ISSUED TO ALL VENDORS WITH LEAK PORT BLOCKAGE. A SCAD WAS NOT ISSUED TO HAR MAC AS THIS SUPPLIER IS NO LONGER IN BUSINESS (REFERENCE SCADS 3761-87-037, -068, AND -112). C. RELIABILITY ASSURANCE HAS ISSUED DC&R P-87-007 TO INSPECT SUSPECT LEAK PORTS ON LWTS 39 THROUGH 42. D. AN ALERT HAS BEEN PREPARED AND FORWARDED TO MSFC FOR EVALUATION RELATIVE TO DISTRIBUTION TO THE GIDEP SYSTEM (REFERENCE ALERT MMC-ET-RA07B-23). E. CONTRACT LETTER 87MO-0629 HAS BEEN ISSUED TO ALERT THE CUSTOMER OF CONCERNS FOR LEAK PORT BLOCK- AGE ON GFP HARDWARE. ACTION IS BEING TAKEN BY CONTRACTS TO CLEAR GFP HARDWARE PER CUSTOMER DIRECTION (REFERENCE CONTRACT LETTER 87MI-0696). F. PROCUREMENT QUALITY HAS IMPLEMENTED AN INSPECTION OF ALL VENDOR SUPPLIED COMPONENTS WHICH HAVE LEAK PORTS INSPECTIONS WILL BE PERFORMED AFTER ALL OTHER OPERATIONS ARE COMPLETE G. ENGINEERING HAS IMPLEMENTED LEAK TEST OF 50 PSI REQUIREMENTS WHICH ARE COMPATIBLE WITH EXISTING RACO/CREAVY FLANGE CONFIGURATION. REF B0 1793 TASK III CLEARANCE OF EFFECTIVITIES BLOCKED LEAK PORTS THERE ARE NO CONSTRAINTS. SUSPECT LEAK PORTS ON LWTS 16, 20, 21, 22 AND 23 THROUGH 38 WILL BE IN- SPECTED WITH MOD KITS GENERATED BY B0 1793 SUBSEQUENT EFFECTIVITIES WILL BE VERIFIED BY DC&R P- 87-007, MPP, OR MARS INSPECTIONS. RAISED MEDIAN AND SEAL CONCERN THERE ARE NO CONSTRAINTS. RACO/CREAVY SEAL INTEGRITY ON LWTS 16, 20, 21, 22, 23, AND UP WILL BE VERIFIED BY 50 PSI LEAK TESTING PER B0 1793. TASK IV CAUSE/CORRECTIVE ACTION SUMMARY INSPECTIONS REVEALED THAT RANDOM OCCURRENCES OF BLOCKED LEAK PORTS EXISTED ON PROPELLENT FLANGES. THESE COMPONENTS WERE SUPPLIED BY VENDORS AND CLEANED OUTSIDE OF MAF. TOOLING WAS DEVELOPED TO INSPECT LEAK PORTS ON PROPELLENT FLANGES ASSEMBLED

PRIOR TO KNOWLEDGE OF THIS PROBLEM. THE INSPEC- TIONS WERE IMPLEMENTED THROUGH MOD KIT, DC&R AND MARS ACTIVITY. INSPECTIONS WERE ADDED TO ALL PRO- PELLENT FLANGE INSTALLATION PLANS TO INSPECT THE LEAK PORTS IMMEDIATELY PRIOR TO ASSEMBLY. LEAK PORT VERIFICATION IS ALSO REQUIRED AT ALL VENDORS AFTER COMPONENT CLEANING. DURING LEAK PORT INVESTIGATIONS, CONCERNS SURFACED REGARDING THE DIMENSIONAL REQUIREMENTS ON RACO/ CREAVY PROPELLENT FLANGES. EXISTING REQUIREMENTS COULD ALLOW RESTRICTION OF TEST MEDIA FLOW RE- SULTING IN INACCURATE LEAK TEST DATA. ENGINEERING CONDUCTED A STUDY OF THIS PHENOMENA AND CONCLUDEDA CHANGE IN LEAK TEST PARAMETERS WOULD COMPENSATE FOR THE CONDITION. THE NEW LEAK TEST REQUIREMENTSWERE IMPLEMENTED BY MOD KIT RELEASE AND ATP/TM04 CHANGES. THESE ACTIONS ARE SUFFICIENT TO CLOSE THIS CAPS

MSFC Response/Concurrence

ASSESSMENT ADDENDUM REPORT

MSFC Report#	**IFA#**	**Contractor RPT#**	**JSC#**	**KSC#**	**EICN#**
A10582	--	P-058-1	--	--	--
Asmnt Part#	**Asmnt Part Name**	**Asmnt Serial/Lot#**			
PD7400193-020	PYRO VALVE	421			
HCRIT CD	**FCRIT CD**	**CAUSE CD**	**FAIL MODE**		
--	1	MN - MFG-ISP	ME - RANDOM		
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**		
2.16.1.1	1	N/A	N/A		
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**		
--	--	--	--		
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**		
--	--	--	--		
Correlated Part#	**Correlated Part#**	**Correlated Part#**			
--	--	--			
Associated LRU#	**Associated LRU#**	**Associated LRU#**			
--	--	--			
MAJOR DESIGN CHANGES					
APRV DATE	**DESCRIPTION OF CHANGES**				
--	--				
ASSESSMENT TEXT					

MSFC PRACA : 2003-02-12 08:41

MSFC Problem Reporting and Corrective Action (PRACA) System
WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A16035	**In-Flight Anomaly Number** --	**Contractor Report Number** P-072	**JSC#** --	**KSC#** --
Problem Title VENT LINE BELLOWS OVER STRESSED				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 1
HCRIT --	**Sys_Lvl** N	**Misc Codes** A B C D E F G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** --	**PART#** --	**SER/LOT#** --	**MANUFACTURER** --
HARDWARE LRU	**NOMENCLATURE** --	**PART#** --	**SER/LOT#** --	**MANUFACTURER** --
HARDWARE NCA	**NOMENCLATURE** LH2 VENT LINE	**PART#** PD4800181-020	**SER/LOT#** 0000181	**MANUFACTURER** PARKER MB
Test/Operation A - ATP	**Prevailing Condtion** F - FUNCTIONAL	**F / U** UC	**Fail Mode** MV - EXT LEAK	**Cause** MTP - MFG-TST-INST
System PROPULSION	**Defect** DB - BENT	**Material** N - HOLE	**Work Contact** W. MATTHEESS	**Fail Date** 06/09/1994
Received at MSFC 06/13/1994	**Date Isolated** 06/09/1994	**FMEA Reference** 2.8.1.1	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location PARKER MB		**Symptom** UC - UNSAT		**Time Cycle** --
Effectivity Text --				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** 06/13/1994	**LVL 3 Close** --	**Remark / Action** 06/24/1994	
Investigation / Resolution Summary				
Last MSFC Update 07/29/1994	**CN RSLV SBMT** 06/29/1994	**Defer Date** 06/22/1994	**Add Date** 06/13/1994	**R/C Codes** 4 - TEST -- --
Assignee				
Design	**Chief Engineer**	**S & MA**	**Project**	**Project MGR**

W. PATTERSON	M. PESSIN	M. SMILES	--	P. COUNTS

Approval

Design	**Chief Engineer**	**S & MA**	**Project**	**Project MGR**
M. MOORE	M. PESSIN	M. SMILES	--	C. SUMNER
PAC Assignee	**PAC Review Complete**	**MSFC Closure Date**	**Status**	**F/A Completion**
B. HURST	BH	07/27/1994	C - CLOSED	06/13/1994
Problem Type	**SEV**	**Program Name**	**REVL**	**OPRINC**
--	--	--	--	--

FUNC MOD	**Software Effectivity**	**Software Fail CD**	**SUBTYPE**	**Software Closure CD**
--	-- -- -- -- --	--	--	--

RES PERSON L2	**Approval Signature L3**
--	--
Related Document Type	**Related Document ID**
--	N008744

Related Document Title
NCD

Related Document Type	**Related Document ID**
--	--

Related Document Title
--

Related Document Type	**Related Document ID**
--	--

Related Document Title
--

Contractor Status Summary

Reliability/Quality Assurance Concerns, Recommendations:

Problem Description

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DURING ATP ON A LH2 VENT LINE A RESTRAINT ADAPTER WAS NOT INSTALLED
ON THE TEST FIXTURE. THIS ALLOWED A BELLOWS TO BE OVER EXTENDED TO
TWICE IT'S NORMAL LENGTH AND OVER STRESSED THE BELLOWS
CRITICALITY: THE LH2 VENT LINE IS LISTED AS CRIT. 1 FMEA ITEM CODE
2.8.1.1, "STRUCTURAL FAILURE OF BELLOWS ASSEMBLY"
(REV."A": REVISED TO UPDATE TASK II AND TASK IV AND CLOSES CAPS--SEE
ASTERISKS)
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Contractor Investigation/Resolution

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GENERAL:
A NEW EMPLOYEE ON THE JOB WAS ASSIGNED THE TASK OF PERFORMING THE ATP
HE DID NOT REALIZE AS PART OF THE SETUP THAT A RESTRAINT ADAPTER MUST
BE INSTALLED TO PREVENT EXCESSIVE BELLOWS EXPANSION AND LINE MOVEMENT
TASK I. PROBLEM/FAILURE INVESTIGATION
DURING ATP ON A LH2 VENT LINE A RESTRAINT ADAPTER WAS NOT INSTALLED ON
THE TEST FIXTURE. THIS ALLOWED THE BELLOWS TO BE OVER EXTENDED TO
TWICE IT'S NORMAL LENGTH AND OVER STRESSED THE BELLOWS
TASK CLOSED
CAUSE
SUPPLIER ATP PROCEDURE 75890 REV. M DID NOT CLEARLY STATE ALL
```

PROTECTIVE EQUIPMENT THAT MUST BE INSTALLED BEFORE TESTING
* TASK II. CORRECTIVE ACTION
THE SUPPLIER WILL REVISE THE ATP TO INCLUDE THE INSTALLATION OF THE RESTRAINT ADAPTER
RESPONSIBILITY: J. MAJOR
COMPLETE: 6/24/94
CLOSURE STATEMENT
ATP 75890 (LINE, VENT GASEOUS HYDROGEN) HAS BEEN UPDATED TO ADDRESS THE INSTALLATION OF THE RESTRAINT ADAPTER PER PARAGRAPH 4.2.6.1., AND TO INSPECT THE TEST FIXTURE TO MAKE SURE BOTH ENDS OF THE ASSEMBLY ARE RESTRAINED. IN ADDITION TO THESE CHANGES, THE TEST FIXTURE HAS BEEN STENCILED WITH THE REQUIREMENT TO INSTALL THE RESTRAINT FOR ALL PRESSURE TESTS
TASK III. FLEET CLEARANCE
ALL ETS CLEARED. ATP INSPECTION IS A POSITIVE SCREEN FOR THIS CONDITION. THIS IS AN ISOLATED CASE
NOTE: THIS IS ALSO THE DEFERRAL RATIONALE
TASK CLOSED
* TASK IV. CAPS CLOSURE SUMMARY
THE BELLOWS OF A LH2 VENT LINE WERE OVER EXTENDED DURING PERFORMANCE OF ATP 75890 AT PARKER METAL BELLOWS, BECAUSE A RESTRAINT ADAPTER WAS NOT INSTALLED ON THE TEST FIXTURE. A NEW EMPLOYEE PERFORMING THE ATP WAS NOT AWARE OF THE NEED TO INSTALL THE RESTRAINT ADAPTER IN ORDER TO PREVENT EXCESSIVE BELLOWS EXPANSION AND MOVEMENT. ATP 75890 (LINE, VENT GASEOUS HYDROGEN), PARAGRAPH 4.2.6.1., HAS BEEN UPDATED TO ENSURE INSTALLATION OF THE RESTRAINT ADAPTER AND THE TEST FIXTURE HAS BEEN STENCILED WITH THE REQUIREMENT TO INSTALL THE RESTRAINT FOR ALL PRESSURE TESTS
THIS CAPS IS CLOSED. NO FURTHER CORRECTIVE ACTION IS REQUIRED

MSFC Response/Concurrence

6/13/94 - DEFFERAL RATIONALE:
BASED ON THE RATIONALE LISTED IN "TASK III. FLEET CLEARANCE" (ABOVE), THIS REPORT HAS BEEN DEFERRED FOR THE NEXT SIX MONTHS PER NSTS 07700, VOLUME XI, PARAGRAPH 3.4.1, ITEM C AND NSTS 08126 REV. E PARAGRAPH 3.3.10.1, ITEM D WHICH STATES "THE PROBLEM CONDITION IS CLEARLY SCREENED BY PREFLIGHT CHECKOUT OR SPECIAL TEST."
SIGNED:_____PARKER V. COUNTS_(SIGNED)___DATE:__6/22/94_____
ET PROJECT MANAGER

MSFC Problem Reporting and Corrective Action (PRACA) System
ASSESSMENT ADDENDUM REPORT

MSFC Report#	**IFA#**	**Contractor RPT#**	**JSC#**	**KSC#**	**EICN#**
A16035	--	P-072	--	--	--

Asmnt Part#	**Asmnt Part Name**	**Asmnt Serial/Lot#**
PD4800181-020	LH2 VENT LINE	0000181

HCRIT CD	**FCRIT CD**	**CAUSE CD**	**FAIL MODE**
--	1	MTP - MFG-TST-INST	MV - EXT LEAK

Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
2.8.1	1	C	N/A
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
--	--	--	--
Asmnt FMEA	**Asmnt FM**	**FMEA CSE**	**FMEA SCSE**
--	--	--	--

Correlated Part#	**Correlated Part#**	**Correlated Part#**
--	--	--

Associated LRU#	Associated LRU#	Associated LRU#
--	--	--

MAJOR DESIGN CHANGES	
APRV DATE	**DESCRIPTION OF CHANGES**
--	--

ASSESSMENT TEXT

WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A10659	**In-Flight Anomaly Number** --	**Contractor Report Number** E-93-1	**JSC#** --	**KSC#** --
Problem Title LOX LEVEL SENSOR (S/N 391) FAILED ELECT ISOLATION TEST				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 1R
HCRIT --	**Sys_Lvl** N	**Misc Codes** A B C D E F G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** EXTERNAL TANK	**PART#** 82601000000	**SER/LOT#** LWT 28	**MANUFACTURER** MMC
HARDWARE LRU	**NOMENCLATURE** N/A	**PART#** N/A	**SER/LOT#** N/A	**MANUFACTURER** N/A
HARDWARE NCA	**NOMENCLATURE** LOX LEVEL SENSOR	**PART#** 74L4-1	**SER/LOT#** 391	**MANUFACTURER** SIMMONDS
Test/Operation L - FLD	**Prevailing Condtion** E - ENVIRONMENT	**F / U** F	**Fail Mode** EE - RANDOM	**Cause** ETP - EI-TEST-INST
System ELECTRICAL	**Defect** CN - CONTAM	**Material** C - EEE	**Work Contact** J. ADAMS	**Fail Date** 08/23/1985
Received at MSFC 04/01/1987	**Date Isolated** --	**FMEA Reference** 3.1.1.4	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location MAF		**Symptom** EVM - CON/MEG FAIL		**Time Cycle** --
Effectivity Text LWTS 15 AND SUBS				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** --	**LVL 3 Close** --	**Remark / Action** --	
Investigation / Resolution Summary				
Last MSFC Update 01/10/1995	**CN RSLV SBMT** 04/01/1987	**Defer Date** --	**Add Date** --	**R/C Codes** 4 - TEST -- --
Assignee				
Design P. MULLER	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --
Approval				
Design	**Chief Engineer**	**S & MA**	**Project**	**Project MGR**

P. MULLER	J. NICHOLS	R. JACKSON	M. PESSIN	--
PAC Assignee J.EL-IBRAHIM	**PAC Review Complete** --	**MSFC Closure Date** 08/06/1987	**Status** C - CLOSED	**F/A Completion** --
Problem Type --	**SEV** --	**Program Name** --	**REVL** --	**OPRINC** --
FUNC MOD --	**Software Effectivity** -- -- -- -- --	**Software Fail CD** --	**SUBTYPE** --	**Software Closure CD** --
RES PERSON L2 --	**Approval Signature L3** --			
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Contractor Status Summary				
Reliability/Quality Assurance Concerns, Recommendations:				

Problem Description

LOX LEVEL SENSOR (S/N 391) ON FORWARD MAST OF LWT-28 FAILED THE ELECTRICAL ISOLATION RESISTANCE TEST PERFORMED IN THE MAF FINAL ASSY AREA. THE MEASURED VALUE OF RESISTANCE WAS LESS THAN 5 MEGOHMS. MINIMUM ACCEPTABLE ISOLATION RESISTANCE VALVE IS 5 MEGOHMS. REF: MARS T-83880, T-83884, T-83888, CAPS E-093, E-092, AND E-093-3

Contractor Investigation/Resolution

R/A - PROCESS INSTRUCTION 5008 WAS REVISED TO PROVIDE FORCED, HEATED, NITROGEN DRYING OF BOTH THE LOX AND LH2 INTERNAL WIRE HARNESSES/MASTS THIS L02 LEVEL SENSOR FAILURE DOES NOT CONSTRAIN FUTURE LAUNCHES FOR THE FOLLOWING REASONS: IN ADDITION TO THE ACCEPTANCE TEST AT THE VENDOR'S FACILITY, ALL L02 LEVEL SENSORS MUST PASS AN ELEC- TRICAL ISOLATION RESISTANCE TEST DURING FINAL ASSEMBLY CHECKOUT AT MAF EXPERIENCE HAS DEMONSTRA- TED THAT THE CHECKOUT PROCEDURES AT MAF IS ADEQUATE TO IDENTIFY ANY DEFECTIVE SENSOR INSTALLED INTO THE SYSTEM THIS STATEMENT HAS BEEN APPROVED BY ET PROJECT MANAGER, G. P. BRIDWELL, REF. PROBLEM A09653. GENERAL A. BACKGROUND INFORMATION THE LOX AND LH2 LIQUID LEVEL SENSORS ARE IDENTICAL EXCEPT FOR THE TYPE OF FLUOROCARBON INSULATION USED ON THE WIRE LEADS. EACH SENSOR IS CONNECTED TO A SIGNAL CONDITIONER IN THE ORBITER. EACH SENSOR CIRCUIT IS CAPABLE OF GENERATING ONLY A "WET" OR "DRY" OUTPUT SIGNAL. AN ARRAY OF THESE POINT LEVEL SENSORS IS INSTALLED IN BOTH THE LOX AND LH2 TANKS TO MONITOR THE FLUID LEVELS. EACH SENSOR CONTAINS A FINE WIRE RESISTIVE ELEMENT. THE ORBITER SIGNAL CONDITIONER PROVIDES CURRENTTO HEAT THE ELEMENT. WHEN A

SENSOR IS IMMERSED IN THE CRYOGENIC LIQUID PROPELLENT, THE COOLING OF THE ELEMENT IS DETECTED BY THE SIGNAL CONDITIONER WHICH PROVIDES A "WET" OUTPUT SIGNAL TO THE ORBITER. IN THE ET LOX TANK THERE IS ONE SENSOR AT THE 5% LEVEL AND SEVEN SENSORS BETWEEN THE 98% AND 3 LEVELS. ALL SEVEN OF THE SENSORS AT THE TOP/FORWARD END OF THE LOX TANK ARE MOUNTED ON A ALUMINUM TUBE KNOWN AS THE "FORWARD LOX MAST" THE MAST IS INSTALLED AS A COMPLETED SUBASSEMBLY DURING WORK PERFORMED IN THE MAF FINAL ASSEMBLY AREA. TASK I FAILURE INVESTIGATION A. 1 DURING IN-PROCESS ELECTRICAL TESTING OF THE FORWARD LOX LEVEL SENSOR MAST ON LWT-27, THE "100% MINUS LIQUID LEVEL" CIRCUIT HAD AN ISOLATION RESISTANCE OF LESS THAN THE REQUIRED FIVE MEGOHMS. FAILURE ANALYSIS FOUND THE PROBABLE CAUSE TO BE COLD FLOW OF THE TEFLON HEAT SHRINK TUBING INTERNAL TO THE SENSOR. THE INTERNAL STEEL TERMINALS HAD BEEN IMPROPERLY FORMED DURING ASSEMBLY AT THE VENDOR. THE TERMINALS FORCED THE OUTPUT LEAD WIRES AGAINST AN INTER- NAL LIP IN THE SENSOR HOUSING AND DAMAGED THE SHRINK TUBING INSULATION (REFERENCE MARS T-85671 AND T-82975). B. 1. THE LOX LEVEL SENSOR MAST WHICH HAD BEEN REMOVED FROM LWT-27, DUE TO FAILURE LISTED IN TASK I.A.1, WAS REPAIRED AND INSTALLED IN LWT-28. AFTER INSTALLATION, A LEVEL SENSOR MEASUREMENT CIRCUIT FAILED TO MEET THE FIVE MEGOHM ISOLATION RESISTANCE REQUIREMENT. THE MAST WAS RE- MOVED, THE FAILURE TRACED TO A LEVEL SENSOR, THE SENSOR WAS REPLACED AND THE MAST WAS REIN- STALLED IN LWT-28. THE CYCLE WAS REPEATED TWICE FOR A TOTAL OF THREE FAILED LEVEL SENSORS. FAILURE ANALYSES T-83880, T-83884, AND T-83888 FOUND THE PROBABLE CAUSE OF THE FAILURES TO BE THAT MOISTURE CONDENSED ON THE SENSORS DURING CLEANING THE LEVEL SENSOR MAST ASSEMBLY IS CLEANED WITH FREON TMC AND FREON PCA IN ORDER TO MEET THE CLEANLINESS REQUIREMENTS FOR USE IN A LOX ENVIRONMENT. EVAPORATION OF THE CLEANING SOLVENT CHILLS THE MAST BELOW THE DEW POINT AND MOISTURE CONDENSES ON IT. THE FIBERGLASS BRAID USED ON LOX TANK WIRE HARNESSES ACTS AS A WICK. THE BRAID CAN BECOME WET WITH WATER CONDENSED FROM THE AIR. 2. LWT-28 MET THE ISOLATION RESISTANCE REQUIREMENTS AFTER REPAIRS TO THE MAST, LISTED IN TASK I.B.1, WERE COMPLETED AND THE ET WAS MOVED TO BUILDING 420 FOR FINAL ACCEPTANCE TESTING. TWO LOX LEVEL SENSOR CIRCUITS FAILED TO MEET THE FIVE MEGOHMS ISOLATION RESISTANCE DURING ACCEP- TANCE TESTING. THE LOX TANK WAS CONNECTED TO A HEATED VENTILATION AIR PACK FOR FOUR DAYS. AT THE END OF THIS TIME, THE TWO DEFECTIVE ISOLATION RESISTANCE READINGS HAD INCREASED FROM APPROXIMATELY TWO MEGOHMS TO APPROXIMATELY EIGHTY MEGOHMS (REFERENCE MARS T-76354). 3. A LOX LEVEL SENSOR MAST FAILED AN IN-PROCESS ISOLATION RESISTANCE TEST IN FINAL ASSEMBLY PRIOR TO INSTALLATION IN LWT-30. FIVE OF THE SEVEN CIRCUITS HAD ISOLATION RESISTANCE VALUES BELOW FIVE MEGOHMS. AFTER FORCED AIR, HEATED TO APPROXIMATELY 100 DEGREES-F, WAS BLOWN OVER THE MAST FOR FOUR HOURS, ALL CIRCUITS WERE ABOVE 100 MEGOHMS (REFERENCE MARS T-86702). 4. A REVEIW OF PREVIOUS MOISTURE CAUSED ISOLATION RESISTANCE FAILURES OF LEVEL SENSOR CIRCUITS FOUND A SINGLE PREVIOUS OCCURRENCE THAT WAS SIMILAR TO THE FAILURES OF LWTS 27, 28, AND 30. AN AFT LOX LEVEL SENSOR MAST FAILED AN ISOLATION RESISTANCE TEST WHEN BEING INSTALLED ON LWT-11. WHEN TESTED AFTER EIGHT HOURS IN THE OPEN AIR, THE ISOLATION RESISTANCE WAS ACCEP- TABLE. THE ENGINEERING ANALYSIS FOUND THAT THE PROBABLE CAUSE WAS MOISTURE ON THE WIRING/ CONNECTOR FROM THE CLEANING PROCESS (REFERENCE MARS T-49783). 5. A REVIEW OF THE PROCEDURES AND EQUIPMENT USED TO PROVIDE DRY AIR TO THE INTERIOR OF THE PRO- PELLANT TANKS DURING ASSEMBLY OF THE ET FOUND NO DEFICIENCIES. THE "PURGE CARTS" ARE CERTI- FIED FOR HUMIDITY AND PARTICULATES. WHEN THE PURGE CARTS ARE NOT IN USE, DESICCANT BREATHERS ARE INSTALLED. THE BREATHERS HAVE HUMIDITY INDICATORS WHICH ARE CHECKED REGULARLY (REFERENCE INTEROFFICE MEMORANDUM 3743-85-231). TASK II CORRECTIVE ACTION 1 PROCESS INSTRUCTION 5008 WAS REVISED TO PROVIDE FORCED, HEATED, NITROGEN DRYING OF BOTH THE LOX AND LH2 INTERNAL WIRE HARNESSES/MASTS (REFERENCE INTEROFFICE MEMORANDUM 3693-87-HP-080). 2. THE CHANGES TO PI-5008 FOR THE LOX WIRE HARNESSES/MASTS WERE INCORPORATED INTO THE

MANUFACTURING PROCESS PLANS (REFERENCE MPP 80932003709-029, PLANNING CHANGE LEVEL: NEW, 3/25/87; AND MPP 80931003769-059, PLANNING CHANGE LEVEL; NEW, 3/25/87. TASK III CLEARANCE OF EFFECTIVITIES THERE ARE NO CONSTRAINTS. THE FAILURES WERE DETECTED DURING TESTING AT MAF. THERE HAVE BEEN NO FAILURES AT KSC. ALL ETS ARE PURGED WITH DRY NITROGEN PRIOR TO SHIPMENT, WHICH PREVENTS MOISTURE RELATED FAILURES WITH THE PROPELLANT TANKS AT KSC. TASK IV CAPS CLOSURE SUMMARY SEVERAL LOX LEVEL SENSORS IN USE ON ETS AT MAF HAD A LOWER ISOLATION RESISTANCE THAN ACCEPTABLE. THE SECOND PROBLEM WAS THE RESULT OF INADEQUATE DRYING OF THE MAST/HARNESS ASSEMBLIES FOLLOWING CLEANING WITH FREON SOLVENTS. THE PROCESS INSTRUCTION FOR DRYING THE ASSEMBLIES WAS IMPROVED. 7/31/87 UPDATE STATUS - THE SENSOR S/N 361 WAS BUILT USING THE OLD TOOLING WHICH IN SOME ISOLATED CASES COULD ALLOW IMPROPERLY FORMED TERMINALS RESULTING IN THE LOW 1R READINGS AS NOTED IN CAPS E-093. PER TELECON WITH MR. ADAMS OF MMC, CN 5/27/87, HE STATED THE SENSOR S/N 391 WAS NOT IN- SPECTED FOR IMPROPERLY FORMED TERMINALS TO THE STANDARDS NOW IN USE SINCE THE FAILURE WAS CAUSED BY MOISTURE (REF FAILURE ANALYSIS T83888) THE SENSOR S/N 391 WILL BE SCRAPPED/REFURBISHED. ALL NEW SENSORS WILL BE MANUFACTURED UTILIZING THE NEW TOOL. ALL SENSORS ARE TESTED AT LEAST TWICE AFTER INSTALLATION AT MAF WHICH PROVIDES PROOF OF INSTALLATION RESISTANCE. MSFC STATEMENT: 8/7/87 - THE SENSORS NOW ON LWT-28 AND LWT-30 WERE FABRICATED WITHOUT A SPECIAL TOOL TO CONTROL THE FORMING OF THE TERMINALS AS DONE ON CURRENT BUILDS. THEREFORE, THE EXACT CAUSE OF THE FAILURES NOTED AFTER INSTALLATION IS NOT KNOWN AND COULD HAVE BEEN DUE TO MOISTURE, AS ASSESSED ABOVE, OR A COMBINATION OF TEFLON COLD FLOW AND MOISTURE. THE ADDITIONAL TESTS REQUIRED AT KSC, ALONG WITH THE BUILT-IN SYSTEM REDUNDANCY, SHOULD PREVENT ANY LAUNCH PROBLEMS. 8/17/87 - MMC CLOSURE SUMMARY SEVERL LOX LEVEL SENSORS IN USE ON ETS AT MAF HAD A LOWER ISOLATION RESISTANCE THAN IS ACCEPTABLE. THE PROBLEMS WERE THE RESULT OF TWO SEPARATE DEFICIENCIES. THE FIRST PROBLEM WAS CAUSED BY COLD FLOWING OF THE TEFLON SHRINK TUBING INSULATION ON THE INTERNAL WIRES OF THE SENSOR DUE TO IMPROPER ASSEMBLY AT THE VENDOR. THE VENDOR DEVELOPED A TOOL TO CORRECT THE ASSEMBLY OPERATION WHICH HAD CAUSED THE FAILURE. ALL SENSORS BUILT BEFORE THE USE OF THE FORMING TOOL FOR THE SENSOR INTERNAL TERMINALS PASSED ACCEPTANCE TESTS. THE CONDITION OF THE TEFLON TUBING IN THESE SENSORS, WHILE NOT KNOWN, IS ADEQUATE TO ASSURE OPERATION. THE SECOND PROBLEM WAS THE RESULT OF INADEQUATE DRYING OF THE MAST/HARNESS ASSEMBLIES FOLLOWING CLEANING WITH FREON SOLVENTS. THE PROCESS INSTRUCTION FOR DRYING THE ASSEMBLIES WAS IMPROVED. THERE ARE SUFFICIENT TESTS AT THE VENDOR, MAF, AND THE LAUNCH SITES TO DETECT SENSOR FAILURES. WHILE THE CAUSE OF THE ORIGINAL SENSOR FAILURES ON LWT-28 WAS CLEARLY IDENTIFIED AS MOISTURE AND THE LATER FAILURES ON LWTS 28 AND 30 INDICATED MOISTURE RELATED PROBLEMS, NO RESEARCH WAS PERFORMED TO CHARACTERIZE THE CONDITION OF THE SENSOR INTERNAL COMPONENTS, INCLUDING THE TERMINALS, AS THEY HAD NOT AFFECTED SENSOR ACCEPTABILITY. THE CAUSE OF FAILURES WERE IDENTIFIED AS (1) IMPROPERLY FORMED TERMINALS AND (2) MOISTURE IN THE MAST/HARNESS DUE TO CLEANING PROCESS. THE FIRST CAUSE IS ADDRESSED IN PROBLEM A09653. THE ABOVE IS A VERBATIM OF MMC CAPS E-093 A

MSFC Response/Concurrence

ASSESSMENT ADDENDUM REPORT

MSFC Report#	**IFA#**	**Contractor RPT#**	**JSC#**	**KSC#**	**EICN#**
A10659	--	E-93-1	--	--	--

Asmnt Part#	**Asmnt Part Name**	**Asmnt Serial/Lot#**
74L4-1	LOX LEVEL SENSOR	391

HCRIT CD --	**FCRIT CD** 1R	**CAUSE CD** ETP - EI-TEST-INST	**FAIL MODE** UC - UNSAT
Asmnt FMEA 3.1.2.2	**Asmnt FM** 2	**FMEA CSE** A	**FMEA SCSE** 4
Asmnt FMEA --	**Asmnt FM** --	**FMEA CSE** --	**FMEA SCSE** --
Asmnt FMEA --	**Asmnt FM** --	**FMEA CSE** --	**FMEA SCSE** --
Correlated Part# --	**Correlated Part#** --	**Correlated Part#** --	
Associated LRU# --	**Associated LRU#** --	**Associated LRU#** --	
MAJOR DESIGN CHANGES			
APRV DATE --	**DESCRIPTION OF CHANGES** --		
ASSESSMENT TEXT			

WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A10660	**In-Flight Anomaly Number** --	**Contractor Report Number** E-93-3	**JSC#** --	**KSC#** --
Problem Title LOX LEVEL SENSOR (S/N 385) FAILED ELECT ISOLATION TEST				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 1R
HCRIT --	**Sys_Lvl** N	**Misc Codes** A B C D E F G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** EXTERNAL TANK	**PART#** 82601000000	**SER/LOT#** LWT 28	**MANUFACTURER** MMC
HARDWARE LRU	**NOMENCLATURE** --	**PART#** --	**SER/LOT#** --	**MANUFACTURER** --
HARDWARE NCA	**NOMENCLATURE** LOX LEVEL SENSOR	**PART#** 74L4-1	**SER/LOT#** 385	**MANUFACTURER** SIMMONDS
Test/Operation L - FLD	**Prevailing Condtion** E - ENVIRONMENT	**F / U** F	**Fail Mode** EE - RANDOM	**Cause** ETP - EI-TEST-INST
System ELECTRICAL	**Defect** CN - CONTAM	**Material** C - EEE	**Work Contact** J. ADAMS	**Fail Date** 08/23/1985
Received at MSFC 04/01/1987	**Date Isolated** --	**FMEA Reference** 3.1.1.4	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location MAF		**Symptom** EVM - CON/MEG FAIL		**Time Cycle** --
Effectivity Text LWTS 15 AND SUBS				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** --	**LVL 3 Close** --	**Remark / Action** --	
Investigation / Resolution Summary				
Last MSFC Update 01/10/1995	**CN RSLV SBMT** 04/01/1987	**Defer Date** --	**Add Date** --	**R/C Codes** 4 - TEST -- --
Assignee				
Design P. MULLER	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --
Approval				
Design	**Chief Engineer**	**S & MA**	**Project**	**Project MGR**

P. MULLER	J. NICHOLS	R. JACKSON	M. PESSIN	--
PAC Assignee J.EL-IBRAHIM	**PAC Review Complete** --	**MSFC Closure Date** 08/06/1987	**Status** C - CLOSED	**F/A Completion** --
Problem Type --	**SEV** --	**Program Name** --	**REVL** --	**OPRINC** --
FUNC MOD --	**Software Effectivity** -- -- -- -- --	**Software Fail CD** --	**SUBTYPE** --	**Software Closure CD** --
RES PERSON L2 --	**Approval Signature L3** --			
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Contractor Status Summary				
Reliability/Quality Assurance Concerns, Recommendations:				

Problem Description

LOX LEVEL SENSOR (S/N 385) ON FORWARD MAST OF LWT-28 FAILED THE ELECTRICAL ISOLATION RESISTANCE TEST PERFORMED IN THE MAF FINAL ASSY AREA. THE MEASURED VALUE OF RESISTANCE WAS LESS THAN 5 ME- GOHMS MINIMUM ACCEPTABLE ISOLATION RESISTANCE VALUE IS 5 MEGOHMS. REF: MARS T-83880, T-83884, T-83888, CAPS E-093, E-093-1, AND E-093-2

Contractor Investigation/Resolution

R/A - PROCESS INSTRUCTION 5008 WAS REVISED TO PROVIDE FORCED, HEATED, NITROGEN DRYING OF BOTH THE LOX AND LH2 INTERNAL WIRE HARNESSES/MASTS THIS L02 LEVEL SENSOR FAILURE DOES NOT CONSTRAIN FUTURE LAUNCHES FOR THE FOLLOWING REASONS: IN ADDITION TO THE ACCEPTANCE TEST AT THE VENDOR'S FACILITY, ALL L02 LEVEL SENSORS MUST PASS AN ELEC- TRICAL ISOLATION RESISTANCE TEST DURING FINAL ASSEMBLY CHECKOUT AT MAF EXPERIENCE HAS DEMONSTRA- TED THAT THE CHECKOUT PROCEDURES AT MAF IS ADEQUATE TO IDENTIFY ANY DEFECTIVE SENSOR INSTALLED INTO THE SYSTEM THIS STATEMENT HAS BEEN APPROVED BY ET PROJECT MANAGER, G. P. BRIDWELL, REF. PROBLEM A09653. GENERAL A. BACKGROUND INFORMATION THE LOX AND LH2 LIQUID LEVEL SENSORS ARE IDENTICAL EXCEPT FOR THE TYPE OF FLUOROCARBON INSULATION USED ON THE WIRE LEADS. EACH SENSOR IS CONNECTED TO A SIGNAL CONDITIONER IN THE ORBITER. EACH SENSOR CIRCUIT IS CAPABLE OF GENERATING ONLY A "WET" OR "DRY" OUTPUT SIGNAL. AN ARRAY OF THESE POINT LEVEL SENSORS IS INSTALLED IN BOTH THE LOX AND LH2 TANKS TO MONITOR THE FLUID LEVELS. EACH SENSOR CONTAINS A FINE WIRE RESISTIVE ELEMENT. THE ORBITER SIGNAL CONDITIONER PROVIDES CURRENTTO HEAT THE ELEMENT. WHEN A

SENSOR IS IMMERSED IN THE CRYOGENIC LIQUID PROPELLENT, THE COOLING OF THE ELEMENT IS DETECTED BY THE SIGNAL CONDITIONER WHICH PROVIDES A "WET" OUTPUT SIGNAL TO THE ORBITER. IN THE ET LOX TANK THERE IS ONE SENSOR AT THE 5% LEVEL AND SEVEN SENSORS BETWEEN THE 98% AND 3 LEVELS. ALL SEVEN OF THE SENSORS AT THE TOP/FORWARD END OF THE LOX TANK ARE MOUNTED ON A ALUMINUM TUBE KNOWN AS THE "FORWARD LOX MAST" THE MAST IS INSTALLED AS A COMPLETED SUBASSEMBLY DURING WORK PERFORMED IN THE MAF FINAL ASSEMBLY AREA. TASK I FAILURE INVESTIGATION A. 1 DURING IN-PROCESS ELECTRICAL TESTING OF THE FORWARD LOX LEVEL SENSOR MAST ON LWT-27, THE "100% MINUS LIQUID LEVEL" CIRCUIT HAD AN ISOLATION RESISTANCE OF LESS THAN THE REQUIRED FIVE MEGOHMS. FAILURE ANALYSIS FOUND THE PROBABLE CAUSE TO BE COLD FLOW OF THE TEFLON HEAT SHRINK TUBING INTERNAL TO THE SENSOR. THE INTERNAL STEEL TERMINALS HAD BEEN IMPROPERLY FORMED DURING ASSEMBLY AT THE VENDOR. THE TERMINALS FORCED THE OUTPUT LEAD WIRES AGAINST AN INTER- NAL LIP IN THE SENSOR HOUSING AND DAMAGED THE SHRINK TUBING INSULATION (REFERENCE MARS T-85671 AND T-82975). B. 1. THE LOX LEVEL SENSOR MAST WHICH HAD BEEN REMOVED FROM LWT-27, DUE TO FAILURE LISTED IN TASK I.A.1, WAS REPAIRED AND INSTALLED IN LWT-28. AFTER INSTALLATION, A LEVEL SENSOR MEASUREMENT CIRCUIT FAILED TO MEET THE FIVE MEGOHM ISOLATION RESISTANCE REQUIREMENT. THE MAST WAS RE- MOVED, THE FAILURE TRACED TO A LEVEL SENSOR, THE SENSOR WAS REPLACED AND THE MAST WAS REIN- STALLED IN LWT-28. THE CYCLE WAS REPEATED TWICE FOR A TOTAL OF THREE FAILED LEVEL SENSORS. FAILURE ANALYSES T-83880, T-83884, AND T-83888 FOUND THE PROBABLE CAUSE OF THE FAILURES TO BE THAT MOISTURE CONDENSED ON THE SENSORS DURING CLEANING THE LEVEL SENSOR MAST ASSEMBLY IS CLEANED WITH FREON TMC AND FREON PCA IN ORDER TO MEET THE CLEANLINESS REQUIREMENTS FOR USE IN A LOX ENVIRONMENT. EVAPORATION OF THE CLEANING SOLVENT CHILLS THE MAST BELOW THE DEW POINT AND MOISTURE CONDENSES ON IT. THE FIBERGLASS BRAID USED ON LOX TANK WIRE HARNESSES ACTS AS A WICK. THE BRAID CAN BECOME WET WITH WATER CONDENSED FROM THE AIR. 2. LWT-28 MET THE ISOLATION RESISTANCE REQUIREMENTS AFTER REPAIRS TO THE MAST, LISTED IN TASK I.B.1, WERE COMPLETED AND THE ET WAS MOVED TO BUILDING 420 FOR FINAL ACCEPTANCE TESTING. TWO LOX LEVEL SENSOR CIRCUITS FAILED TO MEET THE FIVE MEGOHMS ISOLATION RESISTANCE DURING ACCEP- TANCE TESTING. THE LOX TANK WAS CONNECTED TO A HEATED VENTILATION AIR PACK FOR FOUR DAYS. AT THE END OF THIS TIME, THE TWO DEFECTIVE ISOLATION RESISTANCE READINGS HAD INCREASED FROM APPROXIMATELY TWO MEGOHMS TO APPROXIMATELY EIGHTY MEGOHMS (REFERENCE MARS T-76354). 3. A LOX LEVEL SENSOR MAST FAILED AN IN-PROCESS ISOLATION RESISTANCE TEST IN FINAL ASSEMBLY PRIOR TO INSTALLATION IN LWT-30. FIVE OF THE SEVEN CIRCUITS HAD ISOLATION RESISTANCE VALUES BELOW FIVE MEGOHMS. AFTER FORCED AIR, HEATED TO APPROXIMATELY 100 DEGREES-F, WAS BLOWN OVER THE MAST FOR FOUR HOURS, ALL CIRCUITS WERE ABOVE 100 MEGOHMS (REFERENCE MARS T-86702). 4. A REVEIW OF PREVIOUS MOISTURE CAUSED ISOLATION RESISTANCE FAILURES OF LEVEL SENSOR CIRCUITS FOUND A SINGLE PREVIOUS OCCURRENCE THAT WAS SIMILAR TO THE FAILURES OF LWTS 27, 28, AND 30. AN AFT LOX LEVEL SENSOR MAST FAILED AN ISOLATION RESISTANCE TEST WHEN BEING INSTALLED ON LWT-11. WHEN TESTED AFTER EIGHT HOURS IN THE OPEN AIR, THE ISOLATION RESISTANCE WAS ACCEP- TABLE. THE ENGINEERING ANALYSIS FOUND THAT THE PROBABLE CAUSE WAS MOISTURE ON THE WIRING/ CONNECTOR FROM THE CLEANING PROCESS (REFERENCE MARS T-49783). 5. A REVIEW OF THE PROCEDURES AND EQUIPMENT USED TO PROVIDE DRY AIR TO THE INTERIOR OF THE PRO- PELLANT TANKS DURING ASSEMBLY OF THE ET FOUND NO DEFICIENCIES. THE "PURGE CARTS" ARE CERTI- FIED FOR HUMIDITY AND PARTICULATES. WHEN THE PURGE CARTS ARE NOT IN USE, DESICCANT BREATHERS ARE INSTALLED. THE BREATHERS HAVE HUMIDITY INDICATORS WHICH ARE CHECKED REGULARLY (REFERENCE INTEROFFICE MEMORANDUM 3743-85-231). TASK II CORRECTIVE ACTION 1 PROCESS INSTRUCTION 5008 WAS REVISED TO PROVIDE FORCED, HEATED, NITROGEN DRYING OF BOTH THE LOX AND LH2 INTERNAL WIRE HARNESSES/MASTS (REFERENCE INTEROFFICE MEMORANDUM 3693-87-HP-080). 2. THE CHANGES TO PI-5008 FOR THE LOX WIRE HARNESSES/MASTS WERE INCORPORATED INTO THE

MANUFACTURING PROCESS PLANS (REFERENCE MPP 80932003709-029, PLANNING CHANGE LEVEL: NEW, 3/25/87; AND MPP 80931003769-059, PLANNING CHANGE LEVEL; NEW, 3/25/87. TASK III CLEARANCE OF EFFECTIVITIES THERE ARE NO CONSTRAINTS. THE FAILURES WERE DETECTED DURING TESTING AT MAF. THERE HAVE BEEN NO FAILURES AT KSC. ALL ETS ARE PURGED WITH DRY NITROGEN PRIOR TO SHIPMENT, WHICH PREVENTS MOISTURE RELATED FAILURES WITH THE PROPELLANT TANKS AT KSC. TASK IV CAPS CLOSURE SUMMARY SEVERAL LOX LEVEL SENSORS IN USE ON ETS AT MAF HAD A LOWER ISOLATION RESISTANCE THAN ACCEPTABLE. THE SECOND PROBLEM WAS THE RESULT OF INADEQUATE DRYING OF THE MAST/HARNESS ASSEMBLIES FOLLOWING CLEANING WITH FREON SOLVENTS. THE PROCESS INSTRUCTION FOR DRYING THE ASSEMBLIES WAS IMPROVED. 7/31/87 UPDATE STATUS - THE SENSOR S/N 361 WAS BUILT USING THE OLD TOOLING WHICH IN SOME ISOLATED CASES COULD ALLOW IMPROPERLY FORMED TERMINALS RESULTING IN THE LOW 1R READINGS AS NOTED IN CAPS E-093. PER TELECON WITH MR. ADAMS OF MMC, CN 5/27/87, HE STATED THE SENSOR S/N 391 WAS NOT IN- SPECTED FOR IMPROPERLY FORMED TERMINALS TO THE STANDARDS NOW IN USE SINCE THE FAILURE WAS CAUSED BY MOISTURE (REF FAILURE ANALYSIS T83888) THE SENSOR S/N 391 WILL BE SCRAPPED/REFURBISHED. ALL NEW SENSORS WILL BE MANUFACTURED UTILIZING THE NEW TOOL. ALL SENSORS ARE TESTED AT LEAST TWICE AFTER INSTALLATION AT MAF WHICH PROVIDES PROOF OF INSTALLATION RESISTANCE. MSFC STATEMENT: 8/7/87 - THE SENSORS NOW ON LWT-28 AND LWT-30 WERE FABRICATED WITHOUT A SPECIAL TOOL TO CONTROL THE FORMING OF THE TERMINALS AS DONE ON CURRENT BUILDS. THEREFORE, THE EXACT CAUSE OF THE FAILURES NOTED AFTER INSTALLATION IS NOT KNOWN AND COULD HAVE BEEN DUE TO MOISTURE, AS ASSESSED ABOVE, OR A COMBINATION OF TEFLON COLD FLOW AND MOISTURE. THE ADDITIONAL TESTS REQUIRED AT KSC, ALONG WITH THE BUILT-IN SYSTEM REDUNDANCY, SHOULD PREVENT ANY LAUNCH PROBLEMS. 8/17/87 - MMC CLOSURE SUMMARY SEVERL LOX LEVEL SENSORS IN USE ON ETS AT MAF HAD A LOWER ISOLATION RESISTANCE THAN IS ACCEPTABLE. THE PROBLEMS WERE THE RESULT OF TWO SEPARATE DEFICIENCIES. THE FIRST PROBLEM WAS CAUSED BY COLD FLOWING OF THE TEFLON SHRINK TUBING INSULATION ON THE INTERNAL WIRES OF THE SENSOR DUE TO IMPROPER ASSEMBLY AT THE VENDOR. THE VENDOR DEVELOPED A TOOL TO CORRECT THE ASSEMBLY OPERATION WHICH HAD CAUSED THE FAILURE. ALL SENSORS BUILT BEFORE THE USE OF THE FORMING TOOL FOR THE SENSOR INTERNAL TERMINALS PASSED ACCEPTANCE TESTS. THE CONDITION OF THE TEFLON TUBING IN THESE SENSORS, WHILE NOT KNOWN, IS ADEQUATE TO ASSURE OPERATION. THE SECOND PROBLEM WAS THE RESULT OF INADEQUATE DRYING OF THE MAST/HARNESS ASSEMBLIES FOLLOWING CLEANING WITH FREON SOLVENTS. THE PROCESS INSTRUCTION FOR DRYING THE ASSEMBLIES WAS IMPROVED. THERE ARE SUFFICIENT TESTS AT THE VENDOR, MAF, AND THE LAUNCH SITES TO DETECT SENSOR FAILURES. WHILE THE CAUSE OF THE ORIGINAL SENSOR FAILURES ON LWT-28 WAS CLEARLY IDENTIFIED AS MOISTURE AND THE LATER FAILURES ON LWTS 28 AND 30 INDICATED MOISTURE RELATED PROBLEMS, NO RESEARCH WAS PERFORMED TO CHARACTERIZE THE CONDITION OF THE SENSOR INTERNAL COMPONENTS, INCLUDING THE TERMINALS, AS THEY HAD NOT AFFECTED SENSOR ACCEPTABILITY. THE CAUSE OF FAILURES WERE IDENTIFIED AS (1) IMPROPERLY FORMED TERMINALS AND (2) MOISTURE IN THE MAST/HARNESS DUE TO CLEANING PROCESS. THE FIRST CAUSE IS ADDRESSED IN PROBLEM A09653. THE ABOVE IS A VERBATIM OF MMC CAPS E-093 A

MSFC Response/Concurrence

ASSESSMENT ADDENDUM REPORT

MSFC Report#	**IFA#**	**Contractor RPT#**	**JSC#**	**KSC#**	**EICN#**
A10660	--	E-93-3	--	--	--

Asmnt Part#	**Asmnt Part Name**	**Asmnt Serial/Lot#**
74L4-1	LOX LEVEL SENSOR	385

HCRIT CD --	**FCRIT CD** 1R	**CAUSE CD** ETP - EI-TEST-INST	**FAIL MODE** UC - UNSAT
Asmnt FMEA 3.1.2.2	**Asmnt FM** 2	**FMEA CSE** A	**FMEA SCSE** 4
Asmnt FMEA --	**Asmnt FM** --	**FMEA CSE** --	**FMEA SCSE** --
Asmnt FMEA --	**Asmnt FM** --	**FMEA CSE** --	**FMEA SCSE** --
Correlated Part# --	**Correlated Part#** --	**Correlated Part#** --	
Associated LRU# --	**Associated LRU#** --	**Associated LRU#** --	
MAJOR DESIGN CHANGES			
APRV DATE --	**DESCRIPTION OF CHANGES** --		
ASSESSMENT TEXT			

WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A10661	**In-Flight Anomaly Number** --	**Contractor Report Number** E-93-2	**JSC#** --	**KSC#** --
Problem Title LOX LEVEL SENSOR (S/N 376) FAILED ELECT ISOLATION TEST				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 1R
HCRIT --	**Sys_Lvl** N	**Misc Codes** A B C D E F G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** EXTERNAL TANK	**PART#** 82601000000	**SER/LOT#** LWT 28	**MANUFACTURER** MMC
HARDWARE LRU	**NOMENCLATURE** --	**PART#** --	**SER/LOT#** --	**MANUFACTURER** --
HARDWARE NCA	**NOMENCLATURE** LOX LEVEL SENSOR	**PART#** 74L4-1	**SER/LOT#** 376	**MANUFACTURER** SIMMONDS
Test/Operation L - FLD	**Prevailing Condtion** E - ENVIRONMENT	**F / U** F	**Fail Mode** EE - RANDOM	**Cause** ETP - EI-TEST-INST
System ELECTRICAL	**Defect** CN - CONTAM	**Material** C - EEE	**Work Contact** J. ADAMS	**Fail Date** 08/23/1985
Received at MSFC 04/01/1987	**Date Isolated** --	**FMEA Reference** 3.1.1.4	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location MAF		**Symptom** EVM - CON/MEG FAIL		**Time Cycle** --
Effectivity Text LWTS 15 AND SUBS				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** --	**LVL 3 Close** --	**Remark / Action** --	
Investigation / Resolution Summary				
Last MSFC Update 01/10/1995	**CN RSLV SBMT** 04/01/1987	**Defer Date** --	**Add Date** --	**R/C Codes** 4 - TEST -- --
Assignee				
Design P. MULLER	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --
Approval				
Design	**Chief Engineer**	**S & MA**	**Project**	**Project MGR**

P. MULLER	J. NICHOLS	R. JACKSON	M. PESSIN	--
PAC Assignee J.EL-IBRAHIM	**PAC Review Complete** --	**MSFC Closure Date** 08/06/1987	**Status** C - CLOSED	**F/A Completion** --
Problem Type --	**SEV** --	**Program Name** --	**REVL** --	**OPRINC** --
FUNC MOD --	**Software Effectivity** -- -- -- -- --	**Software Fail CD** --	**SUBTYPE** --	**Software Closure CD** --
RES PERSON L2 --	**Approval Signature L3** --			
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Related Document Type --	**Related Document ID** --			
Related Document Title --				
Contractor Status Summary				
Reliability/Quality Assurance Concerns, Recommendations:				

Problem Description

LOX LEVEL SENSOR (S/N 376) ON FORWARD MAST OF LWT-28 FAILED THE ELECTRICAL ISOLATION RESISTANCE TEST PERFORMED IN THE MAF FINAL ASSY AREA. THE MEASURED VALUE OF RESISTANCE WAS LESS THAN 5 MEGOHMS. MINIMUM ACCEPTABLE ISOLATION RESISTANCE VALUE IS 5 MEGOHMS. REF: MARS T-83880, T-83884, T-83888, CAPS E-093, E-093-1, AND E-093-3

Contractor Investigation/Resolution

R/A - PROCESS INSTRUCTION 5008 WAS REVISED TO PROVIDE FORCED, HEATED, NITROGEN DRYING OF BOTH THE LOX AND LH2 INTERNAL WIRE HARNESSES/MASTS THIS L02 LEVEL SENSOR FAILURE DOES NOT CONSTRAIN FUTURE LAUNCHES FOR THE FOLLOWING REASONS: IN ADDITION TO THE ACCEPTANCE TEST AT THE VENDOR'S FACILITY, ALL L02 LEVEL SENSORS MUST PASS AN ELEC- TRICAL ISOLATION RESISTANCE TEST DURING FINAL ASSEMBLY CHECKOUT AT MAF EXPERIENCE HAS DEMONSTRA- TED THAT THE CHECKOUT PROCEDURES AT MAF IS ADEQUATE TO IDENTIFY ANY DEFECTIVE SENSOR INSTALLED INTO THE SYSTEM THIS STATEMENT HAS BEEN APPROVED BY ET PROJECT MANAGER, G. P. BRIDWELL, REF. PROBLEM A09653. GENERAL A. BACKGROUND INFORMATION THE LOX AND LH2 LIQUID LEVEL SENSORS ARE IDENTICAL EXCEPT FOR THE TYPE OF FLUOROCARBON INSULATION USED ON THE WIRE LEADS. EACH SENSOR IS CONNECTED TO A SIGNAL CONDITIONER IN THE ORBITER. EACH SENSOR CIRCUIT IS CAPABLE OF GENERATING ONLY A "WET" OR "DRY" OUTPUT SIGNAL. AN ARRAY OF THESE POINT LEVEL SENSORS IS INSTALLED IN BOTH THE LOX AND LH2 TANKS TO MONITOR THE FLUID LEVELS. EACH SENSOR CONTAINS A FINE WIRE RESISTIVE ELEMENT. THE ORBITER SIGNAL CONDITIONER PROVIDES CURRENTTO HEAT THE ELEMENT. WHEN A

SENSOR IS IMMERSED IN THE CRYOGENIC LIQUID PROPELLENT, THE COOLING OF THE ELEMENT IS DETECTED BY THE SIGNAL CONDITIONER WHICH PROVIDES A "WET" OUTPUT SIGNAL TO THE ORBITER. IN THE ET LOX TANK THERE IS ONE SENSOR AT THE 5% LEVEL AND SEVEN SENSORS BETWEEN THE 98% AND 3 LEVELS. ALL SEVEN OF THE SENSORS AT THE TOP/FORWARD END OF THE LOX TANK ARE MOUNTED ON A ALUMINUM TUBE KNOWN AS THE "FORWARD LOX MAST" THE MAST IS INSTALLED AS A COMPLETED SUBASSEMBLY DURING WORK PERFORMED IN THE MAF FINAL ASSEMBLY AREA. TASK I FAILURE INVESTIGATION A. 1 DURING IN-PROCESS ELECTRICAL TESTING OF THE FORWARD LOX LEVEL SENSOR MAST ON LWT-27, THE "100% MINUS LIQUID LEVEL" CIRCUIT HAD AN ISOLATION RESISTANCE OF LESS THAN THE REQUIRED FIVE MEGOHMS. FAILURE ANALYSIS FOUND THE PROBABLE CAUSE TO BE COLD FLOW OF THE TEFLON HEAT SHRINK TUBING INTERNAL TO THE SENSOR. THE INTERNAL STEEL TERMINALS HAD BEEN IMPROPERLY FORMED DURING ASSEMBLY AT THE VENDOR. THE TERMINALS FORCED THE OUTPUT LEAD WIRES AGAINST AN INTER- NAL LIP IN THE SENSOR HOUSING AND DAMAGED THE SHRINK TUBING INSULATION (REFERENCE MARS T-85671 AND T-82975). B. 1. THE LOX LEVEL SENSOR MAST WHICH HAD BEEN REMOVED FROM LWT-27, DUE TO FAILURE LISTED IN TASK I.A.1, WAS REPAIRED AND INSTALLED IN LWT-28. AFTER INSTALLATION, A LEVEL SENSOR MEASUREMENT CIRCUIT FAILED TO MEET THE FIVE MEGOHM ISOLATION RESISTANCE REQUIREMENT. THE MAST WAS RE- MOVED, THE FAILURE TRACED TO A LEVEL SENSOR, THE SENSOR WAS REPLACED AND THE MAST WAS REIN- STALLED IN LWT-28. THE CYCLE WAS REPEATED TWICE FOR A TOTAL OF THREE FAILED LEVEL SENSORS. FAILURE ANALYSES T-83880, T-83884, AND T-83888 FOUND THE PROBABLE CAUSE OF THE FAILURES TO BE THAT MOISTURE CONDENSED ON THE SENSORS DURING CLEANING THE LEVEL SENSOR MAST ASSEMBLY IS CLEANED WITH FREON TMC AND FREON PCA IN ORDER TO MEET THE CLEANLINESS REQUIREMENTS FOR USE IN A LOX ENVIRONMENT. EVAPORATION OF THE CLEANING SOLVENT CHILLS THE MAST BELOW THE DEW POINT AND MOISTURE CONDENSES ON IT. THE FIBERGLASS BRAID USED ON LOX TANK WIRE HARNESSES ACTS AS A WICK. THE BRAID CAN BECOME WET WITH WATER CONDENSED FROM THE AIR. 2. LWT-28 MET THE ISOLATION RESISTANCE REQUIREMENTS AFTER REPAIRS TO THE MAST, LISTED IN TASK I.B.1, WERE COMPLETED AND THE ET WAS MOVED TO BUILDING 420 FOR FINAL ACCEPTANCE TESTING. TWO LOX LEVEL SENSOR CIRCUITS FAILED TO MEET THE FIVE MEGOHMS ISOLATION RESISTANCE DURING ACCEP- TANCE TESTING. THE LOX TANK WAS CONNECTED TO A HEATED VENTILATION AIR PACK FOR FOUR DAYS. AT THE END OF THIS TIME, THE TWO DEFECTIVE ISOLATION RESISTANCE READINGS HAD INCREASED FROM APPROXIMATELY TWO MEGOHMS TO APPROXIMATELY EIGHTY MEGOHMS (REFERENCE MARS T-76354). 3. A LOX LEVEL SENSOR MAST FAILED AN IN-PROCESS ISOLATION RESISTANCE TEST IN FINAL ASSEMBLY PRIOR TO INSTALLATION IN LWT-30. FIVE OF THE SEVEN CIRCUITS HAD ISOLATION RESISTANCE VALUES BELOW FIVE MEGOHMS. AFTER FORCED AIR, HEATED TO APPROXIMATELY 100 DEGREES-F, WAS BLOWN OVER THE MAST FOR FOUR HOURS, ALL CIRCUITS WERE ABOVE 100 MEGOHMS (REFERENCE MARS T-86702). 4. A REVEIW OF PREVIOUS MOISTURE CAUSED ISOLATION RESISTANCE FAILURES OF LEVEL SENSOR CIRCUITS FOUND A SINGLE PREVIOUS OCCURRENCE THAT WAS SIMILAR TO THE FAILURES OF LWTS 27, 28, AND 30. AN AFT LOX LEVEL SENSOR MAST FAILED AN ISOLATION RESISTANCE TEST WHEN BEING INSTALLED ON LWT-11. WHEN TESTED AFTER EIGHT HOURS IN THE OPEN AIR, THE ISOLATION RESISTANCE WAS ACCEP- TABLE. THE ENGINEERING ANALYSIS FOUND THAT THE PROBABLE CAUSE WAS MOISTURE ON THE WIRING/ CONNECTOR FROM THE CLEANING PROCESS (REFERENCE MARS T-49783). 5. A REVIEW OF THE PROCEDURES AND EQUIPMENT USED TO PROVIDE DRY AIR TO THE INTERIOR OF THE PRO- PELLANT TANKS DURING ASSEMBLY OF THE ET FOUND NO DEFICIENCIES. THE "PURGE CARTS" ARE CERTI- FIED FOR HUMIDITY AND PARTICULATES. WHEN THE PURGE CARTS ARE NOT IN USE, DESICCANT BREATHERS ARE INSTALLED. THE BREATHERS HAVE HUMIDITY INDICATORS WHICH ARE CHECKED REGULARLY (REFERENCE INTEROFFICE MEMORANDUM 3743-85-231). TASK II CORRECTIVE ACTION 1 PROCESS INSTRUCTION 5008 WAS REVISED TO PROVIDE FORCED, HEATED, NITROGEN DRYING OF BOTH THE LOX AND LH2 INTERNAL WIRE HARNESSES/MASTS (REFERENCE INTEROFFICE MEMORANDUM 3693-87-HP-080). 2. THE CHANGES TO PI-5008 FOR THE LOX WIRE HARNESSES/MASTS WERE INCORPORATED INTO THE

MANUFACTURING PROCESS PLANS (REFERENCE MPP 80932003709-029, PLANNING CHANGE LEVEL: NEW, 3/25/87; AND MPP 80931003769-059, PLANNING CHANGE LEVEL; NEW, 3/25/87. TASK III CLEARANCE OF EFFECTIVITIES THERE ARE NO CONSTRAINTS. THE FAILURES WERE DETECTED DURING TESTING AT MAF. THERE HAVE BEEN NO FAILURES AT KSC. ALL ETS ARE PURGED WITH DRY NITROGEN PRIOR TO SHIPMENT, WHICH PREVENTS MOISTURE RELATED FAILURES WITH THE PROPELLANT TANKS AT KSC. TASK IV CAPS CLOSURE SUMMARY SEVERAL LOX LEVEL SENSORS IN USE ON ETS AT MAF HAD A LOWER ISOLATION RESISTANCE THAN ACCEPTABLE. THE SECOND PROBLEM WAS THE RESULT OF INADEQUATE DRYING OF THE MAST/HARNESS ASSEMBLIES FOLLOWING CLEANING WITH FREON SOLVENTS. THE PROCESS INSTRUCTION FOR DRYING THE ASSEMBLIES WAS IMPROVED. 7/31/87 UPDATE STATUS - THE SENSOR S/N 361 WAS BUILT USING THE OLD TOOLING WHICH IN SOME ISOLATED CASES COULD ALLOW IMPROPERLY FORMED TERMINALS RESULTING IN THE LOW 1R READINGS AS NOTED IN CAPS E-093. PER TELECON WITH MR. ADAMS OF MMC, CN 5/27/87, HE STATED THE SENSOR S/N 391 WAS NOT IN- SPECTED FOR IMPROPERLY FORMED TERMINALS TO THE STANDARDS NOW IN USE SINCE THE FAILURE WAS CAUSED BY MOISTURE (REF FAILURE ANALYSIS T83888) THE SENSOR S/N 391 WILL BE SCRAPPED/REFURBISHED. ALL NEW SENSORS WILL BE MANUFACTURED UTILIZING THE NEW TOOL. ALL SENSORS ARE TESTED AT LEAST TWICE AFTER INSTALLATION AT MAF WHICH PROVIDES PROOF OF INSTALLATION RESISTANCE. MSFC STATEMENT: 8/7/87 - THE SENSORS NOW ON LWT-28 AND LWT-30 WERE FABRICATED WITHOUT A SPECIAL TOOL TO CONTROL THE FORMING OF THE TERMINALS AS DONE ON CURRENT BUILDS. THEREFORE, THE EXACT CAUSE OF THE FAILURES NOTED AFTER INSTALLATION IS NOT KNOWN AND COULD HAVE BEEN DUE TO MOISTURE, AS ASSESSED ABOVE, OR A COMBINATION OF TEFLON COLD FLOW AND MOISTURE. THE ADDITIONAL TESTS REQUIRED AT KSC, ALONG WITH THE BUILT-IN SYSTEM REDUNDANCY, SHOULD PREVENT ANY LAUNCH PROBLEMS. 8/17/87 - MMC CLOSURE SUMMARY SEVERL LOX LEVEL SENSORS IN USE ON ETS AT MAF HAD A LOWER ISOLATION RESISTANCE THAN IS ACCEPTABLE. THE PROBLEMS WERE THE RESULT OF TWO SEPARATE DEFICIENCIES. THE FIRST PROBLEM WAS CAUSED BY COLD FLOWING OF THE TEFLON SHRINK TUBING INSULATION ON THE INTERNAL WIRES OF THE SENSOR DUE TO IMPROPER ASSEMBLY AT THE VENDOR. THE VENDOR DEVELOPED A TOOL TO CORRECT THE ASSEMBLY OPERATION WHICH HAD CAUSED THE FAILURE. ALL SENSORS BUILT BEFORE THE USE OF THE FORMING TOOL FOR THE SENSOR INTERNAL TERMINALS PASSED ACCEPTANCE TESTS. THE CONDITION OF THE TEFLON TUBING IN THESE SENSORS, WHILE NOT KNOWN, IS ADEQUATE TO ASSURE OPERATION. THE SECOND PROBLEM WAS THE RESULT OF INADEQUATE DRYING OF THE MAST/HARNESS ASSEMBLIES FOLLOWING CLEANING WITH FREON SOLVENTS. THE PROCESS INSTRUCTION FOR DRYING THE ASSEMBLIES WAS IMPROVED. THERE ARE SUFFICIENT TESTS AT THE VENDOR, MAF, AND THE LAUNCH SITES TO DETECT SENSOR FAILURES. WHILE THE CAUSE OF THE ORIGINAL SENSOR FAILURES ON LWT-28 WAS CLEARLY IDENTIFIED AS MOISTURE AND THE LATER FAILURES ON LWTS 28 AND 30 INDICATED MOISTURE RELATED PROBLEMS, NO RESEARCH WAS PERFORMED TO CHARACTERIZE THE CONDITION OF THE SENSOR INTERNAL COMPONENTS, INCLUDING THE TERMINALS, AS THEY HAD NOT AFFECTED SENSOR ACCEPTABILITY. THE CAUSE OF FAILURES WERE IDENTIFIED AS (1) IMPROPERLY FORMED TERMINALS AND (2) MOISTURE IN THE MAST/HARNESS DUE TO CLEANING PROCESS. THE FIRST CAUSE IS ADDRESSED IN PROBLEM A09653. THE ABOVE IS A VERBATIM OF MMC CAPS E-093 A

MSFC Response/Concurrence

ASSESSMENT ADDENDUM REPORT

MSFC Report#	**IFA#**	**Contractor RPT#**	**JSC#**	**KSC#**	**EICN#**
A10661	--	E-93-2	--	--	--

Asmnt Part#	**Asmnt Part Name**	**Asmnt Serial/Lot#**
74L4-1	LOX LEVEL SENSOR	376

HCRIT CD --	**FCRIT CD** 1R	**CAUSE CD** ETP - EI-TEST-INST	**FAIL MODE** UC - UNSAT
Asmnt FMEA 3.1.2.2	**Asmnt FM** 2	**FMEA CSE** A	**FMEA SCSE** 4
Asmnt FMEA --	**Asmnt FM** --	**FMEA CSE** --	**FMEA SCSE** --
Asmnt FMEA --	**Asmnt FM** --	**FMEA CSE** --	**FMEA SCSE** --
Correlated Part# --	**Correlated Part#** --	**Correlated Part#** --	
Associated LRU# --	**Associated LRU#** --	**Associated LRU#** --	
MAJOR DESIGN CHANGES			
APRV DATE --	**DESCRIPTION OF CHANGES** --		
ASSESSMENT TEXT			

WHOLE RECORD REPORT(+ ADDENDUM)

MSFC Record # A10693	**In-Flight Anomaly Number** --	**Contractor Report Number** S-071-1	**JSC#** --	**KSC#** --
Problem Title L02 FEEDLINE BOLTS DID NOT MEET THE TWO THREAD PROTRUSION ON LWT 33				
EICN# --	**ELEMENT** ET	**Contractor** MMMSS	**FSCM#** --	**FCRIT** 3
HCRIT --	**Sys_Lvl** N	**Misc Codes** A B C D E F G H I J K L M N O		
HARDWARE EIM	**NOMENCLATURE** EXTERNAL TANK	**PART#** 80901010000	**SER/LOT#** N/A	**MANUFACTURER** MMC
HARDWARE LRU	**NOMENCLATURE** EXTERNAL TANK	**PART#** 80901010000	**SER/LOT#** N/A	**MANUFACTURER** MMC
HARDWARE NCA	**NOMENCLATURE** L02 FEEDLINE BOLTS	**PART#** N/A	**SER/LOT#** N/A	**MANUFACTURER** N/A
Test/Operation L - FLD	**Prevailing Condtion** F - FUNCTIONAL	**F / U** UC	**Fail Mode** UC - UNSAT	**Cause** MN - MFG-ISP
System PROPULSION	**Defect** MA - ME ADJ	**Material** L - FASTNR	**Work Contact** C. CAMPBELL	**Fail Date** 11/05/1986
Received at MSFC 04/22/1987	**Date Isolated** --	**FMEA Reference** 2.X.X.X	**IFA: Mission Phase** --	**Mission Elapsed Time** --
Location MAF		**Symptom** UC - UNSAT		**Time Cycle** --
Effectivity Text LWTS 16, 20, 21, 22, 24/SUBS				
Vehicle Effectivity Codes				
Vehicle 1 --	**Vehicle 2** --	**Vehicle 3** --	**Vehicle 4** --	**Vehicle 5** --
Mission Effectivity Codes				
Mssn 1 --	**Mssn 2** --	**Mssn 3** --	**Mssn 4** --	**Mssn 5** --
Estimated Completion Dates				
MSFC Approved Defer Until Date --	**Contractor Req Defer Until Date** --	**LVL 3 Close** --	**Remark / Action** --	
Investigation / Resolution Summary				
Last MSFC Update 01/10/1992	**CN RSLV SBMT** 08/22/1987	**Defer Date** --	**Add Date** --	**R/C Codes** 2 - MFG -- --
Assignee				
Design J. WHITE	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --
Approval				
Design --	**Chief Engineer** J. NICHOLS	**S & MA** R. JACKSON	**Project** M. PESSIN	**Project MGR** --

PAC Assignee	PAC Review Complete	MSFC Closure Date	Status	F/A Completion
J.EL-IBRAHIM	JE	09/24/1987	C - CLOSED	--

Problem Type	SEV	Program Name	REVL	OPRINC
--	--	--	--	--

FUNC MOD	Software Effectivity	Software Fail CD	SUBTYPE	Software Closure CD
--	-- -- -- -- --	--	--	--

RES PERSON L2	Approval Signature L3
--	--

Related Document Type	Related Document ID
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Related Document Title
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Related Document Type	Related Document ID
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Related Document Title
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Related Document Type	Related Document ID
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Related Document Title
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Contractor Status Summary

Reliability/Quality Assurance Concerns, Recommendations:

Problem Description

DURING INSPECTION OF LWTS 33, IT WAS OBSERVED THAT SOME OF THE L02 FEEDLINE BOLTS DID NOT MEET THE TWO THREAD PROTRUSION REQUIREMENT OF STP-2014. ALSO, DURING INSPECTION OF BIPOD STRUTS, IT WAS DETERMINED THAT THE NUTS ON THE 26L2 BOLTS WERE ENGAGING THE IMPERFECT THREAD REF. MARS: T-78994, T-90726 AND DC&R P-86-003, CAPS S-071C EFFECTIVITY: LWT 16, 20, 21, 22, 24 AND UP

Contractor Investigation/Resolution

R/C: 1) PRODUCTION-MMC HAS REVISED STP 2014 TO PROVIDE SPECIFIC PROTRUSION REQUIREMENTS AND PLAN- NING HAS BEEN REVISED TO IMPLEMENT OD 453231. A PERSONNEL TRAINING COURSE WAS ALSO ESTABLISHED. 2) FLEET - RETROFIT MOD. KITS AND CHANGE SUMMARY B0 1777 HAS BEEN ISSUED. THIS PROBLEM IS NOT A LAUNCH CONSTRAINTS. REQUIRED RETROFIT WILL BE ACCOMPLISHED BY CONTRACT MOD KIT (B01777). TASK I FAILURE/PROBLEM INVESTIGATION DURING INSPECTION OF LWTS 33. IT WAS FOUND THAT THE LOX FEEDLINE BOLTS, WHICH MATE THE FEEDLINE TO THE LOX TANK, LACKED SUFFICIENT BOLT PROTRUSION THROUGH THE NUTS TO ASSURE LOCKING FEATURE ENGAGEMENT. AN ANALYSIS OF THE CONDITION REVEALED THAT THE BOLT GRIP LENGTH SPECIFIED PER DRAWING DID NOT ALLOW FOR MAXIMUM FLANGE THICKNESS (REFERENCE MARS T-90345 AND 78944). MPPS FOR THIS PARTICULAR INSTALLATION DID NOT REQUIRE QC TO VERIFY THE TWO THREAD PROTRUSION REQUIREMENT. A REVIEW OF MPPS, WHICH CONTAIN THROUGH BOLT INSTALLATION, REVEALED THREE PLANS WHERE THE TWO THREAD PROTRUSION REQUIREMENT WAS NOT SPECIFIED (REFERENCE INTEROFFICE MEMORANDUM 3743-86-129). DURING A SUBSEQUENT INVESTIGATION, IT WAS FOUND THAT THE FORWARD BIPOD FITTING

BOLTS HAD EXCESSIVE PROTRUSION AND THE ASSOCIATED NUTS WERE ENGAGING THE IMPERFECT THREADS. IT WAS DETERMINED THAT THE ENGINEERING WAS CORRECT, BUT THAT AN INSUFFICIENT NUMBER OF WASHERS HAD BEEN INSTALLED TO AVOID SHANKING. A MEASURABLE REQUIREMENT DOES NOT EXIST IN STP/PI 2014 TO ASSURE LOCKING FEATURE ENGAGEMENT AND THE AVOIDANCE OF SHANKING. BASED ON THESE OBSERVATIONS, THE FOLLOWING ACTIONS ARE DEEMED NECESSARY: A. ENGINEERING IS TASKED TO PERFORM A TOLERANCE ANALYSIS ON ALL THROUGH BOLT INSTALLATIONS WITH AN UNTHREADED GRIP TO IDENTIFY ANY INSTALLATIONS WHICH ARE INCORRECT BY DESIGN. COMPLETED CLOSURE STATEMENT: DEFICIENCIES WERE FOUND. CHANGES ARE BING IMPLEMENTED BY DCNS RELEASE (REFERENCE CORRECTIVE ACTIONS A AND CHANGE SUMMARY B0 1777). B. ENGINEERING IS TASKED TO PERFORM A TOLERANCE ANALYSIS ON ALL BLIND FASTENER INSTALLATIONS, TO IDENTIFY ANY APPLICATIONS WHICH ARE INCORRECT BY DESIGN. COMPLETED CLOSURE STATEMENT: DEFICIENCIES WERE FOUND CONSISTING OF APPROXIMATLEY 113 BOLT APPLICATIONS ON 22 DRAWINGS CHANGES ARE BEING IMPLEMENTED BY DCN RELEASE (REFERENCE CORRECTIVE ACTIONS A AND CHANGE SUMMARY B0 1777). C. DC&RS S-86-020 AND S-86-021 HAVE BEEN RELEASED TO INSPECT ALL ACCESSIBLE THROUGH BOLT INSTALLA- TIONS BUILT PRIOR TO IMPLEMENTATION OF THE REQUIREMENTS IN CORRECTIVE ACTIONS A. POST DD-250 VEHICLES ARE NOT INCLUDED IN THESE INSPECTIONS COMPLETED CLOSURE STATEMENT: INSPECTIONS COMPLETE AND DC&RS CLOSED DATA IS BEING ASSESSED UNDER TASK I.E. D. ENGINEERING WILL PERFORM TESTING TO DETERMINE THE EFFECTS OF SHANKING ON PRELOAD AND FASTENER STRENGTH. COMPLETED CLOSURE STATEMENT: TEST RESULTS ARE BEING ADDRESSED UNDER CORRECTIVE ACTIONS A (REFERENCE CHANGE SUMMARY B0 1777). E CONSTRUCT A MATRIX TO IDENTIFY THE MEANS OF EXONERATING EVERY THROUGH BOLT INSTALLATION BY EFFECTIVITY. CLOSURE STATEMENT: MATRIX CONSTRUCTION IS COMPLETE. TASK II CORRECTIVE ACTIONS A. ENGINEERING ISSUED DCNS TO CORRECT DEFICIENCIES FOUND IN TASK I.A, I.B, AND I.D (REFE- RENCE CHANGE SUMMARY B0 1777). B. BASED UPON INVESTIGATIONS, IT HAS BEEN DETERMINE THAT A SPECIFIC MEASURABLE REQUIRE- MENT IS NEEDED TO PRECLUDE BOLT SHANKING AND ASSURE ADEQUATE ENGAGEMENT OF THE LOCKING FEATURE. MATERIALS ENGINEERING IS TASKED TO PROVIDE MEASURABLE REQUIREMENTS AND IMPLEMENT BY REVISION OF STP-2014. COMPLETED CLOSURE STATEMENT: STP-2014 HAS BEEN REVISED TO PROVIDE SPECIFIC PROTRUSION REQUIREMENTS (REFERENCE CHANGE SUMMARY J31020). C. A MANAGEMENT DECISION WAS MADE TO IMPLEMENT THE PROPOSED STP/PI CHANGES INTO CURRENT PRODUCTION. THIS ACTIVITY WAS DIRECTED BY OD 453231 ET/MGT-030-000 MANUFACTURING PLANNING IS TASKED TO IMPLEMENT THE OD REQUIREMENTS TO FUTURE BUILDS. COMPLETED CLOSURE STATEMENT: PLANNING HAS BEEN REVISED TO INCORPORATE THE OD REQUIREMENTS (REFERENCE INTEROFFICE MEMORANDUM 3614-86-381). D. CONTRACTS OBTAIN F0 MSFC APPROVAL EO RETROFIT MOD KITS AND CHANGE SUMMARY B01777. E. A PERSONNEL TRAINING COURSE IS REQUIRED TO ASSURE ADEQUATE UNDERSTANDING BY ALL PERSONNEL RE- GARDING CORRECT INSTALLATION OF FASTENERS. CLOSURE STATEMENT: COURSE X551 HAS BEEN ESTABLISHED AND IS SCHEDULED TO BEGIN AUGUST 17, 1987. TASK IV CAPS CLOSEOUT SUMMARY A REVIEW OF BOLT INSTALLATIONS REVEALED PROBLEMS WITH INCORRECT GRIP LENGTHS SPECIFIED ON ENGINEER- ING DRAWINGS, INADEQUATE INSPECTION REQUIREMENTS AND TRAINING OF PERSONNEL. AS A RESULT OF THESE FINDINGS, A COMPLETE TOLERANCE ANALYSIS WAS CONDUCTED BY ENGINEERING ON ALL BOLT INSTALLATIONS. DEFICIENCIES WERE CORRECTED THROUGH DCNS FOR THE APPROPRIATE DRAWINGS. INSTALLATIONS COMPLETED PRIOR TO DCN RELEASE WERE CORRECTED BY MOD KITS. A SPECIFIC MEASURABLE REQUIREMENT WAS ESTABLISHED TO VERIFY ALL BOLTS ENGAGE THE LOCKING FEATURE AND DO NOT SHANK. A PERSONNEL TRAINING COURSE WAS ALSO ESTABLISHED. THESE ACTIONS ARE DEEMED APPROPRIATE TO CLOSE THIS CAPS

MSFC Response/Concurrence

MSFC Report#	IFA#	Contractor RPT#	JSC#	KSC#	EICN#
A10693	--	S-071-1	--	--	--

Asmnt Part#	Asmnt Part Name	Asmnt Serial/Lot#
N/A	L02 FEEDLINE BOLTS	N/A

HCRIT CD	FCRIT CD	CAUSE CD	FAIL MODE
--	3	MAP - MFG-ASY-INST	UC - UNSAT

Asmnt FMEA	Asmnt FM	FMEA CSE	FMEA SCSE
N/A	N/A	N/A	N/A

Asmnt FMEA	Asmnt FM	FMEA CSE	FMEA SCSE
--	--	--	--

Asmnt FMEA	Asmnt FM	FMEA CSE	FMEA SCSE
--	--	--	--

Correlated Part#	Correlated Part#	Correlated Part#
--	--	--

Associated LRU#	Associated LRU#	Associated LRU#
--	--	--

MAJOR DESIGN CHANGES

APRV DATE	DESCRIPTION OF CHANGES
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ASSESSMENT TEXT