

WHOLE RECORD REPORT( + ADDENDUM)

<b>MSFC Record #</b> A10715	<b>In-Flight Anomaly Number</b> --	<b>Contractor Report Number</b> E-107	<b>JSC#</b> --	<b>KSC#</b> --
<b>Problem Title</b> SRB TO ORBITER WIRE HARNESS 303W07 FAILED ISOLATION RESISTANCE TEST				
<b>EICN#</b> --	<b>ELEMENT</b> ET	<b>Contractor</b> MMMSS	<b>FSCM#</b> --	<b>FCRIT</b> 1R
<b>HCRIT</b> --	<b>Sys_Lvl</b> Y	<b>Misc Codes</b> A B C D E F G H I J K L M N O		
<b>HARDWARE</b> EIM	<b>NOMENCLATURE</b> WIRE CABLE	<b>PART#</b> N/A	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> N/A
<b>HARDWARE</b> LRU	<b>NOMENCLATURE</b> N/A	<b>PART#</b> N/A	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> N/A
<b>HARDWARE</b> NCA	<b>NOMENCLATURE</b> WIRE HARNESS 303W07	<b>PART#</b> 809310003714-140	<b>SER/LOT#</b> 519	<b>MANUFACTURER</b> ITT CANON
<b>Test/Operation</b> L - FLD	<b>Prevailing Condition</b> F - FUNCTIONAL	<b>F / U</b> F	<b>Fail Mode</b> UC - UNSAT	<b>Cause</b> MAP - MFG-ASY-INST
<b>System</b> ELECTRICAL	<b>Defect</b> CN - CONTAM	<b>Material</b> E - EL C/W	<b>Work Contact</b> J. ADAMS	<b>Fail Date</b> 04/28/1987
<b>Received at MSFC</b> 05/05/1987	<b>Date Isolated</b> --	<b>FMEA Reference</b> 3.12.7.2	<b>IFA: Mission Phase</b> --	<b>Mission Elapsed Time</b> --
<b>Location</b> MAF		<b>Symptom</b> EVM - CON/MEG FAIL		<b>Time Cycle</b> --
<b>Effectivity Text</b> NONE				
<b>Vehicle Effectivity Codes</b>				
<b>Vehicle 1</b> --	<b>Vehicle 2</b> --	<b>Vehicle 3</b> --	<b>Vehicle 4</b> --	<b>Vehicle 5</b> --
<b>Mission Effectivity Codes</b>				
<b>Mssn 1</b> --	<b>Mssn 2</b> --	<b>Mssn 3</b> --	<b>Mssn 4</b> --	<b>Mssn 5</b> --
<b>Estimated Completion Dates</b>				
<b>MSFC Approved Defer Until Date</b> --	<b>Contractor Req Defer Until Date</b> --	<b>LVL 3 Close</b> --	<b>Remark / Action</b> --	
<b>Investigation / Resolution Summary</b>				
<b>Last MSFC Update</b> 02/13/1995	<b>CN RSLV SBMT</b> 07/27/1987	<b>Defer Date</b> --	<b>Add Date</b> --	<b>R/C Codes</b> 0 - EXPL -- --
<b>Assignee</b>				
<b>Design</b> P. MULLER	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> --
<b>Approval</b>				
<b>Design</b>	<b>Chief Engineer</b>	<b>S &amp; MA</b>	<b>Project</b>	<b>Project MGR</b>

P. MULLER	J. NICHOLS	R. JACKSON	M. PESSIN	--	
<b>PAC Assignee</b> J.EL-IBRAHIM	<b>PAC Review Complete</b> --	<b>MSFC Closure Date</b> 06/19/1989	<b>Status</b> C - CLOSED	<b>F/A Completion</b> --	
<b>Problem Type</b> --	<b>SEV</b> --	<b>Program Name</b> --	<b>REVL</b> --	<b>OPRINC</b> --	
<b>FUNC MOD</b> --	<b>Software Effectivity</b> -- - - - - -	<b>Software Fail CD</b> --		<b>SUBTYPE</b> --	<b>Software Closure CD</b> --
<b>RES PERSON L2</b> --	<b>Approval Signature L3</b> --				
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Contractor Status Summary</b>					
<b>Reliability/Quality Assurance Concerns, Recommendations:</b>					
<b>Problem Description</b>  SRB TO ORBITER WIRE HARNESS FAILED THE ELECTRICAL ISOLATION RESISTANCE FIRST IN-PROCESS TEST AFTER ASSEMBLY. THE RESISTANCE BETWEEN PINS "U" AND "T" OF CONNECTOR J12 WAS LESS THAN THE REQUIRED VALUE OF 100 MEGOHMS AT 500 DC AND 2 MEGOHMS AT 1500 VDC. ALSO, A SIMILAR FAILURE OCCURRED BETWEEN PINS "K" AND "L". REF: MARS T-92270, T-88154 AND T-82793					
<b>Contractor Investigation/Resolution</b>  WIRE HARNESSES MUST UNDERGO THE FIRST IN-PROCESS ELECTRICAL TEST AFTER ASSEMBLY FOR PASS/FAIL INDICATIONS. THE FAILURE WAS TRACED TO LOW ISOLATION RESISTANCE ON THE CONNECTOR INSERT. FAILURE ANALYSIS OF THE DEFECTIVE CONNECTOR FOUND CONTAMINATION IN THE PHENOLIC PLASTIC INSERT WHICH CAUSED THE FAILURE. THE CONTAMINATION HAD BEEN MOLDED INTO THE INSERT DURING MANUFACTURE AT THE CONNECTOR VENDOR. BOTH OF THE DEFECTIVE CONNECTORS WERE ASSEMBLED BY TIME ELECTRONICS WEST FROM COMPONENTS MANUFACTURED BY ITT CANNON. THE PART NUMBERS AND LOT CODES OF BOTH CONNECTORS WERE THE SAME: P/N NB0E22-55PWT, LOT CODE 9K5798245-49. THE DEFECTIVE CONNECTOR WILL BE REMOVED FROM THE WIRE HARNESS WHICH FAILED, MARS T-92270, AND PLACED ON A COMPONENT LEVEL MARS. AT THAT POINT, A FAILURE ANALYSIS WILL BE PERFORMED. ECD: DEPENDENT UPON AVAILABILITY OF THE CONNECTOR. THE PART HAS NOT YET BEEN REMOVED FROM HARNESS.THIS SRB TO ORBITER WIRE HARNESS DOES NOT CONSTRAIN FUTURE LAUNCHES FOR THE FOLLOWING REASON: THE FAILURE WAS DETECTED DURING THE FIRST IN-PROCESS TEST AFTER COMPLETION OF THE WIRE					

HARNESS ASSEMBLY. THIS STATEMENT WAS COORDINATED WITH: ET CHIEF DESIGN ENGINEER JACK NICHOLS (SIGNED) J. NICHOLS ET ACTING PROJECT MANAGER H HALLISEY (SIGNED) H. HALLISEY 7/27/87 CLOSURE UPDATE - FAILURE ANALYSIS T-92269 WAS PERFORMED ON THE CONNECTOR REMOVED FROM THE WIRE HARNESS WHICH WAS DOCUMENTED ON MARS T-92270 FOR THE ACCEPTANCE TEST FAILURE THE CAUSE OF THE FAILURE WAS CONTAMINATION MOLDED INTO THE HARD PLASTIC INSULATING INSERT OF THE CONNECTOR. THE CONTAMINATION OCCURRED DURING THE MANUFACTURING STEPS PERFORMED BY ITT CANNON. MARTIN MARIETTA HAD RECEIVED 26 CONNECTORS OF THIS TYPE AND LOT CODE. THE LOT CODE INDICATES THAT THE CONNECTORS WERE ASSEMBLED IN THE SECOND WEEK OF NOVEMBER, 1982 THREE CONNECTORS OF THIS LOT CODE REMAINED IN STOCK AT MAF AT THE TIME OF THE COMPLETION OF THE FAILURE ANALYSIS IN TASK I. THE THREE CONNECTORS WERE DOCUMENTED ON MARS T-93853 WHICH WAS DISPOSITIONED "SCRAP". GIDEP ALERT MMC-ET-RA07B-27 WAS WRITTEN JULY 8, 1987 FOR THE CONTAMINATED CONNECTOR INSERT. CLOSURE SUMMARY: THE HARNESS ASSEMBLY FAILED ACCEPTANCE TEST DUE TO A DEFECTIVE CONNECTOR, WHICH WAS LATER REPLACED. ALL CONNECTORS REMAINING IN STOCK, WITH THE SAME LOT CODE, WERE SCRAPPED. A GIDEP ALERT WAS PROPOSED FOR THE CONNECTORS. THERE ARE NO CONCERNS FOR COMPLETED FLIGHT HARDWARE USING OTHER CONNECTORS FROM THE SAME LOT AS THEY HAVE PASSED THE ACCEPTANCE TESTS WHICH FOUND THIS DEFECT  
THIS PROBLEM IS CONSIDERED CLOSED

#### MSFC Response/Concurrence

#### ASSESSMENT ADDENDUM REPORT

<b>MSFC Report#</b> A10715	<b>IFA#</b> --	<b>Contractor RPT#</b> E-107	<b>JSC#</b> --	<b>KSC#</b> --	<b>EICN#</b> --
<b>Asmnt Part#</b> 809310003714-140	<b>Asmnt Part Name</b> WIRE HARNESS	<b>Asmnt Serial/Lot#</b> 519			
<b>HCRIT CD</b> --	<b>FCRIT CD</b> 1R	<b>CAUSE CD</b> MAP - MFG-ASY-INST	<b>FAIL MODE</b> UC - UNSAT		
<b>Asmnt FMEA</b> 3.12.7.2	<b>Asmnt FM</b> 2	<b>FMEA CSE</b> E	<b>FMEA SCSE</b> 4		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Correlated Part#</b> --	<b>Correlated Part#</b> --	<b>Correlated Part#</b> --			
<b>Associated LRU#</b> --	<b>Associated LRU#</b> --	<b>Associated LRU#</b> --			
<b>MAJOR DESIGN CHANGES</b>					
<b>APRV DATE</b> --	<b>DESCRIPTION OF CHANGES</b> --				
<b>ASSESSMENT TEXT</b>					

WHOLE RECORD REPORT( + ADDENDUM)

<b>MSFC Record #</b> A10721	<b>In-Flight Anomaly Number</b> --	<b>Contractor Report Number</b> S-071-2	<b>JSC#</b> --	<b>KSC#</b> --
<b>Problem Title</b> L02 FEEDLINE BOLTS DID NOT MEET THE TWO THREAD PROTRUSION ON LWT 35				
<b>EICN#</b> --	<b>ELEMENT</b> ET	<b>Contractor</b> MMMSS	<b>FSCM#</b> --	<b>FCRIT</b> 3
<b>HCRIT</b> --	<b>Sys_Lvl</b> N	<b>Misc Codes</b> A B C D E F G H I J K L M N O		
<b>HARDWARE</b> EIM	<b>NOMENCLATURE</b> EXTERNAL TANK	<b>PART#</b> 80901010000	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> MMC
<b>HARDWARE</b> LRU	<b>NOMENCLATURE</b> EXTERNAL TANK	<b>PART#</b> 80901010000	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> MMC
<b>HARDWARE</b> NCA	<b>NOMENCLATURE</b> L02 FEEDLINE BOLTS	<b>PART#</b> N/A	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> N/A
<b>Test/Operation</b> L - FLD	<b>Prevailing Condtion</b> F - FUNCTIONAL	<b>F / U</b> UC	<b>Fail Mode</b> UC - UNSAT	<b>Cause</b> MN - MFG-ISP
<b>System</b> PROPULSION	<b>Defect</b> MA - ME ADJ	<b>Material</b> L - FASTNR	<b>Work Contact</b> C. CAMPBELL	<b>Fail Date</b> 11/05/1986
<b>Received at MSFC</b> 04/22/1987	<b>Date Isolated</b> --	<b>FMEA Reference</b> 2.X.X.X	<b>IFA: Mission Phase</b> --	<b>Mission Elapsed Time</b> --
<b>Location</b> MAF		<b>Symptom</b> UC - UNSAT		<b>Time Cycle</b> --
<b>Effectivity Text</b> LWTS 16, 20, 21, 22, 24/SUBS				
<b>Vehicle Effectivity Codes</b>				
<b>Vehicle 1</b> --	<b>Vehicle 2</b> --	<b>Vehicle 3</b> --	<b>Vehicle 4</b> --	<b>Vehicle 5</b> --
<b>Mission Effectivity Codes</b>				
<b>Mssn 1</b> --	<b>Mssn 2</b> --	<b>Mssn 3</b> --	<b>Mssn 4</b> --	<b>Mssn 5</b> --
<b>Estimated Completion Dates</b>				
<b>MSFC Approved Defer Until Date</b> --	<b>Contractor Req Defer Until Date</b> --	<b>LVL 3 Close</b> --	<b>Remark / Action</b> --	
<b>Investigation / Resolution Summary</b>				
<b>Last MSFC Update</b> 01/10/1992	<b>CN RSLV SBMT</b> 08/22/1987	<b>Defer Date</b> --	<b>Add Date</b> --	<b>R/C Codes</b> 2 - MFG -- --
<b>Assignee</b>				
<b>Design</b> J. WHITE	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> --
<b>Approval</b>				
<b>Design</b> --	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> --

<b>PAC Assignee</b> J.EL-IBRAHIM	<b>PAC Review Complete</b> JE	<b>MSFC Closure Date</b> 09/24/1987	<b>Status</b> C - CLOSED	<b>F/A Completion</b> --	
<b>Problem Type</b> --	<b>SEV</b> --	<b>Program Name</b> --	<b>REVL</b> --	<b>OPRINC</b> --	
<b>FUNC MOD</b> --	<b>Software Effectivity</b> -- - - - - -	<b>Software Fail CD</b> --		<b>SUBTYPE</b> --	<b>Software Closure CD</b> --
<b>RES PERSON L2</b> --	<b>Approval Signature L3</b> --				
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Contractor Status Summary</b>					
<b>Reliability/Quality Assurance Concerns, Recommendations:</b>					
<b>Problem Description</b>  DURING INSPECTION OF THE LWT 35, 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					
<b>Contractor Investigation/Resolution</b>  R/C: 1) PRODUCTION - MMC HAS REVISED STP 2014 TO PROVIDE SPECIFIC PROTRUSION REQUIREMENTS AND PLANNING HAS BEEN REVISED TO IMPLEMENT OD 453231. A PERSONNEL TRAINING COURSE WAS ALSO ESTABLISHED. 2) FLEET - RETROFIT MOD. KITS AND CHANGE SUMMARY BO 1777 HAS BEEN ISSUED. THIS PROBLEM IS NOT A LAUNCH CONSTRAINTS. REQUIRED RETROFIT WILL BE ACCOMPLISHED BY CONTRACT MOD KIT (BO 1777). TASK I FAILURE/PROBLEM INVESTIGATION DURING INSPECTION OF LWTS 33 AND 35, 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 BEING 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 APPROXIMATELY 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 INSTALLATIONS BUILT PRIOR TO IMPLEMENTATION OF THE REQUIREMENTS IN CORRECTIVE ACTIONS C. 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 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. (REFERENCE CHANGE SUMMARY B0 1777). B. BASED UPON INVESTIGATIONS, IT HAS BEEN DETERMINE THAT A SPECIFIC MEASURABLE REQUIREMENT 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 EO MSFC APPROVAL FOR RETROFIT MOD KITS AND CHANGE SUMMARY B01777. E. A PERSONNEL TRAINING COURSE IS REQUIRED TO ASSURE ADEQUATE UNDERSTANDING BY ALL PERSONNEL REGARDING 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 ENGINEERING 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**

<b>MSFC Report#</b> A10721	<b>IFA#</b> --	<b>Contractor RPT#</b> S-071-2	<b>JSC#</b> --	<b>KSC#</b> --	<b>EICN#</b> --
<b>Asmnt Part#</b> N/A	<b>Asmnt Part Name</b> L02 FEEDLINE BOLTS	<b>Asmnt Serial/Lot#</b> N/A			
<b>HCRIT CD</b> --	<b>FCRIT CD</b> 3	<b>CAUSE CD</b> MAP - MFG-ASY-INST	<b>FAIL MODE</b> UC - UNSAT		
<b>Asmnt FMEA</b> N/A	<b>Asmnt FM</b> N/A	<b>FMEA CSE</b> N/A	<b>FMEA SCSE</b> N/A		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Correlated Part#</b> --	<b>Correlated Part#</b> --	<b>Correlated Part#</b> --			
<b>Associated LRU#</b> --	<b>Associated LRU#</b> --	<b>Associated LRU#</b> --			
<b>MAJOR DESIGN CHANGES</b>					
<b>APRV DATE</b> --	<b>DESCRIPTION OF CHANGES</b> --				
<b>ASSESSMENT TEXT</b>					

WHOLE RECORD REPORT( + ADDENDUM)

<b>MSFC Record #</b> A10781	<b>In-Flight Anomaly Number</b> --	<b>Contractor Report Number</b> S-073	<b>JSC#</b> --	<b>KSC#</b> --
<b>Problem Title</b> SELF-LOCKING HIGH PROFILE NUT HAS LOW TORQUE COEFFICIENT				
<b>EICN#</b> --	<b>ELEMENT</b> ET	<b>Contractor</b> MMSS	<b>FSCM#</b> --	<b>FCRIT</b> 1
<b>HCRIT</b> 3	<b>Sys_Lvl</b> Y	<b>Misc Codes</b> A B C D E F G H I J K L M N O		
<b>HARDWARE</b> EIM	<b>NOMENCLATURE</b> N/A	<b>PART#</b> N/A	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> N/A
<b>HARDWARE</b> LRU	<b>NOMENCLATURE</b> N/A	<b>PART#</b> N/A	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> N/A
<b>HARDWARE</b> NCA	<b>NOMENCLATURE</b> HIGH PROFILE NUT	<b>PART#</b> 33L2	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> SPS
<b>Test/Operation</b> L - FLD	<b>Prevailing Condtion</b> F - FUNCTIONAL	<b>F / U</b> UC	<b>Fail Mode</b> UC - UNSAT	<b>Cause</b> MAP - MFG-ASY-INST
<b>System</b> PROPULSION	<b>Defect</b> CN - CONTAM	<b>Material</b> L - FASTNR	<b>Work Contact</b> C. VOGEL	<b>Fail Date</b> 05/25/1987
<b>Received at MSFC</b> 06/03/1987	<b>Date Isolated</b> --	<b>FMEA Reference</b> 2.X.X.X	<b>IFA: Mission Phase</b> --	<b>Mission Elapsed Time</b> --
<b>Location</b> MAF		<b>Symptom</b> UC - UNSAT		<b>Time Cycle</b> --
<b>Effectivity Text</b> LWTS 16, 20, 21, 22, 24 AND UP				
<b>Vehicle Effectivity Codes</b>				
<b>Vehicle 1</b> --	<b>Vehicle 2</b> --	<b>Vehicle 3</b> --	<b>Vehicle 4</b> --	<b>Vehicle 5</b> --
<b>Mission Effectivity Codes</b>				
<b>Mssn 1</b> --	<b>Mssn 2</b> --	<b>Mssn 3</b> --	<b>Mssn 4</b> --	<b>Mssn 5</b> --
<b>Estimated Completion Dates</b>				
<b>MSFC Approved Defer Until Date</b> --	<b>Contractor Req Defer Until Date</b> --	<b>LVL 3 Close</b> --	<b>Remark / Action</b> --	
<b>Investigation / Resolution Summary</b>				
<b>Last MSFC Update</b> 01/10/1992	<b>CN RSLV SBMT</b> 10/13/1987	<b>Defer Date</b> --	<b>Add Date</b> --	<b>R/C Codes</b> 2 - MFG -- --
<b>Assignee</b>				
<b>Design</b> J. WHITE	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> --
<b>Approval</b>				
<b>Design</b> --	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> --



<b>PAC Assignee</b> J.EL-IBRAHIM	<b>PAC Review Complete</b> JE	<b>MSFC Closure Date</b> 11/04/1987	<b>Status</b> C - CLOSED	<b>F/A Completion</b> --	
<b>Problem Type</b> --	<b>SEV</b> --	<b>Program Name</b> --	<b>REVL</b> --	<b>OPRINC</b> --	
<b>FUNC MOD</b> --	<b>Software Effectivity</b> -- - - - - -	<b>Software Fail CD</b> --		<b>SUBTYPE</b> --	<b>Software Closure CD</b> --
<b>RES PERSON L2</b> --	<b>Approval Signature L3</b> --				
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Contractor Status Summary</b>					
<b>Reliability/Quality Assurance Concerns, Recommendations:</b>					
<b>Problem Description</b>  HIGH PROFILE, SELF-LOCKING NUTS SUPPLIED BY SPS SHOW TORQUE COEFFICIENTS SIGNIFICANTLY LOWER THAN THE INDUSTRY TYPICAL IN SOME SIZES IN THE 33L2 SERIES. A LOW TORQUE COEFFICIENT RESULTS IN A THAN NORMAL PRELOAD BEING APPLIED TO THE BOLT WHEN THE BOLT IS INSTALLED TO SPECIFIED TORQUE					
<b>Contractor Investigation/Resolution</b>  R/C - THE ENTIRE FLEET AND INVENTORY SHALL BE INSPECTED FOR SUSPECT SPS NUTS. WHERE FOUND, RE- PLACEMENT SHALL BE MADE. INCOMING HARDWARE SHALL BE SUBJECTED TO SAMPLE TESTING AT MAF. AND, COR- RECTIVE ACTION WAS TAKEN AT THE SUPPLIER OF THE DISCREPANT NUTS. THE PROBLEM WITH A LOW TORQUE COEFFICIENT, K, ON THE SPS NUTS WAS DISCOVERED DURING ANALYSIS CON- DUCTED ON BOLT SHANKING BY CAPS S-071 (A10693). BOLT-NUT COMBINATIONS WERE BEING TESTED TO ANALYZE SHANKING AND UNEXPECTED FAILURES WERE SEEN. THE FAILURES WERE ISOLATED TO SPS NUTS AND SUBSEQUENTLY ISOLATED TO ITS CADMIUM PLATING BY PRELIMINARY ANALYSIS TESTS WERE CONDUCTED BY WHICH THE CADMIUM PLATING ON SPS NUTS WERE REMOVED THEN THE NUTS WERE REPLATED BY A DIFFERENT VENDOR. THE REPLATED NUTS HAD NORMAL TORQUE COEFFICIENTS. THE SAME TEST WAS CONDUCTED CONCURRENTLY ON NUTS SUPPLIED BY OTHER VENDORS, VOI-SHAN AND VALLEY TODECO. THE TORQUE COEFFICIENTS (VIO-SHAN AND VALLEY TODECO)WERE IN THE TYPICAL RANGE BEFORE AND AFTER REPLATING. FURTHER ANALYSIS OF THE CAUSE FOR LOW TORQUE COEFFICIENTS DETERMINED THAT THE CAUSE WAS NOT 23 WITH THE CADMIUM PLATE. RATHER, IT WAS A CONTAMINANT OR COATING OF POLYETHELENE GLYCOL ON THE SUR- FACE OF THE NUT (REFERENCE TASK I.C OF					

THIS CAPS). THE FOLLOWING TASKS HAVE BEEN ASSIGNED IN AN EFFORT TO RESOLVE THE PROBLEM: TASK I FAILURE/PROBLEM INVESTIGATION A. DETERMINE CRITICAL PROBLEM AREAS ENGINEERING SHALL DETERMINE WHICH APPLICATIONS OF SPS NUTS ARE OUTSIDE ACCEPTABLE MARGINS OF SAFETY. ANALYSIS SHALL UTILIZE EMPIRICAL DATA OBTAINED ON EACH SIZE 33L2 SPS NUT. CLOSURE STATEMENT THE FOLLOWING LOCATIONS HAVE BEEN IDENTIFIED AS AREAS OF CONCERN IF SPS NUTS WITH CARBOWAX ARE INSTALLED (REFERENCE INTEROFFICE MEMORANDUMS 3521-87-046 AND 3511-87-026): LH2 SIPHON SUPPORT 80924901908 (16) 33L2-5 GH2 PRESSLINE FLANGE 80921021009 (56) 33L2-5 \*\* LH2 FEEDLINE FLANGE (INTERNAL) 80924901908 (36) 33L2-6 OR 80924901916 \*\* L02 FEEDLINE FLANGE 80921011009 (252) 33L2-6 \*\* GH2 VENT VALVE/LINE 80921021309 (12) 33L2-6 L02 FEEDLINE OUTLET 80921111900 (44) 33L2-7 DIAGONAL STRUT FLANGE 80911031780 (10) 33L2-10 THRUST STRUT - END FLANGE 80911071790 (48) 33L2-10 \*\* ALL 33L2-6 NUTS EXONERATED BY INSPECTION, REFERENCE INTEROFFICE MEMORANDUM 3741-87-108. B. EVALUATION OF TORQUE COEFFICIENTS ENGINEERING SHALL DETERMINE THE TORQUE COEFFICIENT RANGE ON EACH SIZE 33L2 SPS NUT IN STOCK AT MAF VERSUS VOI-SHAN AND VALLEY TODECO NUTS. IDENTIFY THOSE APPLICATIONS THAT HAVE TORQUE COEF- FICIENTS THAT ARE BELOW EXPECTED TYPICALS. CLOSURE STATEMENT TESTS WERE CONDUCTED ON SPS NUTS OF THE FOLLOWING SIZES: 33L2-3, -5, -6, -7, -8, -9, -10, AND -14. TORQUE COEFFICIENTS WERE LOW ON 33L2-3, -5, AND -8 FOR THE SAMPLES TESTED (REFERENCE MAY 4, 1987, PRESENTATION BY D. DEEL "BOLT TORQUE/PRELOAD ASSESSMENT"). C METALURGICAL ANALYSIS CONDUCT A METALURGICAL/CHEMICAL ANALYSIS TO DETERMINE THE DIFFERENCES BETWEEN SPS NUTS VERSUS VOI-SHAN AND VALLEY TODECO. THE ANALYSIS SHALL INCLUDE THE FOLLOWING: O ESCA/AES (SURFACE LAYERS) O STANDARD CHEMICAL (BASE METAL) O STANDARD METALURGICAL (CROSS-SECTION) O FTIR/GC (SURFACE LAYERS) CLOSURE STATEMENT ANALYSIS DETERMINED THAT THERE WAS A CONTAMINATION LAYER OF POLYETHYLENE GLYCOL (CARBOWAX) ON SPS 33L2-3, -5, AND -8 NUTS. NO SUCH CONTAMINATION WAS FOUND ON SAMPLES OF OTHER SIZES SPS OR OTHER VENDOR'S NUTS. REMOVAL OF THE SURFACE CONTAMINATION BY VAPOR DEGREASING PRODUCED AN ACCEPTABLE TORQUE COEFFICIENT (WITHIN TYPICAL RANGE) AS VERIFIED ON SPS 33L2-8 NUTS. SUCH REMOVAL ALSO RESULTED IN A CHANGE IN RUNNING OR LOCKING TORQUE (REFERENCE LAB REPORT NO. 87A207). D. EFFECTS OF TORQUE COEFFICIENT WITH RANGE OF TORQUE COEFFICIENTS FOUND DURING TESTING, DETERMINE THAT ALL FLIGHT INSTALLATIONS MEET DESIGN REQUIREMENTS CLOSURE STATEMENT ENGINEERING REVIEWED THE REQUIREMENTS OF DESIGN AND DETERMINED THAT THE CURRENT FLIGHT INSTAL- LATION METHODS, WITH THE KNOWN RANGE OF TORQUE CO-EFFICIENTS, MEET DESIGN REQUIREMENTS REFERENCE INTEROFFICE MEMORANDUM 3521-87-061. E. VERIFICATION OF USAGE OF SPS NUTS INVESTIGATION HAS ALREADY BEEN MADE INTO USAGE OF ALL 33L2 SERIES NUTS SUPPLIED SPS. PROVIDE RECORDS OF ALL OTHER NUTS SUPPLIED BY SPS. INCLUDE DATE AND QUANTITY. CLOSURE STATEMENT LIST OF ALL NUTS SUPPLIED BY SPS PROVIDED WITH PURCHASE ORDER NUMBER AND QUANTITY. BY SIZE, THE NUTS ARE: 33L1-04, -08, -3, -4, -8, -10, -12; 33L2-3, -5, -5S, -6, -7, -8, -9, -10, -12, -14, -20, -20S; 33L3-06, -08, -3, -4, -5; 33L4-3, -4; 33L8C4; 33L9-08, -3, -4, -5; 33L13-1; 33L14-8, -12; 3315-3. -6; 33L19-9 (REFERENCE INTEROFFICE MEMORANDUM 3760-87-157 WITH AT- TACHMENTS). 6/12/87 STATUS UPDATE- UPGRADED CRIT TO 1 AND A LAUNCH CONSTRAINT FOR 61-M. THIS STATUS UPDATE WAS COORDINATED WITH \_\_\_\_\_ MR. G. P. BRIDWELL - ET PROJECT MANAGER \_\_\_\_\_ MR. J. NICHOLS - CHIEF ENGINEER 9/4/87 STATUS UPDATE (PRB) - LIFTED LAUNCH CONSTRAINTS WITH THE RATIONALE AS FOLLOWS "INSPECTION AND/OR REPAIR SHALL BE MADE REFERENCE DC&RS S-87-004A, S-87-005A, AND S-87-008." THE ABOVE STATEMENT HAS BEEN APPROVED BY: \_\_\_\_\_ G. P. BRIDWELL - ET PROJECT MANAGER \_\_\_\_\_ J NICHOLS ET CHIEF ENGINEER 10/14/87 - CLOSURE UPDATE - REFERENCE CAPS S-073 REVISION "C". THE FOLLOWING IS A CONTINUATION OF TASK I FAILURE/PROBLEM INVESTIGATION: F. L02 COMPATIBILITY OF POLYETHYLENE

GLYCOL 1. EVALUATE THE AFFECT OF THE TANK CLEANING CYCLE AND SUBASSEMBLY CLEANING PER PI 5008. 2. IDENTIFY ALL ADDITIONAL NUTS INSIDE THE L02 TANK OR OTHER AREAS IN CONTACT WITH L02. CLOSURE STATEMENT ALL 33L1 AND 33L2 NUTS INSIDE THE L02 TANK HAVE BEEN IDENTIFIED (REFERENCE INTEROFFICE MEMORANDUM FROM J. MCALLISTER TO C VOGEL, DATED JUNE 29, 1987). G. EVALUATE NEW INSPECTION EVALUATE AND DETERMINE THE FEASIBILITY OF DEVELOPING A CONTACT METHOD FOR DETERMINING WHETHER INSTALLED NUTS ARE CONTAMINATED WITH POLYETHYLENE GLYCOL (CARBOWAX). THE METHOD BEING CONSIDERED SHALL BE CAPABLE OF INSPECTING L02 CLEANED NUTS, AS WELL AS EXTERNAL NUTS THAT ARE NOT COVERED BY TPS. H. REVIEW OF SPS PROCESS 1. EVALUATE SPS PROCESSES TO DETERMINE IF THERE IS ANY RECORD OF APPLICATION OF CARBOWAX ON 33L2 OR 33L1 NUTS. DETERMINE WHAT FORMAL OR INFORMAL CRITERIA GOVERNS ITS APPLICATION AT SPS. DETERMINE WHAT OTHER NUTS MAY ALSO HAVE IT APPLIED DETERMINE WHEN IT OR A SIMILAR PRODUCT WAS FIRST BROUGHT INTO USE AT SPS. CLOSURE STATEMENT NO RECORD IS KEPT OF APPLICATION OF CARBOWAX SPS LISTS "NO LUBRICATION" ON THE BLUEPRINT USED FOR MANUFACTURING AND INSPECTION. NO RECORDS SHOW CARBOWAX APPLIED. NO RECORD REFLECTS WHEN CARBOWAX WAS FIRST BROUGHT INTO USE (REFERENCE INTEROFFICE MEMORANDUM 3760-87-157, WITH ATTACHMENTS). ITEM CLOSED 2. AN MMC TEAM VISITED SPS ON JUNE 17, 1987, FOR EVALUATION OF NUT FABRICATION PROCESS. DURING THE VISIT, IT WAS DETERMINED THAT THE CARBOWAX WAS APPLIED TO THE 33L2 NUT IN A RANDOM MANNER, AND THE MANUFACTURING PLANNING DID NOT INCLUDE A SPECIFIC EXCLUSION OF CARBOWAX ON THE 33L2 NUTS. THE PLANNING PAPER DID INCLUDE A "NO CARBOWAX STATEMENT" FOR THE 33L1 NUTS. THEREFORE, SPS SHALL REVIEW THEIR HISTORY DATA FILES TO DETERMINE THAT THE PLANNING PAPER HAS NOT CHANGED FOR THE 33L1 AND 33L2 NUTS AND PROVIDE A WRITTEN REPORT. CLOSURE STATEMENT ALL 33L1 PROCESSING SHEETS AND MANUFACTURING DRAWINGS SINCE INITIAL MANUFACTURING RUN STATED "NO CARBOWAX", AND A SPECIFIC BUYOFF POINT EXISTED FOR APPLICATION OF LUBRICANT ON ALL INSPECTION RECORDS. NONE OF THE INSPECTION RECORDS HAD A BUYOFF INDICATING THAT LUBRICANT WAS APPLIED. ALSO, EXONERATED ARE 33L2-5S, -20S, AND 33L14 NUTS (REFERENCE INTEROFFICE MEMORANDUM 3741-87-090, AND REPLY TO SCAD-87-145). 3. REVIEW OF SPS PURCHASE ORDER AND RECEIVING RECORDS INDICATES THAT ONLY ONE PURCHASE AND SHIPMENT OF 33L2-6 NUTS WAS EVER MADE. A QUANTITY OF SPS 33L2-6 NUTS STILL EXISTS AT MAF FROM PRODUCTION STORES (CURRENTLY SEQUESTERED). ANALYZE A SAMPLE OF THE 33L2-6 NUTS FOR EVIDENCE OF CARBOWAX. CLOSURE STATEMENT NO EVIDENCE OF CARBOWAX WAS FOUND ON THE 33L2-6 SPS NUTS, FTIR ANALYSIS AND TORQUE TESTS WERE PERFORMED (REFERENCE LAB REPORT #87N293). RELIABILITY ASSURANCE HAS EXONERATED ALL 33L2-6 SPS NUTS BASED UPON THE EVIDENCE THAT NO CARBOWAX WAS EVER APPLIED TO THOSE NUTS (REFERENCE INTEROFFICE MEMORANDUM 3741-87-108). I. REVIEW OF MOD KITS AND HARDWARE SUPPLIED TO VENDORS 1. REVIEW MATERIAL LISTS FOR ALL MOD KITS. MAKE RECORD OF 33L2 AND 33L1 NUT APPLICATIONS SPECIFYING SIZE AND SPECIFIC LOCATION CLOSURE STATEMENT A LIST OF 33L2 AND 33L1 NUTS WITH SPECIFIC MOD KIT ALLOCATION WAS PROVIDED (REFERENCE INTEROFFICE MEMORANDUM 3543-87-024) 2. REVIEW MATERIAL LISTS FOR ALL HARDWARE SUPPLIED TO VENDORS. MAKE RECORD OF 33L2 AND 33L1 NUT APPLICATIONS SPECIFYING SIZE AND SPECIFIC LOCATION. CLOSURE STATEMENT LIST PROVIDED FOR ALL 33L1 AND 33L2 NUTS SHIPPED TO VENDORS. LIST INCLUDES THE FOLLOWING SIZES: 33L1-04, -08, -3, -4, -6; 33L2-3, -6, -8, -20S (REFERENCE DATA SHEET). ITEM CLOSED 3 REVIEW MATERIAL LISTS FOR SHIP LOOSE HARDWARE. MAKE RECORD OF 33L2 AND 33L1 NUT APPLICATIONS SPECIFYING SIZE AND SPECIFIC LOCATION. CLOSURE STATEMENT LIST WAS PROVIDED WITH ALL LOCATIONS WHERE 33L2 NUTS ARE USED IN SHIP LOOSE HARDWARE. 33L1 NUTS WERE EXCLUDED BECAUSE THEY WERE EXONERATED. IT WAS DETERMINED THAT 33L2-5 AND -10 NUTS ARE USED IN THE BIPOD ASSEMBLY KIT, 33L2-4 ARE USED IN THE SRB FAIRING INSTALLATION KIT BUT SPS HAS NEVER SUPPLIED 33L2-4 NUTS (REFERENCE INFORMAL MEMORANDUM FROM J. MCALLISTER TO C. VOGEL, DATED JULY 13, 1987). TASK II CORRECTIVE ACTIONS A. PURGE OF INVENTORY STORES AND PRODUCTION 1. ALL SPS 33L1 AND 33L2 NUTS SHALL BE PURGED FROM INVENTORY AND PRODUCTION

STORES. CLOSURE STATEMENT INVENTORY AND PRODUCTION STORES PURGED OF ALL SPS NUTS OF EVERY TYPE AND SIZE (REFERENCE INTEROFFICE MEMORANDUMS 3724-87-078 AND 3762-87-025A). 2. PURGE ALL 33L1 AND 33L2 NUTS FROM PRODUCTION STAGING AREAS AND FROM LOOSE HARDWARE HELD ON THE FLOOR. ISSUE A MEMORANDUM STATING THAT ALL 33L1 AND 33L2 NUTS HELD IN UNOFFICIAL AREAS (E.G., TOOL BOXES) SHALL BE TURNED IN TO QUALITY CONTROL. CLOSURE STATEMENT 33L1 AND 33L2 NUTS HAVE BEEN PURGED FROM STAGING AREAS AND A LETTER HAS BEEN DISPERSED BY WHICH LOOSE HARDWARE HELD ON THE FLOOR HAS BEEN PURGED OF ALL SPS 33L1 AND 33L2 NUTS (REFERENCE INTEROFFICE MEMORANDUM 3630-87-23). B. SPS NUTS ON PRE-DD250 TANKS AND SUBASSEMBLIES GENERATE A DC&R TO ADDRESS THE POSSIBLE INSTALLATION OF SPS NUTS ON ALL TANKS AND SUBASSEMBLIES PRE-DD250. THE DC&R SHALL ADDRESS THOSE NUTS SPECIFICALLY IDENTIFIED BY ENGINEERING IN TASK I.A FOR LOW FACTOR OF SAFETY. CLOSURE STATEMENT DC&RS S-87-004 AND S-87-008 HAVE BEEN WRITTEN TO ADDRESS SPS NUTS ON ALL PRE-DD250 TANKS AND SUBASSEMBLIES. C. SPS NUTS ON POST-DD250 TANKS GENERATE A DC&R TO ADDRESS THE POSSIBLE INSTALLATION OF SPS NUTS ON ALL TANKS POST DD250. THE DC&R SHALL ADDRESS THOSE NUTS SPECIFICALLY IDENTIFIED BY ENGINEERING IN TASK I.A FOR LOW FACTOR OF SAFETY. CLOSURE STATEMENT DC&R S-87-005 HAS BEEN WRITTEN TO ADDRESS SPS NUTS ON ALL POST-DD250 TANKS. D. VENDOR IDENTIFICATION ON NUTS EVALUATE IMPOSING THE REQUIREMENT FOR VENDORS TO APPLY THEIR VENDOR IDENTIFICATION TO ALL NUTS. CLOSURE STATEMENT THE QUALITY RECEIVING ACCEPTANCE PLAN HAS BEEN REVISED TO REQUIRE VERIFICATION OF VENDOR ID ON THE NUTS (REFERENCE INTEROFFICE MEMORANDUM 3743-87-097). ITEM CLOSED E. REVISION TO QUALITY RECEIVING ACCEPTANCE PLAN THE RECEIVING ACCEPTANCE PLAN SHALL BE REVISED TO INCLUDE INSPECTION FOR LUBRICATION APPLIED TO NUTS AND BOLTS, IN ANY SERIES THAT SPECIFIES NO LUBRICATION. CLOSURE STATEMENT RAPS (RECEIVING ACCEPTANCE PLAN) HAVE BEEN REVISED TO CHECK FOR THE PRESENCE OF LUBRICATION BY LABORATORY ANALYSIS ON ALL NUTS WHERE "NO LUBRICATION" IS REQUIRED (REFERENCE INTEROFFICE MEMORANDUMS 3743-87-074 AND 3743-87-097). F. INITIATION OF NOTIFYING DOCUMENTS 1. INITIATE A SUPPLIER CORRECTIVE ACTION DIRECTION (SCAD) TO SPS CONCERNING THE PROBLEM WITH POLYETHYLENE GLYCOL (CARBOWAX) APPLIED TO NUTS THAT REQUIRE NO LUBRICATION. CLOSURE STATEMENT SCAD-87-145 WAS ISSUED. ALL 33L2 PROCESSING SHEETS AND MANUFACTURING DRAWINGS HAVE BEEN REVISED TO STATE "NO CARBOWAX". ALL 33L PARTS ARE NOW SUBJECTED TO AN ADDITIONAL SAMPLE TEST TO VERIFY THE NON-PRESENCE OF CARBOWAX. AND, THE MATERIAL HANDLING OF THE NUTS HAVE BEEN IMPROVED WITH A NEW INSPECTION/TEST AREA TO PRECLUDE INCIDENTAL CONTACT WITH CARBOWAX. REFERENCE SCAD 87-145 ITEM CLOSED 2. INITIATE AN ALERT CONCERNING 33L2 SERIES NUTS FROM SPS. CLOSURE STATEMENT ALERT NO. MMC-ET-RA07B-26 WAS ISSUED. G. INSPECTION CRITERIA FOR RECEIVING ACCEPTANCE PLAN DEFINE AN INSPECTION CRITERIA FOR THE EVIDENCE OF LUBRICANT APPLIED TO NUTS AND BOLTS, WHERE ENGINEERING REQUIREMENTS SPECIFY NO LUBRICANT. CLOSURE STATEMENT TESTING FOR LUBRICANTS, CARBOWAX, SHALL TAKE PLACE BY ORGANIC CHEMICAL ANALYSIS. REFERENCE INTEROFFICE MEMORANDUM 3772-87-171. ITEM CLOSED H. PURGE OF OFF-SITE INVENTORY ALL SPS NUTS, 33L2, SHALL BE PURGED FROM THE INVENTORY OF: 1. MOD KITS AND SHIP LOOSE, FROM OFF-SITE INVENTORY STORES AT KSC, VANDENBURG, AND NSTL. CLOSURE STATEMENT ALL SUSPECT 33L2 NUTS HAVE BEEN SEQUESTERED AT KSC, NSTL AND VANDENBURG, OR TRACKABLE DOCUMENTATION HAS BEEN WRITTEN. REFERENCE AR NO. M7043-K1, AR NO. M7043-M2, AR NO. 7002 AND AR NO. MV7012-MV1. 2. VENDOR KITS CLOSURE STATEMENT ALL 33L2 NUTS IN KITS SUPPLIED TO VENDORS HAVE BEEN PICKED UP BY MMC PERSONNEL. 33L1 NUTS HAVE BEEN EXCLUDED BECAUSE THEY HAVE BEEN EXONERATED (REFERENCE INFORMAL MEMORANDUM FROM T. FARROW TO C. VOGEL, DATED JULY 13, 1987). 3. MODE KITS AND SHIP LOOSE AT MAF: \* CLOSURE STATEMENT ALL SUSPECT MOD KITS AND SHIP LOOSE SHALL BE INSPECTED BY DC&R S-87-009. REFERENCE DC&R S-87-009. TASK III CAPS CLOSEOUT SUMMARY \* IT WAS DETERMINED, DURING BOLT SHANKING STUDIES, THAT SOME NUTS SUPPLIED BY SPS HAD LOW TORQUE CO-EFFICIENTS. LAB ANALYSIS TRACED THE CAUSE TO LUBRICATION, CARBOWAX, APPLIED TO THE NUTS. IT WAS CONFIRMED

THAT SUSPECT NUTS WERE LIMITED TO THOSE PRODUCED BY SPS. ENGINEERING ANALYSIS DETERMINED WHICH SPECIFIC PLACES SUCH NUTS WOULD POSE A CONCERN FOR FACTOR OF SAFETY. ALL LOCATIONS THUS IDENTIFIED, AND NOT EXONERATED BY ADEQUATE PURCHASE ORDER TRACEABILITY, WERE PLACED ON DC&RS FOR INSPECTION/REPLACEMENT IN THE FLEET. CONCURRENTLY, ALL INVENTORY OF NUTS HAS BEEN PURGED OF SUSPECT SPS NUTS. THERE IS TRACKABLE DOCUMENTATION INITIATED FOR INSPECTION OF SUSPECT MOD KITS AND SHIP LOOSE HARDWARE NOT YET ACCESSIBLE FOR INSPECTION. NEW HARDWARE SHALL BE SUBJECTED TO A REVISED RAP (RECEIVING ACCEPTANCE PLAN) WHICH NOW INCLUDES A SAMPLE INSPECTION FOR EVIDENCE OF LUBRICANT (NO LUBRICATION REQUIRED). CORRECTIVE ACTION WAS ALSO TAKEN AT THE SUPPLIER OF THE DISCREPANT NUTS--IMPROVED DOCUMENTATION, SAMPLE TESTING AND MATERIAL HANDLING. IN SUMMARY, THE ENTIRE FLEET AND INVENTORY SHALL BE INSPECTED FOR SUSPECT SPS NUTS. WHERE FOUND, REPLACEMENT SHALL BE MADE INCOMING HARDWARE SHALL BE SUBJECTED TO SAMPLE TESTING AT MAF. AND, CORRECTIVE ACTION WAS TAKEN AT THE SUPPLIER OF THE DISCREPANT NUTS TASK IV CLEARANCE EFFECTIVITIES LWTs 16, 20, 21, 22, AND 24 THROUGH 46: NO CONSTRAINTS. INSPECTION AND/OR REPAIR SHALL BE MADE (REFERENCE DC&RS S-87-004, S-87-005A, AND S-87-008). LWTs 47 AND UP: NO CONSTRAINTS INVENTORY PURGED OF SUSPECT SPS NUTS

**MSFC Response/Concurrence**

ASSESSMENT ADDENDUM REPORT

<b>MSFC Report#</b> A10781	<b>IFA#</b> --	<b>Contractor RPT#</b> S-073	<b>JSC#</b> --	<b>KSC#</b> --	<b>EICN#</b> --
<b>Asmnt Part#</b> 33L2	<b>Asmnt Part Name</b> HIGH PROFILE NUT	<b>Asmnt Serial/Lot#</b> N/A			
<b>HCRIT CD</b> --	<b>FCRIT CD</b> 1	<b>CAUSE CD</b> MAP - MFG-ASY-INST	<b>FAIL MODE</b> MR - TORQUE HI/LO		
<b>Asmnt FMEA</b> 2.1.13.1	<b>Asmnt FM</b> 1	<b>FMEA CSE</b> A	<b>FMEA SCSE</b> 1		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Correlated Part#</b> --	<b>Correlated Part#</b> --	<b>Correlated Part#</b> --			
<b>Associated LRU#</b> --	<b>Associated LRU#</b> --	<b>Associated LRU#</b> --			
<b>MAJOR DESIGN CHANGES</b>					
<b>APRV DATE</b> --	<b>DESCRIPTION OF CHANGES</b> --				
<b>ASSESSMENT TEXT</b>					

WHOLE RECORD REPORT( + ADDENDUM)

<b>MSFC Record #</b> A10800	<b>In-Flight Anomaly Number</b> --	<b>Contractor Report Number</b> T-057	<b>JSC#</b> --	<b>KSC#</b> --
<b>Problem Title</b> STAINS ON 80% OF LH2 EXTERIOR TANK SURFACE LWT 44				
<b>EICN#</b> --	<b>ELEMENT</b> ET	<b>Contractor</b> MMMSS	<b>FSCM#</b> --	<b>FCRIT</b> 3
<b>HCRIT</b> 3	<b>Sys_Lvl</b> N	<b>Misc Codes</b> A B C D E F G H I J K L M N O		
<b>HARDWARE</b> EIM	<b>NOMENCLATURE</b> ET COMPLETE	<b>PART#</b> 80901010000	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> MMC
<b>HARDWARE</b> LRU	<b>NOMENCLATURE</b> N/A	<b>PART#</b> N/A	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> N/A
<b>HARDWARE</b> NCA	<b>NOMENCLATURE</b> ET CLEAN INSTALLATIO	<b>PART#</b> 80914005940-039	<b>SER/LOT#</b> LWT-44	<b>MANUFACTURER</b> MMC
<b>Test/Operation</b> M - MFG	<b>Prevailing Condition</b> --	<b>F / U</b> UC	<b>Fail Mode</b> UC - UNSAT	<b>Cause</b> MAP - MFG-ASY-INST
<b>System</b> TPS	<b>Defect</b> CR - CORROD	<b>Material</b> T - S-STRT	<b>Work Contact</b> W. JOHNSON	<b>Fail Date</b> 05/20/1987
<b>Received at MSFC</b> 06/10/1987	<b>Date Isolated</b> --	<b>FMEA Reference</b> N/A	<b>IFA: Mission Phase</b> --	<b>Mission Elapsed Time</b> --
<b>Location</b> MAF		<b>Symptom</b> UC - UNSAT		<b>Time Cycle</b> --
<b>Effectivity Text</b> NONE				
<b>Vehicle Effectivity Codes</b>				
<b>Vehicle 1</b> --	<b>Vehicle 2</b> --	<b>Vehicle 3</b> --	<b>Vehicle 4</b> --	<b>Vehicle 5</b> --
<b>Mission Effectivity Codes</b>				
<b>Mssn 1</b> --	<b>Mssn 2</b> --	<b>Mssn 3</b> --	<b>Mssn 4</b> --	<b>Mssn 5</b> --
<b>Estimated Completion Dates</b>				
<b>MSFC Approved Defer Until Date</b> --	<b>Contractor Req Defer Until Date</b> --	<b>LVL 3 Close</b> --	<b>Remark / Action</b> --	
<b>Investigation / Resolution Summary</b>				
<b>Last MSFC Update</b> 05/16/1990	<b>CN RSLV SBMT</b> 12/04/1987	<b>Defer Date</b> --	<b>Add Date</b> --	<b>R/C Codes</b> 2 - MFG -- --
<b>Assignee</b>				
<b>Design</b> B. DAVIS	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> J. CAVALARIS	<b>Project MGR</b> --
<b>Approval</b>				
<b>Design</b>	<b>Chief Engineer</b>	<b>S &amp; MA</b>	<b>Project</b>	<b>Project MGR</b>

--	J. NICHOLS	R. JACKSON	J. CAVALARIS	--	
<b>PAC Assignee</b> J.EL-IBRAHIM	<b>PAC Review Complete</b> --	<b>MSFC Closure Date</b> 02/29/1988	<b>Status</b> C - CLOSED	<b>F/A Completion</b> --	
<b>Problem Type</b> --	<b>SEV</b> --	<b>Program Name</b> --	<b>REVL</b> --	<b>OPRINC</b> --	
<b>FUNC MOD</b> --	<b>Software Effectivity</b> -- - - - - -	<b>Software Fail CD</b> --		<b>SUBTYPE</b> --	<b>Software Closure CD</b> --
<b>RES PERSON L2</b> --	<b>Approval Signature L3</b> --				
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Contractor Status Summary</b>					
<b>Reliability/Quality Assurance Concerns, Recommendations:</b>					
<b>Problem Description</b>  AFTER CLEANING THE LH2 EXTERIOR TANK SURFACE, IT WAS NOTED THAT STAINS EXISTED ON OVER 80% OF THE TANK SUBSTRATE (INCLUDING THE FWD AND AFT DOMES). A SIMILAR PROBLEM WAS REPORTED ON CAPS T-035. (A06905). THE EXTERIOR TANK IS FINAL CLEANED IN CONJUNCTION WITH ENGINEERING DWG 80914005940-039 AND STP/PI 5009					
<b>Contractor Investigation/Resolution</b>  CAUSE: 1. COPPER REDEPOSITION - COPPER COLORED STAINS RESULTING FROM A DWELL (TIME DELAY) BETWEEN THE SOLUTION DEOXIDATION CYCLE AND THE SUBSEQUENT DEMINERALIZED WATER RINSE CYCLE. 2. ALUMINUM OXIDE/COPPER MATRIX STAINS - UNDETERMINED. CAUSE AND CORRECTIVE ACTION FOR THIS FAILURE MODE SHALL BE ADDRESSED PER MISSION TASK 643 ETP-295. 12/4/87 - GENERAL A. THE LH2 AND L02 TANK EXTERIORS ARE FINAL CLEANED PER STP/PI 5009. ENGINEERING SPECIFICATION CONFORMANCE REQUIRES THAT THE POST-WASHED TANK BE VISUALLY CLEAN WITH A WATER BREAK FREE SUR- FACE; THAT THE EXTERIOR SURFACE SHALL BE UNIFORMLY METALLIC IN COLOR, AND FREE FROM OILS, GREASE, STAINS, SMUTS, AND/OR OTHER DISCOLORATION. B SINCE LWT-31, VARYING DEGREES OF NONCONFORMANCE TO THE PRECEDING SPECIFICATION REQUIREMENTS, HAS BEEN DOCUMENTED AGAINST THE LH2 TANK PROCESSING (LWT-31, MARS T079331; LWT-40, MARS T-84022) AND THE L02 TANK PROCESSING (LWT-32, MARS T-77415; LWT-33, MARS T-84724; LWT-37, MARS T-90291; AND LWT-42, MARS T-90026). PRIOR TO LWT-31, AS INDICATED BY A BRIEF HISTORY REVIEW, AN ADDITIONAL 14 MARS AND 21 DRS WERE WRITTEN AGAINST THE LH2 EXTERIOR TANK CLEANING PROCESS (SINCE LWT-6)					

ENGINEERING RESEARCH TO EVALUATE THE INTERMITTENT PROCESS FAILURES, HAS BEEN ON-GOING. C. A CORRECTIVE ACTION PROBLEM SUMMARY HISTORY REVIEW REVEALED THAT CAPS T-035 ADDRESSED SIMILAR EXTERIOR TANK CLEANING ISSUES. HOWEVER, THE DOCUMENT ADDRESSED STREAK-LIKE STAINS RESULTING FROM INDISCRIMINATE WATER COLLECTION/ENTRAPMENT. A BRIEF MARS/DR REVIEW INDICATES THAT THE PROCESS AMELIORATION/CORRECTIVE ACTION, AS PRESENTED IN CAPS T-035, WAS VIABLE. CONSEQUENTLY, CAPS T-035 WILL BE INCLUDED, HEREIN, ONLY FOR PROCESS HISTORY. D. TASKS I THRU IV OF THIS CAPS, ADDRESSES THE FAILURE ANALYSIS OF THE LH2/L02 FINAL CLEANING PROCESS, PROCESS AMELIORATION, AND CONTROL TO PRECLUDE RECURRENCE. TASK I FAILURE/PROBLEM INVESTIGATION THIS TASK REQUIRES THE SUBMITTAL TO RELIABILITY ASSURANCE, THE APPLICABLE PROCESS HISTORY EVALUATION/REVIEW FOR THE EXTERIOR CLEANING OF THE LH2 AND L02 TANKS (REVIEW EFFECTIVITIES-LWT-6 THRU PRESENT BUILD). IN ADDITION, PROBLEM HISTORIES (WHICH INDIVIDUAL DEPARTMENTS ARE COGNIZANT OF) SHALL BE SUBMITTED. ALL INFORMATION SHALL BE REVIEWED AND CATERGORIZED TO ASSIST IN DETERMINING AN EXTERIOR CLEANING FAILURE DEFINITION AND THE SUBSEQUENT CORRECTIVE ACTION THEREOF. A. FAILURE HISTORY AND REVIEW - MARS/DRS CLOSURE STATEMENT THE EXTERIOR CLEANING OF THE LH2 AND L02 TANKS (PER STP/PI 5009) WAS PERFORMED IN CELL "E" FOR LWT EFFECTIVITIES 001 THRU 005 STAINS OCCURRED ON THE LH2 LWT-001, 004, AND 005 TANKS. AN INVESTIGATIVE INTO THE GENERIC CAUSE OF THE STAIN/DISCOLORATION TYPE ANOMALIES, RESULTED IN THE INCORPORATION OF NITRIC ACID INTO THE SMUTGO #1 DEOXIDIZER CLEANING SOLUTION. NITRIC ACID - DEVELOPMENT/BACKGROUND: AT THE BEGINNING OF THE APOLLO S-1C PROGRAM (1963) IT WAS DETERMINED NECESSARY TO ADD 10-35 OZ. OF NITRIC ACID PER GALLON OF DEOXIDIZER; TO PREVENT COPPER DEPOSITION AS A RESULT OF BUILD-UP FROM DEOXIDIZING HIGH COPPER BEARING ALLOYS SUCH AS 2219-T87. THE COPPER TOLERANCE LEVEL OF THE SOLUTION BEFORE "IMMERSION PLATING" WAS THEREBY RAISED FROM ABOUT 60PPM TO OVER 1200PPM WITH THE NITRIC ACID ADDITION (REF MMC-ET-SE05-176). WHEN CELL "P" WAS CONSTRUCTED FOR RATE PRODUCTION IT WAS FABRICATED TO SUPPORT A NITRIC ACID ENVIRONMENT. (IT IS IMPORTANT TO NOTE THAT THE NITRIC ACID ADDITIVE WAS NOT IMPLEMENTED IN CELL "E"; THE CELL'S CONSTRUCTION WOULD RAPIDLY DETERIORATE, AS A RESULT. IN ADDITION, THE ANOMALIES DOCUMENTED IN CELL "E" WERE NOT AS SEVERE/REPETITIOUS FOR THE L02 TANK, LWT-1 THRU 43; AS THEY WERE FOR THE LH2 TANK, LWT 1 THRU 5, CELL "E"; LWT-6 THRU 43, CELL "P". THE INITIAL USE OF CELL "P" (LWT-6 AND 7) RESULTED IN A CONTINUANCE OF SMUT/STAINING/ DISCOLORATION TYPE ANOMALIES. THE STAINS WERE ANALYZED BY MARTIN MARIETTA LABORATORIES AND DETERMINED TO BE AN ALUMINUM OXIDE/COPPER MATRIX. A MARTIN MARIETTA TEST PROGRAM, INCLUDING TURCO PRODUCTS, INC. (MANUFACTURERS OF THE DEOXIDIZER AND ALKALINE CLEANING SOLUTIONS UTILIZED IN CLEANING THE EXTERIOR TANK SURFACES) EVALUATED THE STP/PI 5009 PROCESS TO AFFECT CORRECTIVE ACTION. IT WAS DETERMINED AT THAT TIME (REF. TEST REPORT ETTR 163 AND MEMO FROM TURCO PROD. DATED MAY 23, 1983) THAT THE CONTROL OF THE AMOUNTS OF ACTIVE FLUORIDE IN SOLUTION WOULD NEGATE THE ALUMINUM OXIDE/COPPER POST-CLEANING SMUT (OCCURRING IN CELL "P"). (FLUORIDE IS CONTAINED IN THE DEOXIDIZER FORMULA AS SUPPLIED BY TURCO PRODUCTS, INC. ITS FUNCTION IS TO REMOVE THE ALUMINUM OXIDE FROM THE 2219 SUBSTRATE SURFACE. THE ALUMINUM NITRATE WAS THEORIZED TO DISSOCIATE IN THE DEOXIDIZER SOLUTION WITH THE ALUMINUM REDUCING THE AVAILABLE FREE/ACTIVE FLUORIDE BY BINDING AS AN ALUMINUM FLUORIDE COMPOUND). LWT-8 WAS THE FIRST LH2 TANK TO UTILIZE THE CONTROL OF FLUORIDE BY THE ADDITION OF ALUMINUM NITRATE. THE LH2 TANK WAS CLEANED WITHOUT ANY SIGNIFICANT ANOMALIES. NONCONFORMANCE BEGAN AGAIN AT LWTS-9 THRU 13; HOWEVER, THE STAINS WERE ATTRIBUTED TO MASKING LEAKS, TOOLING, ENTRAPPED FLUID, AND CELL CEILING DRIPS. THESE TYPE ANOMALIES WERE ADDRESSED BY CAPS T-035. RESURGENCE OF MAJOR STAIN/DISCOLORATION TYPE ANOMALIES DID NOT BEGIN UNTIL LWT-26. THIS CONTINUED INTERMITTANTLY UNTIL LWT-44. AT LWT-44 THE ENTIRE CONTENT OF THE LH2 DEOXIDIZER SOLUTION TANK WAS DUMPED. THE SYSTEM WAS RECHARGED WITH 8000 GALLONS OF FRESH MATERIAL; RESULTING IN A CLEAN TANK. THIS IS



SIGNIFICANT IN THAT, INTERVIEWS WITH THE PROCESS AREA FOREMAN, AREA SUPERVISOR, AND THE QUALITY EVALUATION LABORATORY CHEMIST (WHO ANALYZES/ REPLENISHES THE TANK SOLUTIONS), REVEALED THAT, HISTORICALLY, FRESH SOLUTION BATHS ALWAYS RESULTED IN ANOMALIZED/STAINED TANKS FURTHER INVESTIGATION REVEALED, TO THE CONTRARY, THAT UP UNTIL LWT-44 A FRESH SOLUTION BATCH WAS MADE UP IN A TANK THAT WAS ONLY PARTIALLY EMPTIED. A STP/PI 5009 PROCESS SIMULATION (ALONG WITH THE RESULTS OF LWT-44) ILLUSTRATED THAT A FRESH/ VIRGIN SOLUTION WILL SUCCESSFULLY CLEAN THE 2219 ALUMINUM ALLOY. THE LWT-6 PROCESSING WAS FROM A VIRGIN SOLUTION, HOWEVER, HISTORICAL RECORDS INDICATE THAT THE 10% BY VOLUME NITRIC ACID REQUIREMENT WAS NOT MET UNTIL LWT-8 (THIS WAS DUE TO A MISCALCULATION OF TOTAL SOLUTION CONTENT WITHIN THE DEOXIDIZER TANK CONSEQUENTLY, FOR LWT'S 6 AND 7, THE ACTUAL NITRIC ACID CONCENTRATION RANGED BETWEEN 3-4%). B. PROCESS HISTORY AND REVIEW - STP/PI/MPP - PROCESS CHANGES CLOSURE STATEMENT A MATRIX OF PROCESS INSTRUCTION CHANGES RELEVANT TO THE CHEMICAL PROCESSING OF ET TANKS WAS SUBMITTED TO RELIABILITY ASSURANCE. THIS INFORMATION WILL BE ADDED TO A HISTORICAL PROBLEM SUMMARY (TASK IA) AT THE COMPLETION OF ALL ACTIONS IN THE TASK I SECTION, HEREIN (REF. IOM 3693-87-HP-207). C. PROCESS HISTORY AND REVIEW - FACILITIES - TEST OPERATIONS PROCEDURES CLOSURE STATEMENT A CHRONOLOGICAL FLOW OF TEST OPERATION PROCEDURE AND PLC PROGRAM CHANGES WAS SUBMITTED TO RELIABILITY ASSURANCE. THIS INFORMATION WILL BE ADDED TO A HISTORICAL PROBLEM SUMMARY (TASK IA) AT THE COMPLETION OF ALL ACTIONS IN THE TASK I SECTION, HEREIN (REF. IOM 3613-87-132 AND INFORMAL MEMO FROM D. DAWES, DEPT/3131). D. VENDOR(S) MATERIAL EVALUATION - PRODUCT ASSURANCE, PROCESS COMPATIBILITY CLOSURE STATEMENT ALL NECESSARY DOCUMENTS AND PROBLEM HISTORIES HAVE BEEN SUBMITTED TO RELIABILITY ASSURANCE. A COMPILATION OF THE SIGNIFICANT PROBLEMS, TOGETHER WITH THE RESULTS OF THE VENDOR'S MATERIAL EVALUATION (REF VENDOR "TURCO, INC.", TRIP REPORTS 3741-87-098, 116, AND 121) SHALL BE SUMMARIZED IN CONJUNCTION WITH THE FAILURE DEFINITION/CAUSE (TASK I, SECTION E). E. FAILURE DEFINITION/CAUSE CLOSURE STATEMENT: A SIMULATION OF THE EXTERIOR TANK CLEANING ANOMALIES WERE PERFORMED AT TURCO PRODUCTS, INC., WESTMINISTER CAL. THREE SPRAY CHAMBERS WERE UTILIZED; REPRESENTING THE EMULSION WASH, ALKALINE CLEANER, AND DEOXIDIZER SOLUTIONS SPRAYED ON THE EXTERIOR LH2 TANK (CELL "P"). THE EXTERIOR CLEANING SPRAY PROCESS TEST PLAN, WAS DESIGNED TO SIMULATE THE EXTERIOR TANK CLEANING PROCESS ANOMALIES OCCURRING AT MAF; AND TO REPRODUCE THE PROCESS ANOMALIES WHICH OCCURRED AT TURCO, INC. IN MAY, 1983. THE TURCO PROCESS AND THE MAF PROCESS SIMULATED THE FAILURE MODE OF COPPER DEPOSITION (AS A RESULT OF A DELAY IN DEMINERALIZED WATER RINSE AFTER DEOXIDIZER SOLUTION SPRAY). WHEREAS, TURCO WAS UNABLE TO REPRODUCE THE ANOMALIES AS DEPICTED IN THEIR REPORT SUMMARY OF MAY, 1983, THE MAF PROCESS WAS SUCCESSFUL IN A SIMULATION OF TANK STAINING FAILURES; COPPER REDEPOSITION (RESULTING FROM A DELAY IN WATER RINSING AFTER THE DEOXIDIZER CYCLE), AND AN ALUMINUM OXIDE/COPPER MATRIX STAIN (THESE ARE THEORIZED TO BE A RESULT OF A LACK OF FLUORIDE CONTROL WITHIN THE DEOXIDIZER SOLUTION). TASK CLOSED TASK II CORRECTIVE ACTION THE RESULTS OF A HISTORY REVIEW, TEST DATA COMPILATION, LABORATORY ANALYSES, AND PROCESS SIMULATION, INDICATE TWO TYPES OF FAILURE (ANOMALY) MODES; A STAINING/DISCOLORATION - RESULTING FROM COPPER REDEPOSITION THE STAIN/DISCOLORATION FAILURE MODE (DUE TO COPPER REDEPOSITION) WAS DETERMINED BY ANALYSIS (REF. QEL REPORT #87A011) AND CONFIRMED BY PROCESS SIMULATION (UTILIZING A LAB-SCALE SPRAY CHAMBER). COPPER REDEPOSITION RESULTED AS A CONSEQUENCE OF A TIME DELAY (DWELL) BETWEEN THE CONCLUSION OF THE PROCESS DEOXIDIZER CYCLE AND THE SUBSEQUENT DEMINERALIZED WATER RINSE. TO PRECLUDE THE RECURRENCE OF THIS PHENOMENA, IT WAS REQUESTED THAT IMMEDIATE CORRECTIVE ACTION BE INITIATED BY REDUCING THE PROCESS DWELL TIME (BETWEEN THE CONCLUSION OF THE DEOXIDATION CYCLE AND DM WATER RINSE) DURING THE CELL "P" EXTERIOR TANK CLEANING PROCESS (REF. REQUEST FOR FACILITIES #AA03-0121). B STAINING/SMUTTING - (COPPER/ALUMINUM OXIDE MATRIX) THE CAUSE OF THIS

TYPE OF FAILURE HAS NOT BEEN DEFINITELY DETERMINED, HOWEVER, IT IS POSTULATED TO BE A RESULT OF AN OPTIMIZATION OF ACTIVE FLUORIDE CONCENTRATION WITHIN THE DEOXIDIZER SOLUTION BATH. THE CORRECTIVE ACTION FOR THE STAIN/SMUTTING TYPE ANOMALIES SHALL BE ADDRESSED PER MISSION TASK 643 ETTP-295. AN OPERATIONS DIRECTIVE (453235/100-030) AND PRODUCT ASSURANCE DIRECTIVE (PAD 3740-064) TO SUPPORT/DIRECT THE TIMELY COMPLETION OF THE MISSION TASK; HAS BEEN ISSUED. TASK CLOSED TASK III CLEARANCE OF EFFECTIVITIES NO CONSTRAINTS. PREVIOUSLY BUILT VEHICLES HAVE BEEN ACCEPTED, INDIVIDUALLY, THROUGH APPLICABLE MARS DISPOSITIONS TASK CLOSED TASK IV CAUSE/CORRECTIVE ACTION SUMMARY CLOSURE STATEMENT: CAPS T-057 WAS INITIATED TO DEFINE AND AFFECT SYSTEM AMEILIORATION FOR INTERMITTANT "EXTERIOR TANK CLEANING STAINING ANOMALIES". A COMPILATION OF HISTORICAL DATA INDICATES INTERMITTANT PROCESS ANOMALIES RESULTING FROM STP/PI 5009, "EXTERIOR TANK CLEANING". PROCESS SUCCESS STATISTICS (LWT31 AND UP) - 73% OVERALL SUCCESS RATE IN CELL P AND E - 31% CHANCE OF GROSS CONTAMINATION IN CELL P - 08% CHANCE OF GROSS CONTAMINATION IN CELL E A LIMITED CLEANING PROCESS STUDY, A THOROUGH HISTORY REVIEW, AND A STP/PI 5009 PROCESS SIMULATION, HAS INDICATED THAT THE ONLY CONSISTENT SUCCESSFUL PROCESS OF STP/PI 5009 IS TO HAVE 8000 GALS. OF VIRGIN MATERIAL FOR EACH TANK WASHING. IN LIEU OF THIS EXPENSIVE CORRECTIVE ACTION, MATERIALS ENGINEERING WILL BE TASKED (PER MISSION TASK 643) TO OBTAIN OPTIMUM PROCESSING PARAMETERS (FOR CONSISTENT PROCESS CONFORMITY) FOR MATERIAL REPLENISHED SOLUTION TANKS AS PRESENTLY UTILIZED IN STP/PI 5009. A FAILURE SIMULATION, CONDUCTED AT TURCO PRODUCTS, INC., VERIFIED THE CAUSE FOR STAINING NON- CONFORMANCES (COPPER DEPOSITION) THROUGH ASSOCIATED DWELL TIMES BETWEEN THE DEOXIDIZER CYCLE AND THE FINAL DEMINERALIZED WATER RINSE. THE ASSOCIATED CORRECTIVE ACTION IS THE TEST OPERATION CHANGE IMPLEMENTATION OF A REDUCED SOLUTION/RINSE DWELL TIME TO PRECLUDE CONSEQUENTIAL COPPER REDEPOSITION.TASK CLOSED

**MSFC Response/Concurrence**

**ASSESSMENT ADDENDUM REPORT**

<b>MSFC Report#</b> A10800	<b>IFA#</b> --	<b>Contractor RPT#</b> T-057	<b>JSC#</b> --	<b>KSC#</b> --	<b>EICN#</b> --
<b>Asmnt Part#</b> 80914005940-039	<b>Asmnt Part Name</b> LH2 ET SURFACE	<b>Asmnt Serial/Lot#</b> LWT-44			
<b>HCRIT CD</b> --	<b>FCRIT CD</b> 3	<b>CAUSE CD</b> MAP - MFG-ASY-INST	<b>FAIL MODE</b> UC - UNSAT		
<b>Asmnt FMEA</b> N/A	<b>Asmnt FM</b> N/A	<b>FMEA CSE</b> N/A	<b>FMEA SCSE</b> N/A		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Correlated Part#</b> --	<b>Correlated Part#</b> --	<b>Correlated Part#</b> --			
<b>Associated LRU#</b> --	<b>Associated LRU#</b> --	<b>Associated LRU#</b> --			
<b>MAJOR DESIGN CHANGES</b>					
<b>APRV DATE</b> --	<b>DESCRIPTION OF CHANGES</b> --				

**ASSESSMENT TEXT**

WHOLE RECORD REPORT( + ADDENDUM)

<b>MSFC Record #</b> A10942	<b>In-Flight Anomaly Number</b> --	<b>Contractor Report Number</b> P-059-1	<b>JSC#</b> --	<b>KSC#</b> --
<b>Problem Title</b> PROPULSION LINE PD4800175-030 X-RAY REVIEW INTERPRETATIONS (L02 FEEDLINE, FWD ELBOW)				
<b>EICN#</b> --	<b>ELEMENT</b> ET	<b>Contractor</b> MMMSS	<b>FSCM#</b> --	<b>FCRIT</b> 1
<b>HCRIT</b> 1	<b>Sys_Lvl</b> N	<b>Misc Codes</b> A (4) B C D E F G H I J K L M N O		
<b>HARDWARE</b> EIM	<b>NOMENCLATURE</b> ET	<b>PART#</b> 80901000000	<b>SER/LOT#</b> NOTED	<b>MANUFACTURER</b> MMC
<b>HARDWARE</b> LRU	<b>NOMENCLATURE</b> LO2 PROP FEED	<b>PART#</b> 80971028465	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> N/A
<b>HARDWARE</b> NCA	<b>NOMENCLATURE</b> PROPULSION LINE	<b>PART#</b> PD4800175-030	<b>SER/LOT#</b> 171	<b>MANUFACTURER</b> ARROWHEAD
<b>Test/Operation</b> L - FLD	<b>Prevailing Condtion</b> N - INSPECTION	<b>F / U</b> F	<b>Fail Mode</b> UC - UNSAT	<b>Cause</b> MAW - MFG-ASY-WORK
<b>System</b> PROPULSION	<b>Defect</b> DC - BROKEN	<b>Material</b> M - LINK-G	<b>Work Contact</b> J. FINCHER	<b>Fail Date</b> 07/17/1987
<b>Received at MSFC</b> 08/14/1987	<b>Date Isolated</b> --	<b>FMEA Reference</b> 2.1.7.1	<b>IFA: Mission Phase</b> --	<b>Mission Elapsed Time</b> --
<b>Location</b> MMC		<b>Symptom</b> UC - UNSAT		<b>Time Cycle</b> --
<b>Effectivity Text</b> LWT 16 AND UP				
<b>Vehicle Effectivity Codes</b>				
<b>Vehicle 1</b> --	<b>Vehicle 2</b> --	<b>Vehicle 3</b> --	<b>Vehicle 4</b> --	<b>Vehicle 5</b> --
<b>Mission Effectivity Codes</b>				
<b>Mssn 1</b> --	<b>Mssn 2</b> --	<b>Mssn 3</b> --	<b>Mssn 4</b> --	<b>Mssn 5</b> --
<b>Estimated Completion Dates</b>				
<b>MSFC Approved Defer Until Date</b> --	<b>Contractor Req Defer Until Date</b> --	<b>LVL 3 Close</b> --	<b>Remark / Action</b> --	
<b>Investigation / Resolution Summary</b>				
<b>Last MSFC Update</b> 11/04/1991	<b>CN RSLV SBMT</b> 05/17/1988	<b>Defer Date</b> --	<b>Add Date</b> --	<b>R/C Codes</b> 5 - TRNG -- --
<b>Assignee</b>				
<b>Design</b> P. MULLER	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> P. BRIDWELL
<b>Approval</b>				

<b>Design</b> P. MULLER	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> P. BRIDWELL	
<b>PAC Assignee</b> J.EL-IBRAHIM	<b>PAC Review Complete</b> JE	<b>MSFC Closure Date</b> 06/03/1988	<b>Status</b> C - CLOSED	<b>F/A Completion</b> --	
<b>Problem Type</b> --	<b>SEV</b> --	<b>Program Name</b> --	<b>REVL</b> --	<b>OPRINC</b> --	
<b>FUNC MOD</b> --	<b>Software Effectivity</b> -- - - - - -	<b>Software Fail CD</b> --		<b>SUBTYPE</b> --	<b>Software Closure CD</b> --
<b>RES PERSON L2</b> --	<b>Approval Signature L3</b> --				
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Contractor Status Summary</b>					
<b>Reliability/Quality Assurance Concerns, Recommendations:</b>					
<b>Problem Description</b>  DURING A SECOND REREVIEW ON X-RAYS ON LWTS 21 AND 16, PROPULSION LINES, INTERPRETATIONS WERE IN- CONSISTENT WITH PREVIOUS REVIEWS. X-RAYS INDICATIONS WERE DOCUMENTED WHICH HAD NOT BEEN PREVIOUSLY REPORTED REF. CAPS P-053 AND MARS T-93899					
<b>Contractor Investigation/Resolution</b>  R/C: 1- A COMPLETE RE-REVIEW OF EXISTING X-RAYS UNDER TD808 2- ENHANCEMENT OF THE X-RAY TESTING PROGRAM THIS IS A LAUNCH CONSTRAINTS FOR LWTS 21 AND 16. THE CONSTRAINTS RATIONALE AS FOLLOWS: LINE RUP- TURE WOULD BE CATASTROPHIC. THIS STATEMENT HAS BEEN COORDINATED WITH:  ____ MR. G. P. BRIDWELL, ET PROJECT MANAGER, _____ MR. J NICHOLS, ET CHIEF ENGINEER 12/17/87 FAILURE MODE: WELD FAILURE ON PROPULSION LINES CAUSE: EMPLOYEE/VENDOR ERROR 5/3/88 PRB UPDATE: SENIOR MRB HAS DISPOSITIONED THIS ITEM AS "USE AS IS" WHICH CLEARS LWT 21 FOR FLIGHT 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 \_\_\_\_\_ G.P. BRIDWELL (SIGNED) 5/13/88 \_\_\_\_\_

5/17/88 - GENERAL:

THESE INDICATIONS HAVE BEEN DOCUMENTED ON MARS AND FINAL DISPOSITIONS ARE FORTHCOMING

TASK I FAILURE/PROBLEM INVESTIGATION

AS A RESULT OF STS 51L, TD808 WAS INITIATED TO REREVIEW ALL MAF/VENDOR ET WELD X-RAYS. THIS ACTIVITY WAS CONDUCTED BY PERSONNEL WHICH HAD PERFORMED THE ORIGINAL ACCEPTANCE REVIEW. THERE WAS NO FINDINGS DOCUMENTED AS A RESULT OF THIS ACTIVITY. ANOTHER REVIEW WAS CONDUCTED BY PERSONNEL UNASSOCIATED WITH THE TWO PRIOR X-RAY REVIEWS. THIS INDEPENDENT REVIEW REVEALED SEVERAL ANOMALOUS CONDITIONS IN PROPULSION LINES

THE REVIEW ACTIVITY WAS COORDINATED TO COMPLETE X-RAYS BY EFFECTIVITY, LWTS 16 AND 21 BEING THE FIRST VEHICLES REVIEWED. SUBSEQUENT REVIEW ACTIVITY WILL EXAMINE WELDS ON ALL EXISTING HARDWARE

TASK II CORRECTIVE ACTION

IT HAS BEEN DETERMINED THAT THE FOLLOWING ACTIONS ARE REQUIRED TO PRECLUDE A RECURRENCE OF X-RAY MISINTERPRETATION

- A. DISCIPLINARY ACTION FOR THE MMC PERSONNEL ASSOCIATED WITH X-RAY MISINTERPRETATION  
CLOSURE STATEMENT  
THIS ACTION HAS BEEN COMPLETED. REFERENCE DEPARTMENT 3700 MEMORANDUM DATED JULY 27, 1987  
X-RAY CERTIFICATION WAS REVOKED FOR THE EMPLOYEES INVOLVED
- B. IMPLEMENT REAL TIME INSPECTION OF WELD X-RAYS BY PROCUREMENT QUALITY AT THE VENDOR'S FACILITY  
CLOSURE STATEMENT  
ACTION IS COMPLETE. PER MEMO 3761-87-193, REAL TIME X-RAY INSPECTION IMPLEMENTED AS OF 8/31/87
- C. ENHANCE TRACEABILITY OF VENDOR DOCUMENTATION TO SPECIFIC COMPONENTS  
CLOSURE STATEMENT  
ACTION IS COMPLETE. REFERENCE ATTACHED MEMO 3761-87-193 WHICH DESCRIBES IMPROVED TRACEABILITY PROCEDURES
- D. PREPARE AND RELEASE A PLAN TO CREATE WORKMANSHIP STANDARDS FOR UNIQUE CONDITIONS AT VENDORS AND MAF  
CLOSURE STATEMENT  
REFERENCE MEMO 3770-88-028. ACTION IS COMPLETE. REFERENCE TASK II-P
- E. REVIEW X-RAY CERTIFICATION PROGRAM AT VENDORS AND MAF  
CLOSURE STATEMENT  
ACTION IS COMPLETE. REFERENCE ATTACHED MEMO 3720-87-070. PROGRAM WAS FOUND TO BE ACCEPTABLE
- F. EVALUATE PERSONNEL AWARENESS AS IT RELATES TO LESSONS LEARNED AT THE VENDOR AND MAF  
CLOSURE STATEMENT  
ACTION IS COMPLETE. REFERENCE MEMO 3760-87-331. PERSONNEL ARE COGNIZANT OF RECENT X-RAY MISINTERPRETATIONS
- G. ESTABLISH A SEMIANNUAL AUDIT OF X-RAY INTERPRETER PROFICIENCY AT THE VENDORS AND MAF  
CLOSURE STATEMENT  
ACTION IS COMPLETE. REFERENCE MEMO 3770-87-235
- H. PREPARE A PLAN TO REVIEW X-RAY CONTROL DRAWING/TECHNIQUES SHEETS BY VENDOR SOURCE REPRESENTATIVE AND MAF NDE AT VENDOR  
CLOSURE STATEMENT  
PLAN HAS BEEN SUBMITTED. ACTION IS COMPLETE. REFERENCE TASK II-P
- I. ESTABLISH REQUIREMENT TO INITIATE REVIEW OF X-RAYS BY MAF PERSONNEL WITHIN ONE WEEK OF FILM RECEIPT  
CLOSURE STATEMENT  
ACTION COMPLETED (REFERENCE QLI N-009)
- J. GENERATE RFF ON ADDITIONAL X-RAY REVIEW FACILITIES AND EQUIPMENT  
CLOSURE STATEMENT  
RFFS C02-0439, C02-0447, AND C02-0472 HAVE BEEN GENERATED TO

	OBTAIN ADDITIONAL EQUIPMENT. INSTALLATION OF NEW EQUIPMENT IS SCHEDULED TO BE COMPLETED THE SECOND QUARTER OF 1991
K.	INVESTIGATE THE FEASIBILITY OF USING CAD/CAM MODELS OF PROPULSION HARDWARE FOR REFERENCE DURING REVIEW OF X-RAYS CLOSURE STATEMENT ACTION IS COMPLETE. REFERENCE ATTACHED MEMO 3742-87-173. USE OF CAD FOR THIS APPLICATION IS NOT RECOMMENDED
L.	EVALUATE FILM PACKAGING, HANDLING, AND STORAGE FOR ADEQUACY CLOSURE STATEMENT ACTION IS COMPLETE. REFERENCE ATTACHED MEMO 3742-87-157
M.	REVIEW ALL RADIOGRAPHIC PROCEDURES FOR ADEQUACY CLOSURE STATEMENT ACTION IS COMPLETE. REFERENCE ATTACHED MEMO 3743-87-157
N.	A COMPLETE REVIEW OF VENDOR X-RAYS WILL BE ACCOMPLISHED ON ALL EXISTING HARDWARE (TD808) CLOSURE STATEMENT REVIEW OF VENDOR AND MAF X-RAYS WILL BE TRACKED BY DC&R P-88-001 UPON COMPLETION OF AN EFFECTIVITY MAF CONTRACTS WILL BE NOTIFIED
O.	SENIOR MRB REVIEW AND ACCEPTANCE OF BSTRA WELD INDICATIONS CLOSURE STATEMENT ALL BSTRA X-RAY INDICATIONS ON LWT-21 HAVE BEEN DISPOSITIONED "USE-AS-IS" BY SENIOR MATERIAL REVIEW BOARD ACTION (REFERENCE SMRB T-97953). A WORKMANSHIP STANDARD WAS GENERATED TO ESTABLISH ACCEPTANCE CRITERIA ON FUTURE INDICATIONS (REFERENCE WORKMANSHIP STANDARD 9.1)
P.	EVALUATE PROPOSED PLANS DEVELOPED UNDER TASKS II.D. AND H FOR IMPLEMENTATION
<b>MSFC Response/Concurrence</b>	

#### ASSESSMENT ADDENDUM REPORT

<b>MSFC Report#</b> A10942	<b>IFA#</b> --	<b>Contractor RPT#</b> P-059-1	<b>JSC#</b> --	<b>KSC#</b> --	<b>EICN#</b> --
<b>Asmnt Part#</b> PD4800175-030	<b>Asmnt Part Name</b> PROPULSION LINE	<b>Asmnt Serial/Lot#</b> 171			
<b>HCRIT CD</b> --	<b>FCRIT CD</b> 1	<b>CAUSE CD</b> MAW - MFG-ASY-WORK	<b>FAIL MODE</b> UC - UNSAT		
<b>Asmnt FMEA</b> 2.1.7.1	<b>Asmnt FM</b> 1	<b>FMEA CSE</b> A	<b>FMEA SCSE</b> 2		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Correlated Part#</b> --	<b>Correlated Part#</b> --	<b>Correlated Part#</b> --			
<b>Associated LRU#</b> --	<b>Associated LRU#</b> --	<b>Associated LRU#</b> --			
<b>MAJOR DESIGN CHANGES</b>					
<b>APRV DATE</b> --	<b>DESCRIPTION OF CHANGES</b> NONE				
<b>ASSESSMENT TEXT</b>					





WHOLE RECORD REPORT( + ADDENDUM)

<b>MSFC Record #</b> A10943	<b>In-Flight Anomaly Number</b> --	<b>Contractor Report Number</b> P-059-2	<b>JSC#</b> --	<b>KSC#</b> --
<b>Problem Title</b> PROPULSION LINE PD4800175-080 X-RAY REVIEW INTERPRETATIONS (L02 FEEDLINE, FWD ELBOW)				
<b>EICN#</b> --	<b>ELEMENT</b> ET	<b>Contractor</b> MMMSS	<b>FSCM#</b> --	<b>FCRIT</b> 1
<b>HCRIT</b> 1	<b>Sys_Lvl</b> N	<b>Misc Codes</b> A (4) B C D E F G H I J K L M N O		
<b>HARDWARE</b> EIM	<b>NOMENCLATURE</b> ET	<b>PART#</b> 80901000000	<b>SER/LOT#</b> NOTED	<b>MANUFACTURER</b> MMC
<b>HARDWARE</b> LRU	<b>NOMENCLATURE</b> LO2 PROP. FEED	<b>PART#</b> 80973028406	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> N/A
<b>HARDWARE</b> NCA	<b>NOMENCLATURE</b> PROPULSION LINE	<b>PART#</b> PD4800175-080	<b>SER/LOT#</b> 340	<b>MANUFACTURER</b> ARROWHEAD
<b>Test/Operation</b> L - FLD	<b>Prevailing Condtion</b> N - INSPECTION	<b>F / U</b> F	<b>Fail Mode</b> UC - UNSAT	<b>Cause</b> MAW - MFG-ASY-WORK
<b>System</b> PROPULSION	<b>Defect</b> DC - BROKEN	<b>Material</b> M - LINK-G	<b>Work Contact</b> J. FINCHER	<b>Fail Date</b> 07/17/1987
<b>Received at MSFC</b> 08/14/1987	<b>Date Isolated</b> --	<b>FMEA Reference</b> 2.1.6.1	<b>IFA: Mission Phase</b> --	<b>Mission Elapsed Time</b> --
<b>Location</b> MMC		<b>Symptom</b> UC - UNSAT		<b>Time Cycle</b> --
<b>Effectivity Text</b> LWT 16 AND UP				
<b>Vehicle Effectivity Codes</b>				
<b>Vehicle 1</b> --	<b>Vehicle 2</b> --	<b>Vehicle 3</b> --	<b>Vehicle 4</b> --	<b>Vehicle 5</b> --
<b>Mission Effectivity Codes</b>				
<b>Mssn 1</b> --	<b>Mssn 2</b> --	<b>Mssn 3</b> --	<b>Mssn 4</b> --	<b>Mssn 5</b> --
<b>Estimated Completion Dates</b>				
<b>MSFC Approved Defer Until Date</b> --	<b>Contractor Req Defer Until Date</b> --	<b>LVL 3 Close</b> --	<b>Remark / Action</b> --	
<b>Investigation / Resolution Summary</b>				
<b>Last MSFC Update</b> 11/04/1991	<b>CN RSLV SBMT</b> 05/17/1988	<b>Defer Date</b> --	<b>Add Date</b> --	<b>R/C Codes</b> 5 - TRNG -- --
<b>Assignee</b>				
<b>Design</b> P. MULLER	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> P. BRIDWELL

<b>Approval</b>					
<b>Design</b> P. MULLER	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> P. BRIDWELL	
<b>PAC Assignee</b> J.EL-IBRAHIM	<b>PAC Review Complete</b> JE	<b>MSFC Closure Date</b> 06/03/1988	<b>Status</b> C - CLOSED	<b>F/A Completion</b> --	
<b>Problem Type</b> --	<b>SEV</b> --	<b>Program Name</b> --	<b>REVL</b> --	<b>OPRINC</b> --	
<b>FUNC MOD</b> --	<b>Software Effectivity</b> -- - - - - -	<b>Software Fail CD</b> --		<b>SUBTYPE</b> --	<b>Software Closure CD</b> --
<b>RES PERSON L2</b> --	<b>Approval Signature L3</b> --				
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Contractor Status Summary</b>					
<b>Reliability/Quality Assurance Concerns, Recommendations:</b>					
<b>Problem Description</b>  DURING A SECOND REREVIEW ON X-RAYS ON LWTS 21 AND 16, PROPULSION LINES, INTERPRETATIONS WERE IN- CONSISTENT WITH PREVIOUS REVIEWS. X-RAY INDICATIONS WERE DOCUMENTED WHICH AHD NOT BEEN PREVIOUSLY REPORTED REF. CAPS P-053 AND MARS T-93899					
<b>Contractor Investigation/Resolution</b>  UNDER INVESTIGATION THIS IS A LAUNCH CONSTRAINTS FOR LWTS 21 AND 16 THE CONSTRAINTS RATIONALE AS FOLLOWS: LINE RUP- TURE WOULD BE CATASTROPHIC. THIS STATEMENT HAS BEEN COORDINATED WITH: _____ PROJECT MANAGER. _____ MR. G. P. BRIDWELL, ET NICHOLS, ET CHIEF ENGINEER MR. J 12/17/87 FAILURE MODE: WELD FAILURE ON PROPULSION LINES CAUSE: EMPLOYEE/VENDOR ERROR CORRECTIVE ACTION: DISCIPLINARY ACTION/REAL TIME X-RAY INSPECTION/ENHANCED X-RAY TRACEABILITY/REVIEW OF X-RAY CERTIFICATION PROGRAM/SEMI-ANNUAL AUDIT OF X-RAY INTERPRETER PROFICIENCY/ UPGRADE X-RAY REVIEW FACILITIES/REVIEW X-RAY STORAGE, HANDLING, AND PROCEDURES ET CLEARANCE: LWT-21: CONSTRAINT TO FLIGHT PENDING					

<p>ADDITIONAL ENGINEERING ANALYSIS ECD 12/4/87  LWT-16: CONSTRAINT TO FLIGHT. PENDING  ENGINEERING ANALYSIS  LWTS 20, 22, AND 24 THROUGH 45: CONSTRAINT  TO FLIGHT PENDING SUCCESSFUL REVIEW OF  RADIOGRAPHS PER TD 808</p> <p>5/3/88 PRB UPDATE - SENIOR MRB HAS DISPOSITIONED THIS ITEM AS "USE AS  IS" WHICH CLEARED LWT 21 FOR FLIGHT  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 _____G.P. BRIDWELL (SIGNED) 5/13/88_____  5/17/88 CLOSURE UPDATE - SINCE THE OCCURRENCE OF THIS PROBLEM,  INVESTIGATION HAS RESULTED IN A GENERIC RE-REVIEW OF THE X-RAYS  OF ALL ET WELDS. THE CORRECTIVE ACTIONS HAVE BEEN TRANSFERRED TO  MSFC PROBLEM REPORT NO. A10942  THIS CLOSURE IS SUBMITTED TO MSFC FOR REVIEW AND APPROVAL</p> <p><b>MSFC Response/Concurrence</b></p>
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#### ASSESSMENT ADDENDUM REPORT

<b>MSFC Report#</b> A10943	<b>IFA#</b> --	<b>Contractor RPT#</b> P-059-2	<b>JSC#</b> --	<b>KSC#</b> --	<b>EICN#</b> --
<b>Asmnt Part#</b> PD4800175-080	<b>Asmnt Part Name</b> PROPULSION LINE	<b>Asmnt Serial/Lot#</b> 340			
<b>HCRIT CD</b> --	<b>FCRIT CD</b> 1	<b>CAUSE CD</b> MAW - MFG-ASY-WORK	<b>FAIL MODE</b> UC - UNSAT		
<b>Asmnt FMEA</b> 2.1.6.1	<b>Asmnt FM</b> 1	<b>FMEA CSE</b> A	<b>FMEA SCSE</b> 2		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Correlated Part#</b> --	<b>Correlated Part#</b> --	<b>Correlated Part#</b> --			
<b>Associated LRU#</b> --	<b>Associated LRU#</b> --	<b>Associated LRU#</b> --			
<b>MAJOR DESIGN CHANGES</b>					
<b>APRV DATE</b> --	<b>DESCRIPTION OF CHANGES</b> --				
<b>ASSESSMENT TEXT</b>					

WHOLE RECORD REPORT( + ADDENDUM)

<b>MSFC Record #</b> A10944	<b>In-Flight Anomaly Number</b> --	<b>Contractor Report Number</b> P-059-3	<b>JSC#</b> --	<b>KSC#</b> --
<b>Problem Title</b> PROPULSION LINE PD4800205-029 X-RAY REVIEW INTERPRETATIONS (ELBOW FLEX LINE)				
<b>EICN#</b> --	<b>ELEMENT</b> ET	<b>Contractor</b> MMMSS	<b>FSCM#</b> --	<b>FCRIT</b> 1
<b>HCRIT</b> 1	<b>Sys_Lvl</b> N	<b>Misc Codes</b> A (4) B C D E F G H I J K L M N O		
<b>HARDWARE</b> EIM	<b>NOMENCLATURE</b> ET	<b>PART#</b> 80901000000	<b>SER/LOT#</b> NOTED	<b>MANUFACTURER</b> MMC
<b>HARDWARE</b> LRU	<b>NOMENCLATURE</b> PROP/MECH	<b>PART#</b> 80921021009	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> N/A
<b>HARDWARE</b> NCA	<b>NOMENCLATURE</b> PROPULSION LINE	<b>PART#</b> PD4800205-029	<b>SER/LOT#</b> 139	<b>MANUFACTURER</b> ARROWHEAD
<b>Test/Operation</b> L - FLD	<b>Prevailing Condtion</b> N - INSPECTION	<b>F / U</b> F	<b>Fail Mode</b> UC - UNSAT	<b>Cause</b> MAW - MFG-ASY-WORK
<b>System</b> PROPULSION	<b>Defect</b> DC - BROKEN	<b>Material</b> M - LINK-G	<b>Work Contact</b> J. FINCHER	<b>Fail Date</b> 07/17/1987
<b>Received at MSFC</b> 08/14/1987	<b>Date Isolated</b> --	<b>FMEA Reference</b> 2.7.6.1	<b>IFA: Mission Phase</b> --	<b>Mission Elapsed Time</b> --
<b>Location</b> MMC		<b>Symptom</b> UC - UNSAT		<b>Time Cycle</b> --
<b>Effectivity Text</b> LWT 16 AND UP				
<b>Vehicle Effectivity Codes</b>				
<b>Vehicle 1</b> --	<b>Vehicle 2</b> --	<b>Vehicle 3</b> --	<b>Vehicle 4</b> --	<b>Vehicle 5</b> --
<b>Mission Effectivity Codes</b>				
<b>Mssn 1</b> --	<b>Mssn 2</b> --	<b>Mssn 3</b> --	<b>Mssn 4</b> --	<b>Mssn 5</b> --
<b>Estimated Completion Dates</b>				
<b>MSFC Approved Defer Until Date</b> --	<b>Contractor Req Defer Until Date</b> --	<b>LVL 3 Close</b> --	<b>Remark / Action</b> --	
<b>Investigation / Resolution Summary</b>				
<b>Last MSFC Update</b> 12/02/1991	<b>CN RSLV SBMT</b> 05/17/1988	<b>Defer Date</b> --	<b>Add Date</b> --	<b>R/C Codes</b> 5 - TRNG -- --
<b>Assignee</b>				
<b>Design</b> P. MULLER	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> P. BRIDWELL

<b>Approval</b>					
<b>Design</b> P. MULLER	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> P. BRIDWELL	
<b>PAC Assignee</b> J.EL-IBRAHIM	<b>PAC Review Complete</b> JE	<b>MSFC Closure Date</b> 06/03/1988	<b>Status</b> C - CLOSED	<b>F/A Completion</b> --	
<b>Problem Type</b> --	<b>SEV</b> --	<b>Program Name</b> --	<b>REVL</b> --	<b>OPRINC</b> --	
<b>FUNC MOD</b> --	<b>Software Effectivity</b> -- - - - - -	<b>Software Fail CD</b> --		<b>SUBTYPE</b> --	<b>Software Closure CD</b> --
<b>RES PERSON L2</b> --	<b>Approval Signature L3</b> --				
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Contractor Status Summary</b>					
<b>Reliability/Quality Assurance Concerns, Recommendations:</b>					
<b>Problem Description</b>  DURING A SECOND REREVIEW ON X-RAYS ON LWTS 21 AND 16, PROPULSION LINES, INTERPRETATIONS WERE IN- CONSISTENT WITH PREVIOUS REVIEWS. X-RAY INDICATIONS WERE DOCUMENTED WHICH HAD NOT BEEN PREVIOUSLY REPORTED REF. CAPS P-053 AND MARS T-93890					
<b>Contractor Investigation/Resolution</b>  UNDER INVESTIGATION THIS IS A LAUNCH CONSTRAINT FOR LWTS 21 AND 16. THE CONSTRAINTS RATIONALE AS FOLLOWS: LINE RUP- TURE WOULD BE CATASTROPHIC THIS STATEMENT HAS BEEN COORDINATED WITH:  _____ MR. G. P. BRIDWELL, ET PROJECT MANAGER. _____ MR. J NICHOLS, ET CHIEF ENGINEER 12/17/87 FAILURE MODE: WELD FAILURE ON PROPULSION LINES CAUSE: EMPLOYEE/VENDOR ERROR CORRECTIVE ACTION: DISCIPLINARY ACTION/REAL TIME X-RAY INSPECTION/ ENHANCED X-RAY TRACEABILITY/REVIEW OF X-RAY CERTIFICATION PROGRAM/SEMI-ANNUAL AUDIT OF X-RAY INTERPRETER PROFICIENCY/UPGRADE X-RAY REVIEW FACILITIES/REVIEW X-RAY STORAGE, HANDLING, AND PROCEDURES ET CLEARANCE: LWT-21: CONSTRAINT TO FLIGHT PENDING ADDITIONAL					

<p>ENGINEERING ANALYSIS ECD 12/4/87  LWT-16: CONSTRAINT TO FLIGHT. PENDING  ENGINEERING ANALYSIS  LWTS 20, 22, AND 24 THROUGH 45: CONSTRAINT TO  FLIGHT PENDING SUCCESSFUL REVIEW OF RADIOGRAPHS  PER TD 808</p> <p>5/3/88 PRB UPDATE - SENIOR MRB HAS DISPOSITIONED THIS ITEM AS "USE  AS IS" WHICH CLEARED LWT 21</p> <p>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 _____G.P. BRIDWELL (SIGNED) 5/13/88_____  5/17/88 CLOSURE UPDATE - SINCE THE OCCURRENCE OF THIS PROBLEM,  INVESTIGATION HAS RESULTED IN A GENERIC RE-REVIEW OF THE X-RAYS  OF ALL ET WELDS. THE CORRECTIVE ACTIONS HAVE BEEN TRANSFERRED TO  MSFC PROBLEM REPORT NO. A10942  THIS CLOSURE IS SUBMITTED TO MSFC FOR REVIEW AND APPROVAL</p> <p><b>MSFC Response/Concurrence</b></p>
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#### ASSESSMENT ADDENDUM REPORT

<b>MSFC Report#</b> A10944	<b>IFA#</b> --	<b>Contractor RPT#</b> P-059-3	<b>JSC#</b> --	<b>KSC#</b> --	<b>EICN#</b> --
<b>Asmnt Part#</b> PD4800205-029	<b>Asmnt Part Name</b> PROPULSION LINE	<b>Asmnt Serial/Lot#</b> 139			
<b>HCRIT CD</b> --	<b>FCRIT CD</b> 1	<b>CAUSE CD</b> MAW - MFG-ASY-WORK	<b>FAIL MODE</b> UC - UNSAT		
<b>Asmnt FMEA</b> 2.7.6.1	<b>Asmnt FM</b> 1	<b>FMEA CSE</b> A	<b>FMEA SCSE</b> 2		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Correlated Part#</b> --	<b>Correlated Part#</b> --	<b>Correlated Part#</b> --			
<b>Associated LRU#</b> --	<b>Associated LRU#</b> --	<b>Associated LRU#</b> --			
<b>MAJOR DESIGN CHANGES</b>					
<b>APRV DATE</b> --	<b>DESCRIPTION OF CHANGES</b> --				
<b>ASSESSMENT TEXT</b>					

WHOLE RECORD REPORT( + ADDENDUM)

<b>MSFC Record #</b> A10945	<b>In-Flight Anomaly Number</b> --	<b>Contractor Report Number</b> P-059-4	<b>JSC#</b> --	<b>KSC#</b> --
<b>Problem Title</b> PROPULSION LINE PD4800184-020 X-RAY REVIEW INTERPRETATIONS (LH2 FEEDLINE, EXTERNAL)				
<b>EICN#</b> --	<b>ELEMENT</b> ET	<b>Contractor</b> MMMSS	<b>FSCM#</b> --	<b>FCRIT</b> 1
<b>HCRIT</b> 1	<b>Sys_Lvl</b> N	<b>Misc Codes</b> A (4) B C D E F G H I J K L M N O		
<b>HARDWARE</b> EIM	<b>NOMENCLATURE</b> ET	<b>PART#</b> 80901000000	<b>SER/LOT#</b> NOTED	<b>MANUFACTURER</b> MMC
<b>HARDWARE</b> LRU	<b>NOMENCLATURE</b> LH2 PROP. FEED	<b>PART#</b> 80971028410	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> N/A
<b>HARDWARE</b> NCA	<b>NOMENCLATURE</b> PROPULSION LINE	<b>PART#</b> PD4800184-020	<b>SER/LOT#</b> 104	<b>MANUFACTURER</b> ARROWHEAD
<b>Test/Operation</b> L - FLD	<b>Prevailing Condtion</b> N - INSPECTION	<b>F / U</b> F	<b>Fail Mode</b> UC - UNSAT	<b>Cause</b> MAW - MFG-ASY-WORK
<b>System</b> PROPULSION	<b>Defect</b> DC - BROKEN	<b>Material</b> M - LINK-G	<b>Work Contact</b> J. FINCHER	<b>Fail Date</b> 07/17/1987
<b>Received at MSFC</b> 08/14/1987	<b>Date Isolated</b> --	<b>FMEA Reference</b> 2.5.8.1.1	<b>IFA: Mission Phase</b> --	<b>Mission Elapsed Time</b> --
<b>Location</b> MMC		<b>Symptom</b> UC - UNSAT		<b>Time Cycle</b> --
<b>Effectivity Text</b> LWT 16 AND UP				
<b>Vehicle Effectivity Codes</b>				
<b>Vehicle 1</b> --	<b>Vehicle 2</b> --	<b>Vehicle 3</b> --	<b>Vehicle 4</b> --	<b>Vehicle 5</b> --
<b>Mission Effectivity Codes</b>				
<b>Mssn 1</b> --	<b>Mssn 2</b> --	<b>Mssn 3</b> --	<b>Mssn 4</b> --	<b>Mssn 5</b> --
<b>Estimated Completion Dates</b>				
<b>MSFC Approved Defer Until Date</b> --	<b>Contractor Req Defer Until Date</b> --	<b>LVL 3 Close</b> --	<b>Remark / Action</b> --	
<b>Investigation / Resolution Summary</b>				
<b>Last MSFC Update</b> 12/02/1991	<b>CN RSLV SBMT</b> 05/17/1988	<b>Defer Date</b> --	<b>Add Date</b> --	<b>R/C Codes</b> 5 - TRNG -- --
<b>Assignee</b>				
<b>Design</b> P. MULLER	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> P. BRIDWELL

<b>Approval</b>					
<b>Design</b> P. MULLER	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> P. BRIDWELL	
<b>PAC Assignee</b> J.EL-IBRAHIM	<b>PAC Review Complete</b> JE	<b>MSFC Closure Date</b> 06/15/1989	<b>Status</b> C - CLOSED	<b>F/A Completion</b> --	
<b>Problem Type</b> --	<b>SEV</b> --	<b>Program Name</b> --	<b>REVL</b> --	<b>OPRINC</b> --	
<b>FUNC MOD</b> --	<b>Software Effectivity</b> -- - - - - -	<b>Software Fail CD</b> --		<b>SUBTYPE</b> --	<b>Software Closure CD</b> --
<b>RES PERSON L2</b> --	<b>Approval Signature L3</b> --				
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Contractor Status Summary</b>					
<b>Reliability/Quality Assurance Concerns, Recommendations:</b>					
<b>Problem Description</b>  DURING A SECOND REREVIEW ON X-RAYS ON LWT-S 21 AND 16, PROPULSION LINES, INTERPRETATIONS WERE IN- CONSISTENT WITH PREVIOUS REVIEWS. X-RAY INDICATIONS WERE DOCUMENTED WHICH HAD NOT BEEN PREVIOUSLY REPORTED REF. CAPS P-053 AND MARS T-93900					
<b>Contractor Investigation/Resolution</b>  UNDER INVESTIGATION THIS IS A LAUNCH CONSTRAINTS FOR LWTS 21 AND 16 THE CONSTRAINTS RATIONALE AS FOLLOWS: LINE RUP- TURE WOULD BE CATASTROPHIC. THIS STATEMENT HAS BEEN COORDINATED WITH: _____ PROJECT MANAGER. _____ MR. G. P. BRIDWELL, ET NICHOLS, ET CHIEF ENGINEER 12/17/87 FAILURE MODE: WELD FAILURE ON PROPULSION LINES CAUSE: EMPLOYEE/VENDOR ERROR CORRECTIVE ACTIONS: DISCIPLINARY ACTION/REAL TIME X-RAY INSPECTION/ ENHANCED X-RAY TRACEABILITY/REVIEW OF X-RAY CERTIFICATION PROGRAM/SEMI-ANNUAL AUDIT OF X-RAY INTERPRETER PROFICIENCY/UPGRADE X-RAY REVIEW FACILITIES/REVIEW X-RAY STORAGE, HANDLING, AND PROCEDURES ET CLEARANCE: LWT-21: CONSTRAINT TO FLIGHT PENDING					



<p>ADDITIONAL ENGINEERING ANALYSIS ECD 12/4/87  LWT-16: CONSTRAINT TO FLIGHT. PENDING  ENGINEERING ANALYSIS  LWTS 20, 22, AND 24 THROUGH 45: CONSTRAINT  TO FLIGHT PENDING SUCCESSFUL REVIEW OF  RADIOGRAPHS PER TD 808</p> <p>5/3/88 PRB UPDATE - SENIOR MRB HAS DISPOSITIONED THIS ITEM AS "USE AS  IS" WHICH CLEARED LWT 21 FOR FLIGHT</p> <p>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 _____G.P. BRIDWELL (SIGNED) 5/13/88_____  5/17/88 CLOSURE UPDATE - SINCE THE OCCURRENCE OF THIS PROBLEM,  INVESTIGATION HAS RESULTED IN A GENERIC RE-REVIEW OF THE X-RAYS  OF ALL ET WELDS. THE CORRECTIVE ACTIONS HAVE BEEN TRANSFERRED TO  MSFC PROBLEM REPORT NO. A10942  THIS PROBLEM IS CONSIDERED CLOSED</p> <p><b>MSFC Response/Concurrence</b></p>
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#### ASSESSMENT ADDENDUM REPORT

<b>MSFC Report#</b> A10945	<b>IFA#</b> --	<b>Contractor RPT#</b> P-059-4	<b>JSC#</b> --	<b>KSC#</b> --	<b>EICN#</b> --
<b>Asmnt Part#</b> PD4800184-020	<b>Asmnt Part Name</b> PROPULSION LINE	<b>Asmnt Serial/Lot#</b> 104			
<b>HCRIT CD</b> --	<b>FCRIT CD</b> 1	<b>CAUSE CD</b> MAW - MFG-ASY-WORK	<b>FAIL MODE</b> UC - UNSAT		
<b>Asmnt FMEA</b> 2.5.8.1	<b>Asmnt FM</b> 1	<b>FMEA CSE</b> A	<b>FMEA SCSE</b> 2		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Correlated Part#</b> --	<b>Correlated Part#</b> --	<b>Correlated Part#</b> --			
<b>Associated LRU#</b> --	<b>Associated LRU#</b> --	<b>Associated LRU#</b> --			
<b>MAJOR DESIGN CHANGES</b>					
<b>APRV DATE</b> --	<b>DESCRIPTION OF CHANGES</b> --				
<b>ASSESSMENT TEXT</b>					

WHOLE RECORD REPORT( + ADDENDUM)

<b>MSFC Record #</b> A10946	<b>In-Flight Anomaly Number</b> --	<b>Contractor Report Number</b> P-059-5	<b>JSC#</b> --	<b>KSC#</b> --
<b>Problem Title</b> PROPULSION LINE PD4800205-020 X-RAY REVIEW INTERPRETATIONS (MID FIXED LINE)				
<b>EICN#</b> --	<b>ELEMENT</b> ET	<b>Contractor</b> MMMSS	<b>FSCM#</b> --	<b>FCRIT</b> 1
<b>HCRIT</b> 1	<b>Sys_Lvl</b> N	<b>Misc Codes</b> A (4) B C D E F G H I J K L M N O		
<b>HARDWARE</b> EIM	<b>NOMENCLATURE</b> ET	<b>PART#</b> 80901000000	<b>SER/LOT#</b> NOTED	<b>MANUFACTURER</b> MMC
<b>HARDWARE</b> LRU	<b>NOMENCLATURE</b> N/A	<b>PART#</b> 80921021009	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> N/A
<b>HARDWARE</b> NCA	<b>NOMENCLATURE</b> PROPULSION/MECH	<b>PART#</b> PD4800205-020	<b>SER/LOT#</b> 115	<b>MANUFACTURER</b> ARROWHEAD
<b>Test/Operation</b> L - FLD	<b>Prevailing Condion</b> N - INSPECTION	<b>F / U</b> F	<b>Fail Mode</b> UC - UNSAT	<b>Cause</b> MAW - MFG-ASY-WORK
<b>System</b> PROPULSION	<b>Defect</b> DC - BROKEN	<b>Material</b> M - LINK-G	<b>Work Contact</b> J. FINCHER	<b>Fail Date</b> 07/17/1987
<b>Received at MSFC</b> 08/14/1987	<b>Date Isolated</b> --	<b>FMEA Reference</b> 2.7.4.1	<b>IFA: Mission Phase</b> --	<b>Mission Elapsed Time</b> --
<b>Location</b> MMC		<b>Symptom</b> UC - UNSAT		<b>Time Cycle</b> --
<b>Effectivity Text</b> LWT 16 AND UP				
<b>Vehicle Effectivity Codes</b>				
<b>Vehicle 1</b> --	<b>Vehicle 2</b> --	<b>Vehicle 3</b> --	<b>Vehicle 4</b> --	<b>Vehicle 5</b> --
<b>Mission Effectivity Codes</b>				
<b>Mssn 1</b> --	<b>Mssn 2</b> --	<b>Mssn 3</b> --	<b>Mssn 4</b> --	<b>Mssn 5</b> --
<b>Estimated Completion Dates</b>				
<b>MSFC Approved</b> <b>Defer Until Date</b> --	<b>Contractor Req Defer</b> <b>Until Date</b> --	<b>LVL 3 Close</b> --	<b>Remark / Action</b> --	
<b>Investigation / Resolution Summary</b>				
<b>Last MSFC Update</b> 12/02/1991	<b>CN RSLV SBMT</b> 05/17/1988	<b>Defer Date</b> --	<b>Add Date</b> --	<b>R/C Codes</b> 5 - TRNG -- --
<b>Assignee</b>				
<b>Design</b> P. MULLER	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> P. BRIDWELL

<b>Approval</b>					
<b>Design</b> P. MULLER	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> P. BRIDWELL	
<b>PAC Assignee</b> J.EL-IBRAHIM	<b>PAC Review Complete</b> JE	<b>MSFC Closure Date</b> 06/03/1988	<b>Status</b> C - CLOSED	<b>F/A Completion</b> --	
<b>Problem Type</b> --	<b>SEV</b> --	<b>Program Name</b> --	<b>REVL</b> --	<b>OPRINC</b> --	
<b>FUNC MOD</b> --	<b>Software Effectivity</b> -- - - - -	<b>Software Fail CD</b> --		<b>SUBTYPE</b> --	<b>Software Closure CD</b> --
<b>RES PERSON L2</b> --	<b>Approval Signature L3</b> --				
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Contractor Status Summary</b>					
<b>Reliability/Quality Assurance Concerns, Recommendations:</b>					
<b>Problem Description</b>  DURING A SECOND REREVIEW ON X-RAYS ON LWTS 21 AND 16, PROPULSION LINES, INTERPRETATIONS WERE IN- CONSISTENT WITH PREVIOUS REVIEWS. X-RAY INDICATIONS WERE DOCUMENTED WHICH HAD NOT BEEN PREVIOUSLY REPORTED. REF CAPS P-053 AND MARS T-93890					
<b>Contractor Investigation/Resolution</b>  UNDER INVESTIGATION THIS IS A LAUNCH CONSTRAINTS FOR LWTS 21 AND 16 THE CONSTRAINTS RATIONALE AS FOLLOWS: LINE RUP- TURE WOULD BE CATASTROPHIC. THIS STATEMENT HAS BEEN COORDINATED WITH: _____ PROJECT MANAGER. _____ MR. G. P. BRIDWELL, ET NICHOLS, ET CHIEF ENGINEER 12/17/87 FAILURE MODE: WELD FAILURE ON PROPULSION LINES CAUSE: EMPLOYEE/VENDOR ERROR CORRECTIVE ACTIONS: DISCIPLINARY ACTION/REAL TIME X-RAY INSPECTION/ ENHANCED X-RAY TRACEABILITY/REVIEW OF X-RAY CERTIFICATION PROGRAM/SEMI-ANNUAL AUDIT OF X-RAY INTERPRETER PROFICIENCY/UPGRADE X-RAY REVIEW FACILITIES/REVIEW X-RAY STORAGE, HANDLING, AND PROCEDURES ET CLEARANCE: LWT-21: CONSTRAINT TO FLIGHT PENDING					

<p>ADDITIONAL ENGINEERING ANALYSIS ECD 12/4/87  LWT-16: CONSTRAINT TO FLIGHT. PENDING  ENGINEERING ANALYSIS  LWT 20, 22, AND 24 THROUGH 45: CONSTRAINT  TO FLIGHT PENDING SUCCESSFUL REVIEW OF  RADIOGRAPHS PER TD 808</p> <p>5/3/88 PRB UPDATE - SENSOR MRB HAS DISPOSITIONED THIS ITEM AS "USE AS  IS", WHICH CLEARED LWT 21 FOR FLIGHT  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 ____G.P. BRIDWELL (SIGNED) 5/13/88____  5/17/88 CLOSURE UPDATE - SINCE THE OCCURRENCE OF THIS PROBLEM,  INVESTIGATION HAS RESULTED IN A GENERIC RE-REVIEW OF THE X-RAYS  OF ALL ET WELDS. THE CORRECTIVE ACTIONS HAVE BEEN TRANSFERRED TO  MSFC PROBLEM REPORT NO. A10942  THIS CLOSURE IS SUBMITTED TO MSFC FOR REVIEW AND APPROVAL</p> <p><b>MSFC Response/Concurrence</b></p>
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#### ASSESSMENT ADDENDUM REPORT

<b>MSFC Report#</b> A10946	<b>IFA#</b> --	<b>Contractor RPT#</b> P-059-5	<b>JSC#</b> --	<b>KSC#</b> --	<b>EICN#</b> --
<b>Asmnt Part#</b> PD4800205-020	<b>Asmnt Part Name</b> PROPULSION LINE	<b>Asmnt Serial/Lot#</b> 115			
<b>HCRIT CD</b> --	<b>FCRIT CD</b> 1	<b>CAUSE CD</b> MAW - MFG-ASY-WORK	<b>FAIL MODE</b> UC - UNSAT		
<b>Asmnt FMEA</b> 2.7.4.1	<b>Asmnt FM</b> 1	<b>FMEA CSE</b> A	<b>FMEA SCSE</b> 2		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Correlated Part#</b> --	<b>Correlated Part#</b> --	<b>Correlated Part#</b> --			
<b>Associated LRU#</b> --	<b>Associated LRU#</b> --	<b>Associated LRU#</b> --			
<b>MAJOR DESIGN CHANGES</b>					
<b>APRV DATE</b> --	<b>DESCRIPTION OF CHANGES</b> --				
<b>ASSESSMENT TEXT</b>					

WHOLE RECORD REPORT( + ADDENDUM)

<b>MSFC Record #</b> A10947	<b>In-Flight Anomaly Number</b> --	<b>Contractor Report Number</b> P-059-6	<b>JSC#</b> --	<b>KSC#</b> --
<b>Problem Title</b> PROPULSION LINE PD4800180-080 X-RAY REVIEW INTERPRETATIONS				
<b>EICN#</b> --	<b>ELEMENT</b> ET	<b>Contractor</b> MMMSS	<b>FSCM#</b> --	<b>FCRIT</b> 1
<b>HCRIT</b> 1	<b>Sys_Lvl</b> N	<b>Misc Codes</b> A (4) B C D E F G H I J K L M N O		
<b>HARDWARE</b> EIM	<b>NOMENCLATURE</b> ET	<b>PART#</b> 80901000000	<b>SER/LOT#</b> NOTED	<b>MANUFACTURER</b> MMC
<b>HARDWARE</b> LRU	<b>NOMENCLATURE</b> G02 PRESS	<b>PART#</b> 80921021009	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> N/A
<b>HARDWARE</b> NCA	<b>NOMENCLATURE</b> LOWER LINE ASSY	<b>PART#</b> PD4800180-080	<b>SER/LOT#</b> 382	<b>MANUFACTURER</b> ARROWHEAD
<b>Test/Operation</b> A - ATP	<b>Prevailing Condtion</b> N - INSPECTION	<b>F / U</b> F	<b>Fail Mode</b> MV - EXT LEAK	<b>Cause</b> MAW - MFG-ASY- WORK
<b>System</b> PROPULSION	<b>Defect</b> XN - NA	<b>Material</b> N - HOLE	<b>Work Contact</b> J. FINCHER	<b>Fail Date</b> 07/17/1987
<b>Received at MSFC</b> 08/14/1987	<b>Date Isolated</b> --	<b>FMEA Reference</b> 2.2.6.1	<b>IFA: Mission Phase</b> --	<b>Mission Elapsed Time</b> --
<b>Location</b> MMC		<b>Symptom</b> UC - UNSAT		<b>Time Cycle</b> --
<b>Effectivity Text</b> LWT 16 AND UP				
<b>Vehicle Effectivity Codes</b>				
<b>Vehicle 1</b> --	<b>Vehicle 2</b> --	<b>Vehicle 3</b> --	<b>Vehicle 4</b> --	<b>Vehicle 5</b> --
<b>Mission Effectivity Codes</b>				
<b>Mssn 1</b> --	<b>Mssn 2</b> --	<b>Mssn 3</b> --	<b>Mssn 4</b> --	<b>Mssn 5</b> --
<b>Estimated Completion Dates</b>				
<b>MSFC Approved Defer Until Date</b> --	<b>Contractor Req Defer Until Date</b> --	<b>LVL 3 Close</b> --	<b>Remark / Action</b> --	
<b>Investigation / Resolution Summary</b>				
<b>Last MSFC Update</b> 05/07/1992	<b>CN RSLV SBMT</b> 05/17/1988	<b>Defer Date</b> --	<b>Add Date</b> --	<b>R/C Codes</b> 5 - TRNG -- --
<b>Assignee</b>				
<b>Design</b> P. MULLER	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> P. BRIDWELL
<b>Approval</b>				

<b>Design</b> P. MULLER	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> P. BRIDWELL	
<b>PAC Assignee</b> J.EL-IBRAHIM	<b>PAC Review Complete</b> JE	<b>MSFC Closure Date</b> 06/03/1988	<b>Status</b> C - CLOSED	<b>F/A Completion</b> --	
<b>Problem Type</b> --	<b>SEV</b> --	<b>Program Name</b> --	<b>REVL</b> --	<b>OPRINC</b> --	
<b>FUNC MOD</b> --	<b>Software Effectivity</b> -- - - - - -	<b>Software Fail CD</b> --		<b>SUBTYPE</b> --	<b>Software Closure CD</b> --
<b>RES PERSON L2</b> --	<b>Approval Signature L3</b> --				
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Contractor Status Summary</b>					
<b>Reliability/Quality Assurance Concerns, Recommendations:</b>					
<b>Problem Description</b>  DURING A SECOND REREVIEW ON X-RAYS ON LWTS 21 AND 16, PROPULSION LINES, INTERPRETATIONS WERE IN- CONSISTENT WITH PREVIOUS REVIEWS. X-RAY INDICATION WERE DOCUMENTED WHICH HAD NOT BEEN PREVIOUSLY REPORTED. REF CAPS P-053 AND MARS T-93898					
<b>Contractor Investigation/Resolution</b>  UNDER INVESTIGATION THIS IS A LAUNCH CONSTRAINTS FOR LWTS 21 AND 16 THE CONSTRAINTS RATIONALE AS FOLLOWS: LINE RUP- TURE WOULD BE CATASTROPHIC. THIS STATEMENT HAS BEEN COORDINATED WITH: ____ MR. G. P. BRIDWELL, ET PROJECT MANAGER, _____ MR. J NICHOLS, ET CHIEF ENGINEER 12/17/87 FAILURE MODE:      WELD FAILURE ON PROPULSION LINES CAUSE:                              EMPLOYEE/VENDOR ERROR CORRECTIVE ACTION:          DISCIPLINARY ACTION/REAL TIME X-RAY INSPECTION/ENHANCED X-RAY TRACEABILITY/REVIEW OF X-RAY CERTIFICATION PROGRAM/SEMI-ANNUAL AUDIT OF X-RAY INTERPRETER PROFICIENCY/ UPGRADE X-RAY REVIEW FACILITIES/REVIEW X-RAY STORAGE, HANDLING, AND PROCEDURES ET CLEARANCE:                LWT-21:    CONSTRAINT TO FLIGHT PENDING ADDITIONAL ENGINEERING ANALYSIS ECD 12/4/87 LWT-16:    CONSTRAINT TO FLIGHT PENDING					

<p>ENGINEERING ANALYSIS  LWTS 20, 22, AND 24 THROUGH 45: CONSTRAINT  TO FLIGHT PENDING SUCCESSFUL REVIEW OF  RADIOGRAPHS PER TD 808</p> <p>5/3/88 PRB UPDATE - SENSOR MRB HAS DISPOSITIONED THIS ITEM AS "USE  AS IS" WHICH CLEARED LWT 21 FOR FLIGHT</p> <p>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."</p> <p>THE DEFERRAL STATUS HAS BEEN APPROVED BY THE ET PROJECT MANAGER,  MR. G.P. BRIDWELL _____G.P. BRIDWELL (SIGNED) 5/13/88_____</p> <p>5/17/88 CLOSURE UPDATE - SINCE THE OCCURRENCE OF THIS PROBLEM,  INVESTIGATION HAS RESULTED IN A GENERIC RE-REVIEW OF THE X-RAYS  OF ALL ET WELDS. THE CORRECTIVE ACTIONS HAVE BEEN TRANSFERRED TO  MSFC PROBLEM REPORT NO. A10942</p> <p>THIS CLOSURE IS SUBMITTED TO MSFC FOR REVIEW AND APPROVAL</p>
<p><b>MSFC Response/Concurrence</b></p>

#### ASSESSMENT ADDENDUM REPORT

<b>MSFC Report#</b> A10947	<b>IFA#</b> --	<b>Contractor RPT#</b> P-059-6	<b>JSC#</b> --	<b>KSC#</b> --	<b>EICN#</b> --
<b>Asmnt Part#</b> PD4800180-080	<b>Asmnt Part Name</b> LOWER LINE ASSEMBLY	<b>Asmnt Serial/Lot#</b> 382			
<b>HCRIT CD</b> --	<b>FCRIT CD</b> 1	<b>CAUSE CD</b> MAW - MFG-ASY-WORK	<b>FAIL MODE</b> MV - EXT LEAK		
<b>Asmnt FMEA</b> 2.2.6.1	<b>Asmnt FM</b> 1	<b>FMEA CSE</b> A	<b>FMEA SCSE</b> 2		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Correlated Part#</b> --	<b>Correlated Part#</b> --	<b>Correlated Part#</b> --			
<b>Associated LRU#</b> --	<b>Associated LRU#</b> --	<b>Associated LRU#</b> --			
<b>MAJOR DESIGN CHANGES</b>					
<b>APRV DATE</b> --	<b>DESCRIPTION OF CHANGES</b> --				
<b>ASSESSMENT TEXT</b>					

WHOLE RECORD REPORT( + ADDENDUM)

<b>MSFC Record #</b> A10948	<b>In-Flight Anomaly Number</b> --	<b>Contractor Report Number</b> E-101-5	<b>JSC#</b> --	<b>KSC#</b> --
<b>Problem Title</b> TRANSDUCER OUTPUT SIGNAL HAD ELECTRICAL NOISE				
<b>EICN#</b> --	<b>ELEMENT</b> ET	<b>Contractor</b> MMMSS	<b>FSCM#</b> --	<b>FCRIT</b> 1R
<b>HCRIT</b> 1	<b>Sys_Lvl</b> Y	<b>Misc Codes</b> A (4) B C D E F G H I J K L M N O		
<b>HARDWARE</b> EIM	<b>NOMENCLATURE</b> LH2 ULL PRES TRNSDCR	<b>PART#</b> PD7400098-089	<b>SER/LOT#</b> 1465	<b>MANUFACTURER</b> GULTON
<b>HARDWARE</b> LRU	<b>NOMENCLATURE</b> N/A	<b>PART#</b> N/A	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> N/A
<b>HARDWARE</b> NCA	<b>NOMENCLATURE</b> LH2 ULL PRES TRNSDCR	<b>PART#</b> PD7400098-089	<b>SER/LOT#</b> 1465	<b>MANUFACTURER</b> GULTON
<b>Test/Operation</b> A - ATP	<b>Prevailing Condtion</b> F - FUNCTIONAL	<b>F / U</b> F	<b>Fail Mode</b> UC - UNSAT	<b>Cause</b> ETE - EI-TEST-ENVR
<b>System</b> ELECTRICAL	<b>Defect</b> CN - CONTAM	<b>Material</b> C - EEE	<b>Work Contact</b> J. ADAMS	<b>Fail Date</b> 05/15/1986
<b>Received at MSFC</b> 07/01/1986	<b>Date Isolated</b> --	<b>FMEA Reference</b> 3.4.1.2	<b>IFA: Mission Phase</b> --	<b>Mission Elapsed Time</b> --
<b>Location</b> GULTON		<b>Symptom</b> EVM - CON/MEG FAIL		<b>Time Cycle</b> --
<b>Effectivity Text</b> LWT 16, 20, 21, 22, 24/SUBS				
<b>Vehicle Effectivity Codes</b>				
<b>Vehicle 1</b> --	<b>Vehicle 2</b> --	<b>Vehicle 3</b> --	<b>Vehicle 4</b> --	<b>Vehicle 5</b> --
<b>Mission Effectivity Codes</b>				
<b>Mssn 1</b> --	<b>Mssn 2</b> --	<b>Mssn 3</b> --	<b>Mssn 4</b> --	<b>Mssn 5</b> --
<b>Estimated Completion Dates</b>				
<b>MSFC Approved Defer Until Date</b> --	<b>Contractor Req Defer Until Date</b> --	<b>LVL 3 Close</b> --	<b>Remark / Action</b> --	
<b>Investigation / Resolution Summary</b>				
<b>Last MSFC Update</b> 02/14/1995	<b>CN RSLV SBMT</b> 02/23/1987	<b>Defer Date</b> --	<b>Add Date</b> --	<b>R/C Codes</b> 2 - MFG -- --
<b>Assignee</b>				
<b>Design</b> P. MULLER	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> --
<b>Approval</b>				



<b>Design</b> P. MULLER	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> --	
<b>PAC Assignee</b> J.EL-IBRHIM	<b>PAC Review Complete</b> JE	<b>MSFC Closure Date</b> 11/06/1987	<b>Status</b> C - CLOSED	<b>F/A Completion</b> --	
<b>Problem Type</b> --	<b>SEV</b> --	<b>Program Name</b> --	<b>REVL</b> --	<b>OPRINC</b> --	
<b>FUNC MOD</b> --	<b>Software Effectivity</b> -- - - - - -	<b>Software Fail CD</b> --		<b>SUBTYPE</b> --	<b>Software Closure CD</b> --
<b>RES PERSON L2</b> --	<b>Approval Signature L3</b> --				
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Contractor Status Summary</b>					
<b>Reliability/Quality Assurance Concerns, Recommendations:</b>					
<b>Problem Description</b>  REF: MARS T-10485 AND PREVIOUS CAPS E-091 AND E-082. THE TRANSDUCER EXCEEDED THE MAXIMUM ALLOWABLE CONTACT RESISTANCE OF 25 OHMS AT TWO POINTS IN ITS PRESSURE RANGE. THE HIGHEST MEASURED RESISTANCE WAS 53 OHMS AT AN INPUT PRESSURE OF 39.5 PSIA					
<b>Contractor Investigation/Resolution</b>  R/A - ADDITIONAL INSPECTION STEPS HAVE BEEN ADDED TO REDUCE THE FREQUENCY OF OCCURRENCE. 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**

**ASSESSMENT ADDENDUM REPORT**

<b>MSFC Report#</b> A10948	<b>IFA#</b> --	<b>Contractor RPT#</b> E-101-5	<b>JSC#</b> --	<b>KSC#</b> --	<b>EICN#</b> --
<b>Asmnt Part#</b> PD7400098-089	<b>Asmnt Part Name</b> LH2 ULL PRES TRNSDCR	<b>Asmnt Serial/Lot#</b> 1465			
<b>HCRIT CD</b> --	<b>FCRIT CD</b> 1R	<b>CAUSE CD</b> EIC - EI-CONTAM	<b>FAIL MODE</b> UC - UNSAT		
<b>Asmnt FMEA</b> 3.4.1.2	<b>Asmnt FM</b> 2	<b>FMEA CSE</b> G	<b>FMEA SCSE</b> 1		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Correlated Part#</b> --	<b>Correlated Part#</b> --	<b>Correlated Part#</b> --			
<b>Associated LRU#</b> --	<b>Associated LRU#</b> --	<b>Associated LRU#</b> --			
<b>MAJOR DESIGN CHANGES</b>					
<b>APRV DATE</b> --	<b>DESCRIPTION OF CHANGES</b> --				
<b>ASSESSMENT TEXT</b>					

<b>MSFC Record #</b> A10948	<b>In-Flight Anomaly Number</b> --	<b>Contractor Report Number</b> E-101-5	<b>JSC#</b> --	<b>KSC#</b> --
<b>Problem Title</b> TRANSDUCER OUTPUT SIGNAL HAD ELECTRICAL NOISE				
<b>EICN#</b> --	<b>ELEMENT</b> ET	<b>Contractor</b> MMMSS	<b>FSCM#</b> --	<b>FCRIT</b> 1R
<b>HCRIT</b> 1	<b>Sys_Lvl</b> Y	<b>Misc Codes</b> A (4) B C D E F G H I J K L M N O		
<b>HARDWARE</b> EIM	<b>NOMENCLATURE</b> LH2 ULL PRES TRNSDCR	<b>PART#</b> PD7400098-089	<b>SER/LOT#</b> 1465	<b>MANUFACTURER</b> GULTON
<b>HARDWARE</b> LRU	<b>NOMENCLATURE</b> N/A	<b>PART#</b> N/A	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> N/A
<b>HARDWARE</b> NCA	<b>NOMENCLATURE</b> LH2 ULL PRES TRNSDCR	<b>PART#</b> PD7400098-089	<b>SER/LOT#</b> 1465	<b>MANUFACTURER</b> GULTON
<b>Test/Operation</b> A - ATP	<b>Prevailing Condtion</b> F - FUNCTIONAL	<b>F / U</b> F	<b>Fail Mode</b> UC - UNSAT	<b>Cause</b> ETE - EI-TEST-ENVR
<b>System</b> ELECTRICAL	<b>Defect</b> CN - CONTAM	<b>Material</b> C - EEE	<b>Work Contact</b> J. ADAMS	<b>Fail Date</b> 05/15/1986
<b>Received at MSFC</b> 07/01/1986	<b>Date Isolated</b> --	<b>FMEA Reference</b> 3.4.1.2	<b>IFA: Mission Phase</b> --	<b>Mission Elapsed Time</b> --
<b>Location</b> GULTON		<b>Symptom</b> EVM - CON/MEG FAIL		<b>Time Cycle</b> --
<b>Effectivity Text</b> LWT 16, 20, 21, 22, 24/SUBS				
<b>Vehicle Effectivity Codes</b>				
<b>Vehicle 1</b> --	<b>Vehicle 2</b> --	<b>Vehicle 3</b> --	<b>Vehicle 4</b> --	<b>Vehicle 5</b> --
<b>Mission Effectivity Codes</b>				
<b>Mssn 1</b> --	<b>Mssn 2</b> --	<b>Mssn 3</b> --	<b>Mssn 4</b> --	<b>Mssn 5</b> --
<b>Estimated Completion Dates</b>				
<b>MSFC Approved Defer Until Date</b> --	<b>Contractor Req Defer Until Date</b> --	<b>LVL 3 Close</b> --	<b>Remark / Action</b> --	
<b>Investigation / Resolution Summary</b>				
<b>Last MSFC Update</b> 02/14/1995	<b>CN RSLV SBMT</b> 02/23/1987	<b>Defer Date</b> --	<b>Add Date</b> --	<b>R/C Codes</b> 2 - MFG -- --
<b>Assignee</b>				
<b>Design</b> P. MULLER	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> --
<b>Approval</b>				
<b>Design</b> P. MULLER	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> --
<b>PAC Assignee</b> J.EL-IBRHIM	<b>PAC Review Complete</b> JE	<b>MSFC Closure Date</b>	<b>Status</b> C - CLOSED	<b>F/A Completion</b> --

		11/06/1987			
<b>Problem Type</b> --	<b>SEV</b> --	<b>Program Name</b> --	<b>REVL</b> --	<b>OPRINC</b> --	
<b>FUNC MOD</b> --	<b>Software Effectivity</b> -----	<b>Software Fail CD</b> --		<b>SUBTYPE</b> --	<b>Software Closure CD</b> --
<b>RES PERSON L2</b> --	<b>Approval Signature L3</b> --				
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Contractor Status Summary</b>					
<b>Reliability/Quality Assurance Concerns, Recommendations:</b>					
<b>Problem Description</b>  REF: MARS T-10485 AND PREVIOUS CAPS E-091 AND E-082. THE TRANSDUCER EXCEEDED THE MAXIMUM ALLOWABLE CONTACT RESISTANCE OF 25 OHMS AT TWO POINTS IN ITS PRESSURE RANGE. THE HIGHEST MEASURED RESISTANCE WAS 53 OHMS AT AN INPUT PRESSURE OF 39.5 PSIA					
<b>Contractor Investigation/Resolution</b>  R/A - ADDITIONAL INSPECTION STEPS HAVE BEEN ADDED TO REDUCE THE FREQUENCY OF OCCURRENCE. 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 QUALITY MANDATORY INSPECTION 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 INVESTIGATIONS OF FAILURE DUE TO SHORTED TURNS. THIS PROBLEM IS					

SUBMITTED TO MSFC FOR CLOSURE REVIEW AND APPROVAL

**MSFC Response/Concurrence**

ASSESSMENT ADDENDUM REPORT

<b>MSFC Report#</b> A10948	<b>IFA#</b> --	<b>Contractor RPT#</b> E-101-5	<b>JSC#</b> --	<b>KSC#</b> --	<b>EICN#</b> --
<b>Asmnt Part#</b> PD7400098-089	<b>Asmnt Part Name</b> LH2 ULL PRES TRNSDCR	<b>Asmnt Serial/Lot#</b> 1465			
<b>HCRIT CD</b> --	<b>FCRIT CD</b> 1R	<b>CAUSE CD</b> EIC - EI-CONTAM	<b>FAIL MODE</b> UC - UNSAT		
<b>Asmnt FMEA</b> 3.4.1.2	<b>Asmnt FM</b> 2	<b>FMEA CSE</b> G	<b>FMEA SCSE</b> 1		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Correlated Part#</b> --	<b>Correlated Part#</b> --	<b>Correlated Part#</b> --			
<b>Associated LRU#</b> --	<b>Associated LRU#</b> --	<b>Associated LRU#</b> --			
<b>MAJOR DESIGN CHANGES</b>					
<b>APRV DATE</b> --	<b>DESCRIPTION OF CHANGES</b> --				
<b>ASSESSMENT TEXT</b>					

WHOLE RECORD REPORT( + ADDENDUM)

<b>MSFC Record #</b> A10949	<b>In-Flight Anomaly Number</b> --	<b>Contractor Report Number</b> E-101-6	<b>JSC#</b> --	<b>KSC#</b> --
<b>Problem Title</b> TRANSDUCER OUTPUT SIGNAL HAD ELECTRICAL NOISE				
<b>EICN#</b> --	<b>ELEMENT</b> ET	<b>Contractor</b> MMMSS	<b>FSCM#</b> --	<b>FCRIT</b> 1R
<b>HCRIT</b> 1	<b>Sys_Lvl</b> Y	<b>Misc Codes</b> A (4) B C D E F G H I J K L M N O		
<b>HARDWARE</b> EIM	<b>NOMENCLATURE</b> LH2 ULL PRES TRNSDCR	<b>PART#</b> PD7400098-089	<b>SER/LOT#</b> 1463	<b>MANUFACTURER</b> GULTON
<b>HARDWARE</b> LRU	<b>NOMENCLATURE</b> N/A	<b>PART#</b> N/A	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> N/A
<b>HARDWARE</b> NCA	<b>NOMENCLATURE</b> LH2 ULL PRES TRNSDCR	<b>PART#</b> PD7400098-089	<b>SER/LOT#</b> 1463	<b>MANUFACTURER</b> GULTON
<b>Test/Operation</b> A - ATP	<b>Prevailing Condtion</b> F - FUNCTIONAL	<b>F / U</b> F	<b>Fail Mode</b> UC - UNSAT	<b>Cause</b> ETE - EI-TEST-ENVR
<b>System</b> ELECTRICAL	<b>Defect</b> CN - CONTAM	<b>Material</b> C - EEE	<b>Work Contact</b> J. ADAMS	<b>Fail Date</b> 05/15/1986
<b>Received at MSFC</b> 07/01/1986	<b>Date Isolated</b> --	<b>FMEA Reference</b> 3.4.1.2	<b>IFA: Mission Phase</b> --	<b>Mission Elapsed Time</b> --
<b>Location</b> GULTON		<b>Symptom</b> EVM - CON/MEG FAIL		<b>Time Cycle</b> --
<b>Effectivity Text</b> LWT 16, 20, 21, 22, 24/SUBS				
<b>Vehicle Effectivity Codes</b>				
<b>Vehicle 1</b> --	<b>Vehicle 2</b> --	<b>Vehicle 3</b> --	<b>Vehicle 4</b> --	<b>Vehicle 5</b> --
<b>Mission Effectivity Codes</b>				
<b>Mssn 1</b> --	<b>Mssn 2</b> --	<b>Mssn 3</b> --	<b>Mssn 4</b> --	<b>Mssn 5</b> --
<b>Estimated Completion Dates</b>				
<b>MSFC Approved Defer Until Date</b> --	<b>Contractor Req Defer Until Date</b> --	<b>LVL 3 Close</b> --	<b>Remark / Action</b> --	
<b>Investigation / Resolution Summary</b>				
<b>Last MSFC Update</b> 02/14/1995	<b>CN RSLV SBMT</b> 02/23/1987	<b>Defer Date</b> --	<b>Add Date</b> --	<b>R/C Codes</b> 2 - MFG -- --
<b>Assignee</b>				
<b>Design</b> P. MULLER	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> --
<b>Approval</b>				

<b>Design</b> P. MULLER	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> --	
<b>PAC Assignee</b> J.EL-IBRAHIM	<b>PAC Review Complete</b> JE	<b>MSFC Closure Date</b> 11/06/1987	<b>Status</b> C - CLOSED	<b>F/A Completion</b> --	
<b>Problem Type</b> --	<b>SEV</b> --	<b>Program Name</b> --	<b>REVL</b> --	<b>OPRINC</b> --	
<b>FUNC MOD</b> --	<b>Software Effectivity</b> -- - - - - -	<b>Software Fail CD</b> --		<b>SUBTYPE</b> --	<b>Software Closure CD</b> --
<b>RES PERSON L2</b> --	<b>Approval Signature L3</b> --				
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Contractor Status Summary</b>					
<b>Reliability/Quality Assurance Concerns, Recommendations:</b>					
<b>Problem Description</b>  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 94 OHMS AT AN INPUT PRESSURE OF 33 PSIA					
<b>Contractor Investigation/Resolution</b>  R/A - ADDITIONAL INSPECTION STEPS HAVE BEEN ADDED TO REDUCE THE FREQUENCY OF OCCURRENCE. 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**

**ASSESSMENT ADDENDUM REPORT**

<b>MSFC Report#</b> A10949	<b>IFA#</b> --	<b>Contractor RPT#</b> E-101-6	<b>JSC#</b> --	<b>KSC#</b> --	<b>EICN#</b> --
<b>Asmnt Part#</b> PD7400098-089	<b>Asmnt Part Name</b> LH2 ULL PRES TRNSDCR	<b>Asmnt Serial/Lot#</b> 1463			
<b>HCRIT CD</b> --	<b>FCRIT CD</b> 1R	<b>CAUSE CD</b> EIC - EI-CONTAM	<b>FAIL MODE</b> UC - UNSAT		
<b>Asmnt FMEA</b> 3.4.1.2	<b>Asmnt FM</b> 2	<b>FMEA CSE</b> G	<b>FMEA SCSE</b> 1		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Correlated Part#</b> --	<b>Correlated Part#</b> --	<b>Correlated Part#</b> --			
<b>Associated LRU#</b> --	<b>Associated LRU#</b> --	<b>Associated LRU#</b> --			
<b>MAJOR DESIGN CHANGES</b>					
<b>APRV DATE</b> --	<b>DESCRIPTION OF CHANGES</b> --				
<b>ASSESSMENT TEXT</b>					



WHOLE RECORD REPORT( + ADDENDUM)

<b>MSFC Record #</b> A10968	<b>In-Flight Anomaly Number</b> --	<b>Contractor Report Number</b> P-058-2	<b>JSC#</b> --	<b>KSC#</b> --
<b>Problem Title</b> PYRO TUMBLE VALVE CONTAMINATION ON LWT-39				
<b>EICN#</b> --	<b>ELEMENT</b> ET	<b>Contractor</b> MMMSS	<b>FSCM#</b> --	<b>FCRIT</b> 1
<b>HCRIT</b> --	<b>Sys_Lvl</b> N	<b>Misc Codes</b> A B C D E F G H I J K L M N O		
<b>HARDWARE</b> EIM	<b>NOMENCLATURE</b> ET	<b>PART#</b> 82601000000	<b>SER/LOT#</b> NOTED	<b>MANUFACTURER</b> MMC
<b>HARDWARE</b> LRU	<b>NOMENCLATURE</b> N/A	<b>PART#</b> N/A	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> N/A
<b>HARDWARE</b> NCA	<b>NOMENCLATURE</b> PYRO VALVE	<b>PART#</b> PD7400193-020	<b>SER/LOT#</b> 423	<b>MANUFACTURER</b> PYRONETICS
<b>Test/Operation</b> M - MFG	<b>Prevailing Condtion</b> --	<b>F / U</b> F	<b>Fail Mode</b> ME - RANDOM	<b>Cause</b> MN - MFG-ISP
<b>System</b> PROPULSION	<b>Defect</b> CN - CONTAM	<b>Material</b> N - HOLE	<b>Work Contact</b> C. CAMPBELL	<b>Fail Date</b> 02/04/1987
<b>Received at MSFC</b> 08/24/1987	<b>Date Isolated</b> --	<b>FMEA Reference</b> 2.7.1	<b>IFA: Mission Phase</b> --	<b>Mission Elapsed Time</b> --
<b>Location</b> MAF		<b>Symptom</b> UC - UNSAT		<b>Time Cycle</b> --
<b>Effectivity Text</b> LWTS 16, 20, 21, 22, 24/SUBS				
<b>Vehicle Effectivity Codes</b>				
<b>Vehicle 1</b> --	<b>Vehicle 2</b> --	<b>Vehicle 3</b> --	<b>Vehicle 4</b> --	<b>Vehicle 5</b> --
<b>Mission Effectivity Codes</b>				
<b>Mssn 1</b> --	<b>Mssn 2</b> --	<b>Mssn 3</b> --	<b>Mssn 4</b> --	<b>Mssn 5</b> --
<b>Estimated Completion Dates</b>				
<b>MSFC Approved Defer Until Date</b> --	<b>Contractor Req Defer Until Date</b> --	<b>LVL 3 Close</b> --	<b>Remark / Action</b> --	
<b>Investigation / Resolution Summary</b>				
<b>Last MSFC Update</b> 11/04/1991	<b>CN RSLV SBMT</b> --	<b>Defer Date</b> --	<b>Add Date</b> --	<b>R/C Codes</b> 2 - MFG -- --
<b>Assignee</b>				
<b>Design</b> P. MULLER	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> --
<b>Approval</b>				
<b>Design</b>	<b>Chief Engineer</b>	<b>S &amp; MA</b>	<b>Project</b>	<b>Project MGR</b>

P. MULLER	J. NICHOLS	R. JACKSON	M. PESSIN	--	
<b>PAC Assignee</b> J.EL-IBRAHIM	<b>PAC Review Complete</b> JE	<b>MSFC Closure Date</b> 09/24/1987	<b>Status</b> C - CLOSED	<b>F/A Completion</b> --	
<b>Problem Type</b> --	<b>SEV</b> --	<b>Program Name</b> --	<b>REVL</b> --	<b>OPRINC</b> --	
<b>FUNC MOD</b> --	<b>Software Effectivity</b> -- - - - - -	<b>Software Fail CD</b> --		<b>SUBTYPE</b> --	<b>Software Closure CD</b> --
<b>RES PERSON L2</b> --	<b>Approval Signature L3</b> --				
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Contractor Status Summary</b>					
<b>Reliability/Quality Assurance Concerns, Recommendations:</b>					
<b>Problem Description</b>  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					
<b>Contractor Investigation/Resolution</b>  R/C MMC HAS DEVELOPED A TOOL TO INSPECT ALL PROPELLANT 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 MARKETING 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 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 MARKED 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 (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 (REFERENCE 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 PROPELLANT FLANGES. THESE COMPONENTS WERE SUPPLIED BY VENDORS AND CLEANED OUTSIDE OF MAF. TOOLING WAS DEVELOPED TO INSPECT LEAK PORTS ON PROPELLANT FLANGES ASSEMBLED

PRIOR TO KNOWLEDGE OF THIS PROBLEM. THE INSPECTIONS WERE IMPLEMENTED THROUGH MOD KIT, DC&R AND MARS ACTIVITY. INSPECTIONS WERE ADDED TO ALL PROPELLANT 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 PROPELLANT FLANGES. EXISTING REQUIREMENTS COULD ALLOW RESTRICTION OF TEST MEDIA FLOW RESULTING IN INACCURATE LEAK TEST DATA. ENGINEERING CONDUCTED A STUDY OF THIS PHENOMENA AND CONCLUDED A CHANGE IN LEAK TEST PARAMETERS WOULD COMPENSATE FOR THE CONDITION. THE NEW LEAK TEST REQUIREMENTS WERE IMPLEMENTED BY MOD KIT RELEASE AND ATP/TM04 CHANGES. THESE ACTIONS ARE SUFFICIENT TO CLOSE THIS CAPS

**MSFC Response/Concurrence**

**ASSESSMENT ADDENDUM REPORT**

<b>MSFC Report#</b> A10968	<b>IFA#</b> --	<b>Contractor RPT#</b> P-058-2	<b>JSC#</b> --	<b>KSC#</b> --	<b>EICN#</b> --
<b>Asmnt Part#</b> PD7400193-020	<b>Asmnt Part Name</b> PYRO VALVE	<b>Asmnt Serial/Lot#</b> 423			
<b>HCRIT CD</b> --	<b>FCRIT CD</b> 1	<b>CAUSE CD</b> MN - MFG-ISP	<b>FAIL MODE</b> ME - RANDOM		
<b>Asmnt FMEA</b> 2.16.1.1	<b>Asmnt FM</b> 1	<b>FMEA CSE</b> N/A	<b>FMEA SCSE</b> N/A		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Correlated Part#</b> --	<b>Correlated Part#</b> --	<b>Correlated Part#</b> --			
<b>Associated LRU#</b> --	<b>Associated LRU#</b> --	<b>Associated LRU#</b> --			
<b>MAJOR DESIGN CHANGES</b>					
<b>APRV DATE</b> --	<b>DESCRIPTION OF CHANGES</b> --				
<b>ASSESSMENT TEXT</b>					

WHOLE RECORD REPORT( + ADDENDUM)

<b>MSFC Record #</b> A11016	<b>In-Flight Anomaly Number</b> --	<b>Contractor Report Number</b> E-100-2	<b>JSC#</b> --	<b>KSC#</b> --
<b>Problem Title</b> LO2 LEVEL SENSOR FAILED ISOLATION TEST				
<b>EICN#</b> --	<b>ELEMENT</b> ET	<b>Contractor</b> MMMSS	<b>FSCM#</b> --	<b>FCRIT</b> 1
<b>HCRIT</b> 1	<b>Sys_Lvl</b> Y	<b>Misc Codes</b> A B C D E F G H I J K L M N O		
<b>HARDWARE</b> EIM	<b>NOMENCLATURE</b> L02 LEVEL SENSOR	<b>PART#</b> 74L4-1	<b>SER/LOT#</b> 948	<b>MANUFACTURER</b> SIMMONDS
<b>HARDWARE</b> LRU	<b>NOMENCLATURE</b> L02 TANK	<b>PART#</b> 80911000000	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> MMC
<b>HARDWARE</b> NCA	<b>NOMENCLATURE</b> L02 LEVEL SENSOR	<b>PART#</b> 74L4-1	<b>SER/LOT#</b> 948	<b>MANUFACTURER</b> SIMMONDS
<b>Test/Operation</b> A - ATP	<b>Prevailing Condtion</b> F - FUNCTIONAL	<b>F / U</b> F	<b>Fail Mode</b> EE - RANDOM	<b>Cause</b> ETP - EI-TEST-INST
<b>System</b> ELECTRICAL	<b>Defect</b> EM - ELADJ	<b>Material</b> C - EEE	<b>Work Contact</b> J. ADAMS	<b>Fail Date</b> 11/21/1986
<b>Received at MSFC</b> 09/28/1987	<b>Date Isolated</b> --	<b>FMEA Reference</b> 3.1.2.1	<b>IFA: Mission Phase</b> --	<b>Mission Elapsed Time</b> --
<b>Location</b> MAF		<b>Symptom</b> EVM - CON/MEG FAIL		<b>Time Cycle</b> --
<b>Effectivity Text</b> LWTS 16, 20, 21, 22, 24/SUBS				
<b>Vehicle Effectivity Codes</b>				
<b>Vehicle 1</b> --	<b>Vehicle 2</b> --	<b>Vehicle 3</b> --	<b>Vehicle 4</b> --	<b>Vehicle 5</b> --
<b>Mission Effectivity Codes</b>				
<b>Mssn 1</b> --	<b>Mssn 2</b> --	<b>Mssn 3</b> --	<b>Mssn 4</b> --	<b>Mssn 5</b> --
<b>Estimated Completion Dates</b>				
<b>MSFC Approved Defer Until Date</b> --	<b>Contractor Req Defer Until Date</b> --	<b>LVL 3 Close</b> --	<b>Remark / Action</b> --	
<b>Investigation / Resolution Summary</b>				
<b>Last MSFC Update</b> 02/10/1995	<b>CN RSLV SBMT</b> 09/28/1987	<b>Defer Date</b> --	<b>Add Date</b> --	<b>R/C Codes</b> 4 - TEST -- --
<b>Assignee</b>				
<b>Design</b> P. MULLER	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> --
<b>Approval</b>				
<b>Design</b>	<b>Chief Engineer</b>	<b>S &amp; MA</b>	<b>Project</b>	<b>Project MGR</b>

P. MULLER	J. NICHOLS	R. JACKSON	M. PESSIN	--	
<b>PAC Assignee</b> J.EL-IBRAHIM	<b>PAC Review Complete</b> JE	<b>MSFC Closure Date</b> 12/17/1987	<b>Status</b> C - CLOSED	<b>F/A Completion</b> --	
<b>Problem Type</b> --	<b>SEV</b> --	<b>Program Name</b> --	<b>REVL</b> --	<b>OPRINC</b> --	
<b>FUNC MOD</b> --	<b>Software Effectivity</b> -- - - - - -	<b>Software Fail CD</b> --		<b>SUBTYPE</b> --	<b>Software Closure CD</b> --
<b>RES PERSON L2</b> --	<b>Approval Signature L3</b> --				
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Contractor Status Summary</b>					
<b>Reliability/Quality Assurance Concerns, Recommendations:</b>					
<b>Problem Description</b>  A LIQUID OXYGEN LEVEL SENSOR, P/N 74L4-1, FAILED TO MEET THE ISOLATION RESISTANCE REQUIREMENT OF AN ET, WORK-IN-PROGRESS, CONFIDENCE TEST PROCEDURE. THE MINIMUM ALLOWABLE RESISTANCE AT 50 VOLTS DC IS 5 MEGOHMS. THE ACTUAL VALUE OBTAINED WAS 2.5 MEGOHMS. REFERENCE MARS T-62787. REF: CAPS E-081, E-093, MARS T62787, AND A10102. THIS PROBLEM WAS OPENED DUE TO MULTI-FAILURES AS REPORTED ON CAPS E-100B					
<b>Contractor Investigation/Resolution</b>  R/C: THE TEST REQUIREMENTS FOR THE SENSORS ARE NOT CONSISTENT AMONG THE VENDOR, MAF, AND THE LAUNCH SITES. TEST REQUIREMENTS HAVE BEEN REVISED TO BE CONSISTENT WITH THE VENDOR'S. 10/6/87 - TASK I FAILURE INVESTIGATION THE RESULTS OF FAILURE ANALYSIS T-62787/T-62792/T-92260, AS PERFORMED BY MMC, ARE LISTED BELOW. THE ANALYSIS INCLUDED THE ORIGINAL FAILURE AS WELL AS SEVERAL OTHER SENSORS, FROM THE SAME LEVEL SENSOR MAST ASSEMBLY, WHICH HAD LOWER THAN EXPECTED ISOLATION RESISTANCE. 1. THE CAUSE OF THE ORIGINAL SENSOR FAILURE, SERIAL NUMBER 948, WAS ARCING BETWEEN THE CIRCUIT PATH ON THE SENSOR ELEMENT SUBSTRATE AND THE METAL CASE OF THE SENSOR. 2. THE PROBABLE CAUSE OF THE LOW ISOLATION RESISTANCE ON THE TWO ADDITIONAL SENSORS, SERIAL NUMBERS 949 AND 950, WAS A THIN OR POROUS TEFLON PAINT ON THE TRANSDUCER CASE COMBINED WITH THE CIRCUIT PATH ON THE SENSOR ELEMENT SUBSTRATE PRESSING AGAINST THE TEFLON PAINT. 3. THE VENDOR ACCEPTANCE TESTS DOES NOT CONTROL HUMIDITY DURING THE ELECTRICAL TEST. HUMIDITY AGGRAVATES THE PROBLEMS ASSOCIATED WITH THIN OR POROUS TEFLON PAINT. 4. THE VENDOR					

ACCEPTANCE TEST REQUIRES AN ISOLATION RESISTANCE OF GREATER THAN 2 MEGOHMS AT 500 VDC. THE MAF REQUIREMENT IS 5 MEGOHMS AT 50 VDC. THIS RESULTED IN SENSOR SERIAL NUMBER 948 FAILING THE MAF REQUIREMENT WHILE STILL PASSING THE VENDOR REQUIREMENTS. 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 ISOLATION RESISTANCE TEST OF THE LH2 DEPLETION SENSORS AND TO TEST ALL VEHICLES THAT HAVE ALREADY COMPLETED FILE 4 TESTING. CLOSURE STATEMENT: THE RCN WAS APPROVED AND ASSIGNED NUMBER MT-7484. C. ELECTRICAL ENGINEERING HAS INITIATED CHANGE SUMMARY B01806 TO REVISE THE SENSOR ISOLATION RESISTANCE REQUIREMENTS AND TEST METHODS AT THE VENDOR AND AT MAF. CLOSURE STATEMENT: 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 CLOSED TASK IV CAPS CLOSURE SUMMARY THE SENSOR EXPERIENCED ISOLATION RESISTANCE FAILURES WHICH RESULTED FROM BOTH THE SENSITIVITY OF THE SENSOR 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 TEST 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 REMAINING 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. THE 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.

11/20/87 - THE SENSOR DESIGN HAS NOT BEEN CHANGED TO PROVIDE POSITIVE PHYSICAL SEPARATION BETWEEN THE ELECTRICAL CIRCUIT PATH OF THE SENSOR ELEMENT AND METAL CASE. THEREFORE, A RISK REMAINS THAT THE SENSOR ELEMENT MAY SHIFT IN THE CASE AT SOME TIME AFTER MANUFACTURING AND PRESS AGAINST THE TEFLON COVERED INTERIOR OF THE CASE

**MSFC Response/Concurrence**

**ASSESSMENT ADDENDUM REPORT**

MSFC Report#	IFA#	Contractor RPT#	JSC#	KSC#	EICN#
A11016	--	E-100-2	--	--	--



Asmnt Part# 74L4-1	Asmnt Part Name LOX LEVEL SENSOR	Asmnt Serial/Lot# 948	
HCRIT CD --	FCRIT CD 1R	CAUSE CD ETP - EI-TEST-INST	FAIL MODE EM - ELECT LEAK
Asmnt FMEA 3.1.2.2	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)

<b>MSFC Record #</b> A11117	<b>In-Flight Anomaly Number</b> --	<b>Contractor Report Number</b> E-109	<b>JSC#</b> --	<b>KSC#</b> --
<b>Problem Title</b> TEMPERATURE TRANSDUCER FAILED THE ISOLATION RESISTANCE TEST				
<b>EICN#</b> --	<b>ELEMENT</b> ET	<b>Contractor</b> MMMSS	<b>FSCM#</b> --	<b>FCRIT</b> 1R
<b>HCRIT</b> --	<b>Sys_Lvl</b> N	<b>Misc Codes</b> A (1) B C D E (X) F G H I J K L M N O		
<b>HARDWARE</b> EIM	<b>NOMENCLATURE</b> ET	<b>PART#</b> 80901000000	<b>SER/LOT#</b> NOTED	<b>MANUFACTURER</b> MMC
<b>HARDWARE</b> LRU	<b>NOMENCLATURE</b> N/A	<b>PART#</b> N/A	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> N/A
<b>HARDWARE</b> NCA	<b>NOMENCLATURE</b> TEMPERATURE TRN	<b>PART#</b> PD7400095-149	<b>SER/LOT#</b> 1262	<b>MANUFACTURER</b> HY CAL ENG
<b>Test/Operation</b> L - FLD	<b>Prevailing Condtion</b> F - FUNCTIONAL	<b>F / U</b> F	<b>Fail Mode</b> EV - NOT-TO-SPEC	<b>Cause</b> U - UNKNOWN
<b>System</b> ELECTRICAL	<b>Defect</b> --	<b>Material</b> C - EEE	<b>Work Contact</b> J. ADAMS	<b>Fail Date</b> 10/28/1987
<b>Received at MSFC</b> 12/04/1987	<b>Date Isolated</b> --	<b>FMEA Reference</b> 3.9.13.3	<b>IFA: Mission Phase</b> --	<b>Mission Elapsed Time</b> --
<b>Location</b> KSC		<b>Symptom</b> EE - RANDOM		<b>Time Cycle</b> N/A
<b>Effectivity Text</b> LWTS 16, 20, 21, 22, 24/SUBSEQUENT				
<b>Vehicle Effectivity Codes</b>				
<b>Vehicle 1</b> --	<b>Vehicle 2</b> --	<b>Vehicle 3</b> --	<b>Vehicle 4</b> --	<b>Vehicle 5</b> --
<b>Mission Effectivity Codes</b>				
<b>Mssn 1</b> --	<b>Mssn 2</b> --	<b>Mssn 3</b> --	<b>Mssn 4</b> --	<b>Mssn 5</b> --
<b>Estimated Completion Dates</b>				
<b>MSFC Approved Defer Until Date</b> --	<b>Contractor Req Defer Until Date</b> --	<b>LVL 3 Close</b> --	<b>Remark / Action</b> --	
<b>Investigation / Resolution Summary</b>				
<b>Last MSFC Update</b> 02/13/1995	<b>CN RSLV SBMT</b> 03/18/1988	<b>Defer Date</b> --	<b>Add Date</b> --	<b>R/C Codes</b> 0 - EXPL -- --
<b>Assignee</b>				
<b>Design</b> A. JACKMAN	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> G. BRIDWELL
<b>Approval</b>				
<b>Design</b>	<b>Chief Engineer</b>	<b>S &amp; MA</b>	<b>Project</b>	<b>Project MGR</b>

A. JACKMAN	J. NICHOLS	R. JACKSON	M. PESSIN	G. BRIDWELL	
<b>PAC Assignee</b> J.EL-IBRAHIM	<b>PAC Review Complete</b> JE	<b>MSFC Closure Date</b> 04/14/1988	<b>Status</b> C - CLOSED	<b>F/A Completion</b> --	
<b>Problem Type</b> --	<b>SEV</b> --	<b>Program Name</b> --	<b>REVL</b> --	<b>OPRINC</b> --	
<b>FUNC MOD</b> --	<b>Software Effectivity</b> -- - - - - -	<b>Software Fail CD</b> --		<b>SUBTYPE</b> --	<b>Software Closure CD</b> --
<b>RES PERSON L2</b> --	<b>Approval Signature L3</b> --				
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Contractor Status Summary</b>					
<b>Reliability/Quality Assurance Concerns, Recommendations:</b>					
<b>Problem Description</b>  DURING TESTS IN PREPARATION FOR INSTALLATION ON LWT-21, THE TRANSDUCER FAILED THE ISOLATION RESISTANCE TEST. THE RESISTANCE REQUIREMENTS IS A MINIMUM OF 20 MEGOHMS AT 50 VOLTS DC. THE TRANSDUCER HAD A NEAR ZERO ISOLATION RESISTANCE. NOTE: THE ORIGINAL TRANSDUCER ON LWT-21 HAD BEEN DAMAGED DURING WORK IN THE INTERTANK, THUS NECESSITATING ITS REPLACEMENT. PREVIOUS CAPS E-083. REFERENCE MARS T-98776					
<b>Contractor Investigation/Resolution</b>  THERE ARE NO CONSTRAINTS. THE TRANSDUCERS ARE TESTED FOR ISOLATION RESISTANCE AT THE VENDOR, DURING IN-PROCESS TESTS AFTER INSTALLATION ON THE ET, DURING FINAL ACCEPTANCE TESTS OF THE ET PRIOR TO DELIVERY, AND WHENEVER THEY ARE REPLACED. THIS STATEMENT HAS BEEN COORDINATED WITH MR. G.P. BRIDWELL, ET PROJECT MANAGER____G.P. BRIDWELL (SIGNED 4/8/88)____ GENERAL: THE TEMPERATURE TRANSDUCER IS A PLATINUM WIRE RESISTIVE ELEMENT WOUND ON A CERAMIC MANDREL AND SUPPORTED BY A STAINLESS STEEL HOUSING TRANSDUCERS OF THIS TYPE ARE USED ON THE ET TO MONITOR THE GAS TEMPERATURE IN BOTH THE NOSE CONE AND THE INTERTANK. DURING VENDOR LEVEL ACCEPTANCE TESTS OF THE TRANSDUCER, THE MINIMUM ISOLATION RESISTANCE IS 50 MEGOHMS AT 50 VOLTS DC. DURING ALL SUBSEQUENT TESTS OF THE SENSOR THE MINIMUM ACCEPTABLE ISOLATION RESISTANCE IS 20 MEGOHMS AT 50 VOLTS DC TASK I. FAILURE INVESTIGATION A FAILURE ANALYSIS WAS PERFORMED ON THE TRANSDUCER AS PART OF MARS T-98776. THE LOW ISOLATION RESISTANCE WAS ISOLATED TO THE POINT					

AT WHICH THE EXTERNAL WIRE LEADS ENTER THE EPOXY POTTING COMPOUND IN THE MOUNTING BASE OF THE TRANSDUCER. THE BLACK EPOXY POTTING WAS SCRAPED AWAY IN STAGES BUT THE EXACT LOCATION OF THE FAULT COULD NOT BE LOCATED CLOSER THAN +/- 0.1 INCH. NO ANOMALOUS CONDITIONS WERE NOTED OTHER THAN THE WIRE HAVING BEEN STRIPPED OF INSULATION .050 INCH FARTHER BACK THAN THE MANUFACTURERS DRAWING REQUIRED. DISCUSSIONS WITH KSC PERSONNEL PRESENT AT THE TIME OF THE FAILURE REVEALED THAT THE TECHNICIANS INITIALLY SELECTED A MEGOHMMETER UNSUITABLE FOR THE TEST AND ANOTHER HAD TO BE SENT FOR. IT APPEARS THAT THE TEST CONDITIONS WERE NOT TIGHTLY CONTROLLED IN THAT THE REQUIRED METER WAS NOT SPECIFIED BY PROCEDURE. HOWEVER, THERE WAS NOT EVIDENCE THAT TESTS HAD BEEN IMPROPERLY PERFORMED. THE FAILURE ANALYSIS WAS UNABLE TO ISOLATE THE ROOT CAUSE OF THE FAILURE. AMONG THE POSSIBLE CAUSES OF THE FAILURE ARE: 1) INADVERTENT APPLICATION OF HIGH VOLTAGE WHILE USING THE MEGOHMMETER AT KSC; AND 2) THE FAULT MAY HAVE BEEN PRECIPITATED BY THE IMPROPERLY STRIPPED WIRE LEADS

TASK CLOSED

TASK II CORRECTIVE ACTION

NO CORRECTIVE ACTION IS REQUIRED. THE TESTING AT THE VENDOR, MAF, AND THE LAUNCH SITE ASSURE OPERATION OF THE SENSORS. A COPY OF THE FAILURE ANALYSIS WAS FURNISHED TO THE VENDOR, HY-CAL ENGINEERING, FOR INFORMATION ONLY. THE VENDOR HAS DECLINED TO ENTER A BID FOR TEMPERATURE TRANSDUCERS FOR THE "5TH BUY" (LWTS 54 THROUGH 113)

TASK CLOSED

TASK III CLEARANCE OF EFFECTIVITIES

ALL ETS CLEARED. THE TRANSDUCERS ARE TESTED FOR ISOLATION RESISTANCE AT THE VENDOR, DURING IN-PROCESS TESTS AFTER INSTALLATION ON THE ET, DURING FINAL ACCEPTANCE TESTS OF THE ET PRIOR TO DELIVERY, AND WHENEVER THEY ARE REPLACED. THE ISOLATION RESISTANCE TESTS ARE PERFORMED AT 50 VDC WHILE THE VOLTAGE APPLIED TO THE TRANSDUCER DURING OPERATION IS ONLY 1.5 VDC

TASK CLOSED

TASK IV. CLOSURE SUMMARY

THE TRANSDUCER FAILED DURING AN IN-PROCESS TEST AT KSC PRIOR TO INSTALLATION ON THE VEHICLE. THIS WAS THE FIRST OCCURRENCE OF A TEMPERATURE TRANSDUCER FAILING AT THE INTERNAL LOCATION IDENTIFIED IN THIS FAILURE ANALYSIS. NO CORRECTIVE ACTIONS ARE REQUIRED

TASK CLOSED

**MSFC Response/Concurrence**

#### ASSESSMENT ADDENDUM REPORT

MSFC Report# A11117	IFA# --	Contractor RPT# E-109	JSC# --	KSC# --	EICN# --
Asmnt Part# PD7400095-149	Asmnt Part Name TEMP. TRANSDUCER	Asmnt Serial/Lot# 1262			
HCRIT CD --	FCRIT CD 1R	CAUSE CD UU - UNK-UND	FAIL MODE EV - NOT-TO-SPEC		
Asmnt FMEA 3.9.13.3	Asmnt FM 3	FMEA CSE B	FMEA SCSE 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	
--	--	
ASSESSMENT TEXT		

WHOLE RECORD REPORT( + ADDENDUM)

<b>MSFC Record #</b> A11125	<b>In-Flight Anomaly Number</b> --	<b>Contractor Report Number</b> E-110	<b>JSC#</b> --	<b>KSC#</b> --
<b>Problem Title</b> GH2 PRESSURE TRANSDUCER FAILED DURING ATP				
<b>EICN#</b> --	<b>ELEMENT</b> ET	<b>Contractor</b> MMMSS	<b>FSCM#</b> --	<b>FCRIT</b> 1R
<b>HCRIT</b> 1	<b>Sys_Lvl</b> N	<b>Misc Codes</b> A B C D E F G H I J K L M N O		
<b>HARDWARE</b> EIM	<b>NOMENCLATURE</b> PRESSURE TRAN	<b>PART#</b> PD7400098-089	<b>SER/LOT#</b> 2132	<b>MANUFACTURER</b> GULTON
<b>HARDWARE</b> LRU	<b>NOMENCLATURE</b> N/A	<b>PART#</b> N/A	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> N/A
<b>HARDWARE</b> NCA	<b>NOMENCLATURE</b> LH2 PRES TRN	<b>PART#</b> PD7400098-089	<b>SER/LOT#</b> 2132	<b>MANUFACTURER</b> GULTON
<b>Test/Operation</b> A - ATP	<b>Prevailing Condtion</b> F - FUNCTIONAL	<b>F / U</b> F	<b>Fail Mode</b> EV - NOT-TO-SPEC	<b>Cause</b> ETE - EI-TEST-ENVR
<b>System</b> ELECTRICAL	<b>Defect</b> CX - VOID	<b>Material</b> C - EEE	<b>Work Contact</b> J. ADAMS	<b>Fail Date</b> 12/08/1987
<b>Received at MSFC</b> 12/10/1987	<b>Date Isolated</b> --	<b>FMEA Reference</b> 3.4.X.X	<b>IFA: Mission Phase</b> --	<b>Mission Elapsed Time</b> --
<b>Location</b> GULTON		<b>Symptom</b> EE - RANDOM		<b>Time Cycle</b> --
<b>Effectivity Text</b> LWTS 16, 20, 21, 22, 24/SUBS				
<b>Vehicle Effectivity Codes</b>				
<b>Vehicle 1</b> --	<b>Vehicle 2</b> --	<b>Vehicle 3</b> --	<b>Vehicle 4</b> --	<b>Vehicle 5</b> --
<b>Mission Effectivity Codes</b>				
<b>Mssn 1</b> --	<b>Mssn 2</b> --	<b>Mssn 3</b> --	<b>Mssn 4</b> --	<b>Mssn 5</b> --
<b>Estimated Completion Dates</b>				
<b>MSFC Approved Defer Until Date</b> --	<b>Contractor Req Defer Until Date</b> --	<b>LVL 3 Close</b> --	<b>Remark / Action</b> --	
<b>Investigation / Resolution Summary</b>				
<b>Last MSFC Update</b> 02/13/1995	<b>CN RSLV SBMT</b> 05/23/1988	<b>Defer Date</b> --	<b>Add Date</b> --	<b>R/C Codes</b> 0 - EXPL -- --
<b>Assignee</b>				
<b>Design</b> A. JACKMAN	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> P. BRIDWELL
<b>Approval</b>				
<b>Design</b>	<b>Chief Engineer</b>	<b>S &amp; MA</b>	<b>Project</b>	<b>Project MGR</b>

A. JACKMAN	J. NICHOLS	R. JACKSON	M. PESSIN	P. BRIDWELL	
<b>PAC Assignee</b> J.EL-IBRAHIM	<b>PAC Review Complete</b> JE	<b>MSFC Closure Date</b> 06/03/1988	<b>Status</b> E - CLOSED-E	<b>F/A Completion</b> --	
<b>Problem Type</b> --	<b>SEV</b> --	<b>Program Name</b> --	<b>REVL</b> --	<b>OPRINC</b> --	
<b>FUNC MOD</b> --	<b>Software Effectivity</b> -- - - - - -	<b>Software Fail CD</b> --		<b>SUBTYPE</b> --	<b>Software Closure CD</b> --
<b>RES PERSON L2</b> --	<b>Approval Signature L3</b> --				
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Contractor Status Summary</b>					
<b>Reliability/Quality Assurance Concerns, Recommendations:</b>					
<b>Problem Description</b>  THE ULLAGE TRANSDUCER FAILED THE VENDOR ATP REQUIREMENTS FOR ACCURACY OF THE OUTPUT VOLTAGE VERSUS THE APPLIED PRESSURE. THE TRANSDUCER OUTPUT VOLTAGE WAS 4.3% OF FULL SCALE BELOW THE NOMINAL VALUE AT 33 PSIA, ON PRESSURE RISE. MAXIMUM ALLOWED IS 1%					
<b>Contractor Investigation/Resolution</b>  CAUSE: THE TRANSDUCER CASE HAD AN AIR LEAK, PROBABLY AT THE SEAL-OFF WELD OR ELECTRICAL FEED THROUGH HERMETIC SEALS R/C: NONE REQUIRED 12/10/87 - THIS REPORT IS NOT A LAUNCH CONSTRAINT: THE FAILURE WAS DETECTED DURING VENDOR ACCEPTANCE TEST WHICH IS DESIGNED TO DETECT DEFECTIVE HARDWARE. THIS STATEMENT HAS BEEN COORDINATED WITH THE ET PROJECT MANAGER, MR. G.P. BRIDWELL _____ 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 ____G.P. BRIDWELL (SIGNED) 5/13/88_____ 5/23/88 GENERAL - THE TRANSDUCER FAILED TO MEET THE ACCURACY REQUIREMENTS FOR OUTPUT VOLTAGE VERSUS APPLIED PRESSURE AT 73 DEGREES-F DURING VENDOR ACCEPTANCE TESTING (ATP). THE VENDOR ATP CONTAINS MULTIPLE TESTS OF ACCURACY, BOTH BEFORE AND AFTER VIBRATION AND PROOF PRESSURE TESTING,					

AND AT SEVERAL DIFFERENT OPERATING TEMPERATURES. PREVIOUS CAPS:  
E-082, E-091, E-101, E-106

**TASK I. FAILURE INVESTIGATION**

FAILURE ANALYSIS T-34365 WILL BE PERFORMED AT THE VENDOR'S FACILITY,  
UNDER THE OBSERVATION OF THE MMC SOURCE REPRESENTATIVE  
CLOSURE STATEMENT

THE VENDOR PERFORMED THE FAILURE ANALYSIS ACCORDING TO A JOINTLY  
APPROVED FAILURE ANALYSIS PLAN. THE TRANSDUCER CASE WAS FOUND TO  
HAVE AN AIR LEAK, PROBABLY AT THE CASE SEAL-OFF HOLE WELD OR AT ONE  
OF THE ELECTRICAL FEEDTHROUGH HERMETIC SEALS. THE TIME BETWEEN THE  
VENDOR'S IN-PROCESS TEST, WHICH HAD LESS THAN 1% ERROR, AND THE  
ACCEPTANCE TEST PLAN FAILURE WAS 266 DAYS. ASSUMING A CONSTANT  
LEAK RATE, THE TRANSDUCER LEAKED AT APPROXIMATELY  $4.2 \times 10^{-10}$  (TO THE  
NEGATIVE EIGHTH) CC/SEC OF AIR, AT NORMAL TEMPERATURE AND PRESSURE  
THE VENDOR TESTS THE COMPLETED TRANSDUCER, LESS THE CASE SEAL-OFF  
WELD AND OUTPUT WIRE ATTACHMENT, TO A LEAK RATE OF LESS THAN  $1.0 \times 10^{-10}$  (TO THE  
NEGATIVE TENTH) CC/SEC OF AIR, AT NORMAL TEMPERATURE AND  
PRESSURE

**TASK II. CORRECTIVE ACTION**

NO CORRECTIVE ACTION IS REQUIRED. THIS IS THE FIRST OCCURRENCE  
OF SUCH A FAILURE IN THE ET PROGRAM

**TASK III. CLEARANCE OF EFFECTIVITIES**

THERE ARE NO CONSTRAINTS. THERE ARE NUMEROUS CHECKS OF TRANSDUCER  
ACCURACY BETWEEN MANUFACTURE AND FLIGHT. THE TESTS APPLY TO BOTH  
LOX AND LH2 ULLAGE PRESSURE TRANSDUCERS

- O THE VENDOR ACCEPTANCE TEST PLAN PROVIDES HIGHLY ACCURATE  
CALIBRATION CHECKS ACROSS THE ENTIRE TRANSDUCER OPERATING BAND  
AT THREE DIFFERENT TEMPERATURES
- O TRANSDUCER ACCURACY IS VERIFIED DURING FINAL TEST AND CHECK-OUT  
OF THE ET PER THE "ET FLIGHT ACCEPTANCE REQUIREMENT, TM04K-B"  
THE TEST RESULTS ARE REQUIRED TO BE EVALUATED BY MMC ELECTRICAL  
ENGINEERING
- O THE "OPERATIONS AND MAINTENANCE REQUIREMENTS AND SPECIFICATIONS  
DOCUMENT, FILE IV", CHECKS THE TRANSDUCERS FOR ACCURACY AT THE  
STORAGE PRESSURE OF THE ET (I.E. APPROXIMATELY 6 PSIG)
- O THE "OPERATIONS AND MAINTENANCE REQUIREMENTS AND SPECIFICATIONS  
DOCUMENT, FILE II," CHECKS THE TRANSDUCERS FOR ACCURACY, ONE  
AGAINST THE OTHER, AT THE STORAGE PRESSURE OF THE ET. THE  
CHECKS ARE REQUIRED AFTER ET/ORBITER MATE AND DURING THE  
LAUNCH COUNTDOWN

**TASK IV. CAPS CLOSURE SUMMARY**

THE TRANSDUCER FAILED THE VENDOR ATP FOR ACCURACY DUE TO AN AIR LEAK IN  
THE CASE. THIS WAS THE FIRST SUCH FAILURE IN THE ET PROGRAM. THERE ARE  
SUFFICIENT TESTS OF TRANSDUCER PERFORMANCE IN THE BUILD/FLIGHT  
PREPARATION CYCLE TO DETECT ANY SUCH FAILURES  
THIS PROBLEM IS SUBMITTED TO MSFC FOR REVIEW AND APPROVAL

**MSFC Response/Concurrence**

**ASSESSMENT ADDENDUM REPORT**

<b>MSFC Report#</b> A11125	<b>IFA#</b> --	<b>Contractor RPT#</b> E-110	<b>JSC#</b> --	<b>KSC#</b> --	<b>EICN#</b> --
<b>Asmnt Part#</b> PD7400098-089	<b>Asmnt Part Name</b> LH2 PRES TRANSDUCER	<b>Asmnt Serial/Lot#</b> 2132			
<b>HCRIT CD</b> --	<b>FCRIT CD</b> 1R	<b>CAUSE CD</b> MAW - MFG-ASY-WORK	<b>FAIL MODE</b> MV - EXT LEAK		



Asmnt FMEA 3.4.1.2	Asmnt FM 2	FMEA CSE G	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)

<b>MSFC Record #</b> A11137	<b>In-Flight Anomaly Number</b> --	<b>Contractor Report Number</b> E-108	<b>JSC#</b> --	<b>KSC#</b> --
<b>Problem Title</b> IMPROPER INSTALLATION OF BOND JUMPERS				
<b>EICN#</b> --	<b>ELEMENT</b> ET	<b>Contractor</b> MMMSS	<b>FSCM#</b> --	<b>FCRIT</b> 3
<b>HCRIT</b> 3	<b>Sys_Lvl</b> Y	<b>Misc Codes</b> A (3) B (X) C D E F (X) G H I J K L M N O		
<b>HARDWARE</b> EIM	<b>NOMENCLATURE</b> ET COMPLETE	<b>PART#</b> 80901010000	<b>SER/LOT#</b> LWT-41	<b>MANUFACTURER</b> MMC
<b>HARDWARE</b> LRU	<b>NOMENCLATURE</b> N/A	<b>PART#</b> N/A	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> N/A
<b>HARDWARE</b> NCA	<b>NOMENCLATURE</b> ELECT. BOND JUMPER	<b>PART#</b> 80901010000	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> MMC
<b>Test/Operation</b> M - MFG	<b>Prevailing Condtion</b> N - INSPECTION	<b>F / U</b> F	<b>Fail Mode</b> EV - NOT-TO-SPEC	<b>Cause</b> MAP - MFG-ASY-INST
<b>System</b> ELECTRICAL	<b>Defect</b> CN - CONTAM	<b>Material</b> E - EL C/W	<b>Work Contact</b> J. ADAMS	<b>Fail Date</b> 11/17/1987
<b>Received at MSFC</b> 12/31/1987	<b>Date Isolated</b> --	<b>FMEA Reference</b> N/A	<b>IFA: Mission Phase</b> --	<b>Mission Elapsed Time</b> --
<b>Location</b> MAF		<b>Symptom</b> EV - NOT-TO-SPEC		<b>Time Cycle</b> N/A
<b>Effectivity Text</b> LWTS 16, 20, 21, 22, 24/SUBS				
<b>Vehicle Effectivity Codes</b>				
<b>Vehicle 1</b> --	<b>Vehicle 2</b> --	<b>Vehicle 3</b> --	<b>Vehicle 4</b> --	<b>Vehicle 5</b> --
<b>Mission Effectivity Codes</b>				
<b>Mssn 1</b> --	<b>Mssn 2</b> --	<b>Mssn 3</b> --	<b>Mssn 4</b> --	<b>Mssn 5</b> --
<b>Estimated Completion Dates</b>				
<b>MSFC Approved Defer Until Date</b> --	<b>Contractor Req Defer Until Date</b> --	<b>LVL 3 Close</b> --	<b>Remark / Action</b> --	
<b>Investigation / Resolution Summary</b>				
<b>Last MSFC Update</b> 02/13/1995	<b>CN RSLV SBMT</b> 05/18/1988	<b>Defer Date</b> --	<b>Add Date</b> 01/04/1988	<b>R/C Codes</b> 5 - TRNG -- --
<b>Assignee</b>				
<b>Design</b> A. JACKMAN	<b>Chief Engineer</b> A. JACKMAN	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> P. BRIDWELL
<b>Approval</b>				
<b>Design</b>	<b>Chief Engineer</b>	<b>S &amp; MA</b>	<b>Project</b>	<b>Project MGR</b>

A. JACKMAN	J. NICHOLS	R. JACKSON	M. PESSIN	P. BRIDWELL	
<b>PAC Assignee</b> J.EL-IBRAHIM	<b>PAC Review Complete</b> JE	<b>MSFC Closure Date</b> 06/14/1988	<b>Status</b> C - CLOSED	<b>F/A Completion</b> --	
<b>Problem Type</b> --	<b>SEV</b> --	<b>Program Name</b> --	<b>REVL</b> --	<b>OPRINC</b> --	
<b>FUNC MOD</b> --	<b>Software Effectivity</b> -- - - - - -	<b>Software Fail CD</b> --		<b>SUBTYPE</b> --	<b>Software Closure CD</b> --
<b>RES PERSON L2</b> --	<b>Approval Signature L3</b> --				
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Contractor Status Summary</b>					
<b>Reliability/Quality Assurance Concerns, Recommendations:</b>					
<b>Problem Description</b>  A. A DEFECTIVE BOND JUMPER INSTALLATION WAS FOUND ON THE GOX PRESSURIZATION LINE OF LWT-41 WHILE INVESTIGATING NEARBY DAMAGED HARDWARE. EPOXY PRIMER HAD BEEN LEFT ON THE ALUMINUM STRUCTURE TO WHICH THE BOND JUMPER TERMINAL WAS BOLTED. THE ENGINEERING REQUIREMENTS, STP-6511, REQUIRES BOND JUMPERS TO BE INSTALLED ON EITHER CLEANED AND ABRADED BARE METAL OR CLEANED AND IRRIDITED ALUMINUM. REVIEW OF THE MANUFACTURING PROCESS PLANS FOUND THAT THE PLANS DID NOT PROPERLY IMPLEMENT THE ENGINEERING REQUIREMENTS FOR SURFACE PREPARATION OF THE METAL B. WHILE INVESTIGATING THE PROBLEMS WITH SURFACE PREPARATION FOR BONDING, DESCRIBED IN "A" ABOVE, IT WAS FOUND THAT THE BOND RESISTANCE TESTING, PERFORMED ON EACH COMPLETED BOND, WAS QUESTIONABLE. THE TEST EQUIPMENT AND TEST METHODS USED COULD RESULT IN A DEFECTIVE INSTALLATION WITH HIGH RESISTANCE INDICATING AN ACCEPTABLY LOW RESISTANCE ON THE OHMMETER REF: ORIGINAL FAILURE - MARS T-98971 AND DR 150365					
<b>Contractor Investigation/Resolution</b>  R/A - 1) FLEET: MARS ARE WRITTEN FOR ALL DEFECTIVE OR SUSPECT BONDING INSTALLATIONS ON ALL ETS. THE MARS WILL BE BASED ON REVIEW OF THE MPP FOR EACH LOCATION 2) PRODUCTION: REVISED MPP AND TRAINED PERSONNEL CAUSE - A. THE MANUFACTURING PROCESS PLAN WHICH CONTROLLED THE INSTALLATION OF THE JUMPER WERE INCORRECT					

- B. THE PRODUCTION WORKERS AND QUALITY INSPECTORS WERE NOT PROVIDED WITH THE NECESSARY INFORMATION OR EXPERIENCE TO UNDERSTAND AND PERFORM THE BOND RESISTANCE TEST REQUIRED BY STP 6511 AND THE TEST EQUIPMENT HAD UNFORESEEN OPERATING CHARACTERISTICS

GENERAL

ELECTRICAL BOND JUMPERS AND INHERENT BONDING ARE USED ON THE ET BETWEEN VARIOUS ELECTRICAL AND STRUCTURAL COMPONENTS FOR REASONS OF LIGHTNING PROTECTION, ELECTROMAGNETIC INTERFERENCE PROTECTION, AND STATIC DISCHARGE. THE ENGINEERING REQUIREMENTS FOR SUCH BOND JUMPERS, STANDARD PROCESS 6511, SPECIFIES HOW VARIOUS METALS AND SURFACE COATINGS ARE TO BE PREPARED FOR THE BONDING AS WELL AS SPECIFYING THE MAXIMUM ALLOWABLE RESISTANCE VALUE BETWEEN THE COMPONENTS BEING BONDED

- A. THE INTENT OF STP 6511 IS THAT ALL UNPLATED METAL SURFACES BE ABRADED PRIOR TO BONDING, WITH THE EXCEPTION OF IRRIDITED ALUMINUM SURFACES. ERRORS IN THE MANUFACTURING PROCESS PLANS INCLUDED DIRECTING THE BOND JUMPERS TO BE INSTALLED OVER: EPOXY PRIMER COVERED ALUMINUM; ZINC CHROMATE LACQUER PRIMED ALUMINUM; ALUMINUM WITH NO SURFACE COATING OF ANY KIND; AND UNABRADED STAINLESS STEEL SURFACES
- B. COMPLETED BONDS ARE REQUIRED BY STP 6511 TO BE TESTED FOR RESISTANCE ACROSS THE BOND. BOND CLASSES "L" (LIGHTNING PROTECTION) AND "R" (ELECTROMAGNETIC ENERGY GROUNDING) REQUIRE A RESISTANCE OF LESS THAN 2.5 MILLIOHMS. DURING THE REWORK OF IMPROPERLY INSTALLED BOND JUMPERS ON AN ET, SEE "A" ABOVE, AN ENGINEER OBSERVED THAT A HEWLETT PACKARD MODEL 4328A MILLIOHMETER GAVE AN ERRONEOUS READING. AN INVESTIGATION INTO THE METER OPERATION FOUND THAT THE HP 4328A IS CAPABLE OF GIVING A MIDSCALE INDICATION ON ITS METER WHEN ONE OF THE "SENSE" LEADS IS NOT IN CONTACT WITH THE PART UNDER TEST. THE OPERATING MANUAL FOR THE HP 4328A MAKES NO MENTION OF THIS CONDITION. THE RESULT OF THIS METER CHARACTERISTIC IS THAT BONDS WITH AN UNACCEPTABLE HIGH RESISTANCE COULD "PASS" WHEN TESTED WITH THE HP 4328A AND OTHER MILLIOHMETERS AND OBTAINED ERRONEOUS READINGS OF "0" MILLIOHMS ACROSS BONDS. (REFERENCE: INTEROFFICE MEMO 3741-88-021)

02/29/88 UPDATE - UPGRADED CRITICALITY TO 1 DUE TO TPS DEBRIS HAZARD BOND JUMPERS HAVE BEEN INSTALLED OVER PAINTED STRUCTURE, FORWARD OF STATION 2058, AND IN THE DIRECT LIGHTING PATH. IN THE EVENT OF A LIGHTNING STRIKE THE JUMPERS WOULD ARC/BURN. TPS OVER THE JUMPERS COULD BE EXPELLED AND MAY STRIKE THE ORBITER

5/19/88 UPDATE: CRITICALITY - THE ELECTRICAL BOND JUMPERS AND STRUCTURAL INHERENT BOND ARE LISTED IN NEITHER THE FMEA NOR THE CIL EVALUATION OF THE ET DESIGN AND SIMULATED LIGHTNING STRIKE TESTS OF THE THRUST STRUT TO LONGERON BOND JUMPER, ENGINEERING TEST REPORT 826-2383, FOUND THAT AN INFLIGHT LIGHTNING STRIKE WOULD EXPEL NO DEBRIS THAT WOULD IMPACT ON THE ORBITER

TASK I. FAILURE INVESTIGATION

- A. MANUFACTURING ENGINEERING, DEPARTMENT 3614, QUALITY ENGINEERING, DEPARTMENT 3743, AND RELIABILITY ASSURANCE, DEPARTMENT 3741, REVIEWED THE MANUFACTURING PROCESS PLANS FOR ALL WORK ASSEMBLED AND TESTED PRIOR TO THE CORRECTIVE ACTIONS LISTED IN TASKS IIA, IIB, IIC, AND IIE. ALL MPPS HAD BEEN CORRECTED BY LWT-49. THE RESULTS OF THE MPP REVIEW WERE USED BY RELIABILITY ASSURANCE TO GENERATE MARS FOR ALL DEFECTIVE INSTALLATIONS (SEE TASK III)
- B. TEST OPERATIONS, DEPARTMENT 3613, EVALUATED THE VARIOUS BRANDS AND MODELS OF MILLIOHMETERS CURRENTLY AVAILABLE IN ORDER TO FIND ONE THAT IS BETTER SUITED TO USE ON THE ET THAN THE HP 4328A WHICH IS NOW IN USE. IT WAS DETERMINED THAT THE KEITHLEY MODEL 580 COULD PROVIDE SIMPLER, MORE RELIABLE OPERATION (REFERENCE: INTEROFFICE MEMO 3613-88-059). CONCURRENTLY WITH THE EVALUATION OF NEW METERS, ACTIONS WERE TAKEN TO CONTROL THE USE OF THE HP 4328A SO AS TO

PROVIDE ASSURANCE THAT MEASUREMENTS ARE MADE CORRECTLY (SEE TASKS IIA, IIB, AND IIC)

NOTE: KEITHLEY MODEL 580 METERS ARE ON ORDER AND WILL REPLACE THE HP 4328A METERS WHEN THEY ARE AVAILABLE AND THE WORKERS HAVE BEEN TRAINED IN THEIR USE (REFERENCE: PURCHASE ORDER NO. R53418)

TASK CLOSED

TASK II CORRECTIVE ACTION

- A. ELECTRICAL ENGINEERING, DEPARTMENT 3514, AND MISSION SUPPORT, DEPARTMENT 3545, REVISED THE TESTING REQUIREMENTS FOR BONDS CHANGE SUMMARY B01815-001, RCN 108 (PRCN L-ED) ADDED THE REQUIREMENT TO USE TEST PROCEDURE TP-7J01-FT TO THE "ET FLIGHT ACCEPTANCE REQUIREMENTS, MMC-ET-TM04K-B, PARAGRAPH 2.2.6.2"
  - B. TEST OPERATIONS ENGINEERING, DEPARTMENT 3613, AND QUALITY ENGINEERING, DEPARTMENT 3743, ISSUED TEST PROCEDURE TP-7J01-FT, PCN45, APPENDIX 9.3.30, TO CONTROL BONDING RESISTANCE MEASUREMENTS THE NEW TEST PROVIDES SUFFICIENT CONTROLS TO PREVENT DEFECTIVE BONDS PASSING THE RESISTANCE TEST DUE TO TEST EQUIPMENT CHARACTERISTICS OR TEST METHOD ERRORS. THE TEST PROCEDURES REQUIRES THAT THE WORKERS HAVE THE CERTIFICATION FOR MILLIOHMMETERS  
ITEM CLOSED
  - C. TRAINING, DEPARTMENT 3084, AND ADVANCED MANUFACTURING TECHNOLOGY, DEPARTMENT 3693, DEVELOPED A CERTIFICATION COURSE FOR THE USE OF MILLIOHMMETERS WHICH INCLUDES COVERAGE OF THE REQUIREMENTS OF TEST PROCEDURE TP-7J01-FT. ALL WORKERS WHO PERFORM BONDING RESISTANCE MEASUREMENTS HAVE BEEN TRAINED  
ITEM CLOSED
  - D. "GOVERNMENT-INDUSTRY DATA EXCHANGE PROGRAM (GIDEP) ALERT" NUMBER MMC-ET-RA07B-29 HAS BEEN SUBMITTED TO THE MSFC ALERT COORDINATOR TO INFORM INDUSTRY OF THE UNIQUE OPERATING CHARACTERISTICS OF THE HEWLETT PACKARD MODEL 4328A MILLIOHMMETER  
ITEM CLOSED
  - E. ADVANCED MANUFACTURING TECHNOLOGY, DEPARTMENT 3693, AND MANUFACTURING ENGINEERING, DEPARTMENT 3614, RETRAINED THE PERSONNEL RESPONSIBLE FOR WRITING THE MPPS IN THE PROPER METHODS OF SURFACE PREPARATION FOR BONDING PER PI-6511 (REFERENCE: INTEROFFICE MEMO 3693-87-RM-131)  
ITEM CLOSED
- NOTE: CHANGE SUMMARY B01831, WHICH IS THE PROCESS OF REVISION AND AND APPROVAL, WILL IMPROVE THE CLARITY OF STP-6511 AS WELL AS MAKING IMPROVEMENTS IN THE BONDING METHODS. AS A RESULT OF THE STP CHANGE, THE PI WILL SUBSEQUENTLY BE REVISED
- F. MANUFACTURING ENGINEERING, DEPARTMENT 3614, AND QUALITY ENGINEERING, DEPARTMENT 3743, CORRECTED THE MPP STEPS FOR THE INSTALLATION AND TESTING OF ELECTRICAL BONDS. THE MPPS THAT HAD NOT YET BEEN USED TO ASSEMBLE HARDWARE WERE CORRECTED BEGINNING WITH LWT-42 ALL MPPS FOR LWT-49 AND SUBSEQUENT HAVE BEEN CORRECTED. (REFERENCE: INTEROFFICE MEMOS 3614-88-116 AND 3614-88-040)  
ITEM CLOSED

TASK III CLEARANCE OF EFFECTIVITIES

MARS WERE WRITTEN FOR ALL DEFECTIVE OR SUSPECT BONDING INSTALLATIONS ON ALL ETS. THE MARS WERE BASED ON A REVIEW OF THE MANUFACTURING PROCESS PLANS FOR EACH LOCATION (SEE TASK IA). A COMPLETE LIST OF THE MARS IS PROVIDED AS ATTACHMENT 1 TO THIS CAPS

TASK CLOSED

TASK IV. CLOSURE SUMMARY

THE MANUFACTURING PROCESS PLANS FOR THE INSTALLATION OF ELECTRICAL BOND JUMPERS CONTAINED ERRORS THAT AFFECTED THE ELECTRICAL PERFORMANCE OF THE BONDS. THE TEST METHODS USED TO MEASURE THE RESISTANCE OF THE BONDS COULD PASS DEFECTIVE HARDWARE

THE PERSONNEL THAT WRITE THE MPPS WRE RETRAINED. THE TEST METHODS FOR BOND RESISTANCE CHECKS WERE CHANGED AND INCLUDED IN A FORMAL TEST PROCEDURE. THE WORKERS THAT PERFORM THE RESISTANCE TESTS HAVE BEEN

TRAINED AND CERTIFIED. ALL NONCONFORMING AND SUSPECT HARDWARE HAS BEEN DOCUMENTED ON MARS  
 TASK CLOSED  
 THIS CLOSURE IS SUBMITTED TO MSFC FOR REVIEW AND APPROVAL LISTED BELOW, BY EFFECTIVITY, ARE ALL OF THE MARS THAT WERE WRITTEN FOR DEFECTIVE BOND JUMPER INSTALLATIONS AND FOR IMPROPERLY PERFORMED BOND RESISTANCE TESTS

LWT-16 T-96020, T-96021, T-96023, T-97502, T-99764  
 LWT-20 T-100144, T-100145, T-100146, T-100147  
 LWT-21 T-96016, T-96017, T-96024, T-97503  
 LWT-22 T-100156, T-100157, T-100161, T-100162  
 LWT-24 T-100164, T-100165, T-100166, T-100167  
 LWT-25 T-100135, T-100137, T-100138, T-100139  
 LWT-26 T-100140, T-100141, T-100142, T-100143  
 LWT-27 T-100131, T-100132, T-100133, T-100134  
 LWT-28 T-100127, T-100128, T-100129, T-100130  
 LWT-29 T-100123, T-100124, T-100125, T-100126  
 LWT-30 T-100105, T-100106, T-100107, T-100109  
 LWT-31 T-100155, T-100152, T-100153, T-100154  
 LWT-32 T-100185, T-100186, T-100172, T-100173  
 LWT-33 T-100179, T-100182, T-100183, T-100184  
 LWT-34 T-100110, T-100112, T-100113, T-100114  
 LWT-35 T-100192, T-100193, T-100194, T-100195  
 LWT-36 T-100119, T-100120, T-100121, T-100122  
 LWT-37 T-100190, T-100115, T-100116, T-100117, T-100118  
 LWT-38 T-100191, T-100180, T-100101, T-100103, T-100104  
 LWT-39 T-100197, T-100174, T-100175, T-100176, T-100199  
 LWT-40 T-96018, T-96019, T-96022, T-96025, T-98046  
 LWT-41 T-94029, T-94030, T-97265, T-99765  
 LWT-42 T-98042, T-98044  
 LWT-43 T-99762, T-99763  
 LWT-44 THROUGH 48 (COMPONENTS)  
 T-78026, T-78042, T-78039, T-78027, T-78044, T-78041,  
 T-78033, T-78040, T-78035, T-78036, T-78028, T-78038

**MSFC Response/Concurrence**

**ASSESSMENT ADDENDUM REPORT**

MSFC Report# A11137	IFA# --	Contractor RPT# E-108	JSC# --	KSC# --	EICN# --
Asmnt Part# 80901010000	Asmnt Part Name ELECT. BOND JUMPER	Asmnt Serial/Lot# --			
HCRIT CD --	FCRIT CD 3	CAUSE CD MAP - MFG-ASY-INST	FAIL MODE EV - NOT-TO-SPEC		
Asmnt FMEA N/A	Asmnt FM N/A	FMEA CSE N/A	FMEA SCSE 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)

<b>MSFC Record #</b> A11138	<b>In-Flight Anomaly Number</b> --	<b>Contractor Report Number</b> S-074	<b>JSC#</b> --	<b>KSC#</b> --
<b>Problem Title</b> MANHOLE COVER BOLT THREADS WERE DISTORTED ON LWT 24				
<b>EICN#</b> --	<b>ELEMENT</b> ET	<b>Contractor</b> MMMSS	<b>FSCM#</b> --	<b>FCRIT</b> 3
<b>HCRIT</b> 1	<b>Sys_Lvl</b> N	<b>Misc Codes</b> A (2) B (X) C D E (X) F G H I J K L M N O		
<b>HARDWARE</b> EIM	<b>NOMENCLATURE</b> ET COMPLETE	<b>PART#</b> 80901000000	<b>SER/LOT#</b> NOTED	<b>MANUFACTURER</b> MMC
<b>HARDWARE</b> LRU	<b>NOMENCLATURE</b> MAN HOLE COVER	<b>PART#</b> 80911001449	<b>SER/LOT#</b> TBD	<b>MANUFACTURER</b> MMC
<b>HARDWARE</b> NCA	<b>NOMENCLATURE</b> BOLT	<b>PART#</b> 26L2-5H10	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> UNKNOWN
<b>Test/Operation</b> L - FLD	<b>Prevailing Condtion</b> F - FUNCTIONAL	<b>F / U</b> UC	<b>Fail Mode</b> UC - UNSAT	<b>Cause</b> MAW - MFG-ASY-WORK
<b>System</b> PROPULSION	<b>Defect</b> MA - ME ADJ	<b>Material</b> L - FASTNR	<b>Work Contact</b> C. VOGEL	<b>Fail Date</b> 12/14/1987
<b>Received at MSFC</b> 12/21/1987	<b>Date Isolated</b> --	<b>FMEA Reference</b> 2.10.6.1	<b>IFA: Mission Phase</b> --	<b>Mission Elapsed Time</b> --
<b>Location</b> KSC		<b>Symptom</b> UC - UNSAT		<b>Time Cycle</b> N/A
<b>Effectivity Text</b> LWT 16, 20, 21, 22, 24 AND UP				
<b>Vehicle Effectivity Codes</b>				
<b>Vehicle 1</b> --	<b>Vehicle 2</b> --	<b>Vehicle 3</b> --	<b>Vehicle 4</b> --	<b>Vehicle 5</b> --
<b>Mission Effectivity Codes</b>				
<b>Mssn 1</b> --	<b>Mssn 2</b> --	<b>Mssn 3</b> --	<b>Mssn 4</b> --	<b>Mssn 5</b> --
<b>Estimated Completion Dates</b>				
<b>MSFC Approved Defer Until Date</b> --	<b>Contractor Req Defer Until Date</b> --	<b>LVL 3 Close</b> --	<b>Remark / Action</b> --	
<b>Investigation / Resolution Summary</b>				
<b>Last MSFC Update</b> 09/10/1992	<b>CN RSLV SBMT</b> 03/14/1988	<b>Defer Date</b> --	<b>Add Date</b> 12/23/1987	<b>R/C Codes</b> 2 - MFG -- --
<b>Assignee</b>				
<b>Design</b> F. HUNEIDI	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> P. BRIDWELL



<b>Approval</b>					
<b>Design</b> F. HUNEIDI	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> P. BRIDWELL	
<b>PAC Assignee</b> J.EL-IBRAHIM	<b>PAC Review Complete</b> JE	<b>MSFC Closure Date</b> 04/28/1988	<b>Status</b> C - CLOSED	<b>F/A Completion</b> --	
<b>Problem Type</b> --	<b>SEV</b> --	<b>Program Name</b> --	<b>REVL</b> --	<b>OPRINC</b> --	
<b>FUNC MOD</b> --	<b>Software Effectivity</b> -- - - - - -	<b>Software Fail CD</b> --		<b>SUBTYPE</b> --	<b>Software Closure CD</b> --
<b>RES PERSON L2</b> --	<b>Approval Signature L3</b> --				
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Contractor Status Summary</b>					
<b>Reliability/Quality Assurance Concerns, Recommendations:</b>					
<b>Problem Description</b>  AFTER REMOVAL OF THE MANHOLE COVER BOLTS ON LWT-24 TO PERFORM ECO SENSOR BRACKET MODIFICATIONS, ONE BOLT OUT OF NINETY TWO WAS DISCOVERED TO HAVE A MAJOR PART OF THE THREADS DISTORTED. IT IS SUSPECTED THAT THIS CONDITION WAS CAUSED BY INTERFERENCE WITH THE NAFLEX INCONEL SEAL					
<b>Contractor Investigation/Resolution</b>  RECCURENCE CONTROL: MANUFACTURING PROCESS PLANS HAVE BEEN REVISED TO IMPROVE INSTRUCTIONS ON PROPER SEAL ALIGNMENT AND USE OF ALIGNMENT PINS AND BOLT INSTALLATION. AND, THE DESIGN OF THE ALIGNMENT PIN WAS IMPROVED AND THE NEW DESIGN FABRICATED CAUSE OF FAILURE: IMPROPER INSTALLATION OF THE BOLT (POSITION 43 ON THE MANHOLE COVER). THE BOLT THREADS WERE DISTORTED BY AN INTERFERENCE WITH THE NAFLEX INCONEL SEAL DURING INSTALLATION GENERAL DURING KSC REMOVAL OF THE LH2 AFT MANHOLE COVER ON LWT-24, IT WAS OBSERVED THAT ONE OF THE 92 ATTACHING BOLTS HAD ALL THREADS DISTORTED EXCEPT THE LEADING THREE. KSC PERSONNEL GENERATED PR PV6-087153 (ET-31-ST-00-0023) TO DOCUMENT THIS DISCREPANCY. EVIDENCE SHOWED THAT THE SLOTTED HOLE ON THE SEAL RECEIVED SOME DAMAGE WHERE THE BOLT WAS LOCATED (POSITION 43, -Y AXIS). IT WAS DECIDED, AT THAT TIME, THAT FAILURE ANALYSIS WOULD TAKE PLACE AT KSC WITH SUPPORT BY MMC, AND THAT					

MMC WOULD DETERMINE AND IMPLEMENT CORRECTIVE ACTION. THIS CAPS SHALL REPORT THE RESULTS OF THE FAILURE ANALYSIS AND DOCUMENT THE CORRECTIVE ACTIONS

INVESTIGATIONS TOOK PLACE AT MMC TO DETERMINE THE APPROPRIATE CORRECTIVE ACTION. THIS LED TO THE FOLLOWING CONCLUSIONS WHICH ARE ALSO DOCUMENTED IN THE RESPONSE TO AR NO. K7184

TOLERANCE STUDY:

- O .003 INCH MAXIMUM BOLT TO SEAL INTERFERENCE AT +/- Y AXIS (PROPER USE OF GUIDE PINS)
- O .064 INCH MAXIMUM BOLT TO SEAL INTERFERENCE AT +/- Y AXIS (IMPROPER USE OF GUIDE PINS)

PROCEDURE STUDY:

- O PROPER USE OF THE GUIDE PINS WOULD REQUIRE THAT THE PINS BE INSTALLED IN THE SLOTTED HOLES, THAT THE SLOTTED HOLES BE ALIGNED WITH THE +/- Y AND +/- Z AXIS, AND THAT THE GUIDE PINS BE REMOVED ONE AT A TIME AND A BOLT BE INSTALLED SNUGGLY PRIOR TO REMOVAL OF THE NEXT GUIDE PIN
- O THE MANUFACTURING PROCESS PLAN (MPP) DID NOT SPECIFICALLY REQUIRE THE PROCEDURES DEFINED ABOVE

DAMAGED BOLT STUDY:

- O 8300 POUND PULL STRENGTH WAS ACHIEVED WITH DAMAGED BOLTS HAVING ONLY THREE LEADING THREADS (SIMILAR TO LWT-24)
- O 8300 POUNDS IS FAR IN EXCESS OF FLIGHT LOADS

DUPLICATION OF FAILURE STUDY:

- O .025 INCH MAXIMUM INTERFERENCE FROM BOLT TO SEAL EDGE COULD BE ACCOMPLISHED WITH THE BOLT ENGAGED INTO THE KEENSERT
- O .020 INCH INTERFERENCE FROM BOLT TO SEAL EDGE RESULTED IN DAMAGE TO THE BOLT ALMOST IDENTICAL TO LWT-24

A DETAILED ACCOUNTING OF THE ABOVE INFORMATION WAS PROVIDED BY THE RESPONSE TO AR NO. K7184 WHICH IS TASK I.B. IN THIS CAPS

TASK I FAILURE/PROBLEM INVESTIGATION

A. FAILURE ANALYSIS BY KSC

KSC (NASA) HAS BEEN TASKED TO PERFORM THE FAILURE ANALYSIS ON THE DAMAGED BOLT FROM LWT-24 LH2 MANHOLE COVER PER A TELECON MEETING BETWEEN KSC, MSFC, AND MMC (MAF) PERSONNEL. THE RESULTS OF THAT FAILURE ANALYSIS SHALL BE OBTAINED AND PRESENTED TO RELIABILITY ASSURANCE, DEPARTMENT 3741

CLOSURE STATEMENT

A REPORT WAS FORWARDED FROM KSC TO MMC, MAF. REFERENCE REPORT NO. MAB-229-87. THIS REPORT CONCLUDED THAT THE DAMAGED THREADS SEEN ON THE LWT-24 MANHOLE COVER BOLT WERE THE RESULT OF MACHINING THE BOLT THREADS PRIOR TO FINAL INSERTION. INVESTIGATIONS MADE AT MAF COULD NOT AFFIRM THIS CONCLUSION, AND IT IS THE CONCLUSION FROM THE INVESTIGATIONS MADE AT MAF THAT ARE REFLECTED IN THIS CAPS (I.E. THE BOLT THREADS WERE DAMAGED BY AN INTERFERENCE WITH THE NAFLEX INCONEL SEAL DURING INSTALLATION)

B. RESPONSE TO AR NO. K7184

A MSR ACTION RESPONSE, K7184, WAS INITIATED AT KSC AS A RESULT OF THE PROBLEM WITH THE LH2 MANHOLE COVER. MMC (MAF) RESPONDED TO THIS AR AND PROVIDED ADDITIONAL RESPONSE, PER "PART B" ON THE AR. THIS TASK DOCUMENTS THAT RESPONSE

CLOSURE STATEMENT

THE RESPONSE TO AR NO K7184 WAS MADE ON THAT DOCUMENT WITH "PART B" ATTACHED. THAT RESPONSE IS ALSO REFLECTED IN THIS CAPS UNDER THE "GENERAL" SECTION

ITEM CLOSED

TASK II CORRECTIVE ACTION

A. REVISE MANUFACTURING PROCESS PLANS (MPPS)

REVISE THE MPPS (FOR ALL MANHOLE COVERS) TO INCLUDE WHERE THE SLOTTED HOLES IN THE SEAL SHALL BE LOCATED, AND TO REQUIRE THE REMOVAL OF ALIGNMENT PINS AND THE INSTALLATION OF BOLTS ONE AT A TIME AFTER THE OTHER 88 FASTENERS ARE INSTALLED

CLOSURE STATEMENT

THE MPPS WERE REVISED FOR ALL COVER INSTALLATIONS (TWO LO2 LOCATIONS AND THREE LH2 LOCATIONS), IMPLEMENTED FOR LWT-44 AND UP WITH PARTIAL IMPLEMENTATION AS PRODUCTION PERMITTED FOR LWTs 41, 42, AND 43. REFERENCE INTEROFFICE MEMORANDUM 3614-88-030

ITEM CLOSED

B. IMPROVE ALIGNMENT PIN DESIGN

REVIEW THE ALIGNMENT PIN DRAWING AND REVISE THE DESIGN OF THE ALIGNMENT PIN TO REDUCE THE THREAD LENGTH AND INCREASE THE SHANK DIAMETER

CLOSURE STATEMENT

THE ALIGNMENT PIN THREAD LENGTH WAS CHANGED FROM .50 TO .20 AND THE SHANK DIAMETER WAS CHANGED FROM .312 TO .320 (INCHES). THIS WILL PROVIDE A CLOSER FIT IN THE SLOTTED HOLES AND THUS ADDED ASSURANCE AGAINST AN INTERFERENCE FIT. IMPLEMENTED AS OF LWT-42. REFERENCE INTEROFFICE MEMORANDUM 3614-88-030 AND TOOL ORDER TL-0620-010A

TASK III CLEARANCE OF EFFECTIVITIES LWTs 16, 20, 21, 22, 24 AND UP NO CONSTRAINTS. ENGINEERING ANALYSIS, IN AR NO. K7184, DETERMINED THAT THE DAMAGE TO THE BOLT THREADS, AS SEEN ON LWT-24, IS NOT DETRIMENTAL TO THE FLIGHT PERFORMANCE OF THE ET. THIS ANALYSIS JUSTIFIES THE POSITION NOT TO INSPECT THE FLEET FOR BOLT DAMAGE ON MANHOLE COVER. THIS SPECIFIC ANALYSIS ALSO JUSTIFIES THE CLASSIFICATION OF THIS CAPS AS A CRITICALITY 3 RATHER THAN CRITICALITY 1 PER FMEA ITEM CODE 2.10.6.1 AND 6.2.1.1

TASK IV. CAPS CLOSEOUT SUMMARY

\* IN THE PROCESS OF EVALUATING APPROPRIATE CORRECTIVE ACTION, INVESTIGATIONS WERE CONDUCTED AT MAF TO EVALUATE THE CAUSE OF THE BOLT THREAD DEFORMATION AS SEEN IN POSITION 43 ON THE LWT-24 LH2 AFT MANHOLE COVER. THESE INVESTIGATIONS CONCLUDED THAT THE BOLT DAMAGE WAS CAUSED BY INTERFERENCE WITH THE EDGE OF THE SLOTTED HOLE IN THE SEAL DURING INSTALLATION OF THE MANHOLE COVER AT MAF. IN TURN, THE IMPROPER BOLT INSTALLATION PROBABLY RESULTED FROM THE ASSEMBLY GUIDE PINS BEING PLACED IN THE WRONG LOCATIONS AND/OR THE GUIDE PINS BEING IMPROPERLY CHANGED OUT FOR BOLTS DURING INSTALLATION CORRECTIVE ACTIONS WERE IMPLEMENTED TO PRECLUDE THE RE-OCCURRENCE OF THIS PROBLEM. MANUFACTURING PROCESS PLANS WERE REVISED TO IMPROVE INSTRUCTIONS ON PROPER SEAL ALIGNMENT AND USE OF ALIGNMENT PINS AND BOLT INSTALLATION. AND, THE DESIGN OF THE ALIGNMENT PIN WAS IMPROVED AND THE NEW DESIGN FABRICATED. THESE IMPROVEMENTS WERE INCORPORATED IN THE INSTALLATION OF ALL MANHOLE COVERS AS REFLECTED HERE:

A. UPDATED BY REDLINE:

LWT-41 L02 AFT COVER INST.	80911001204-009
LWT-42 L02 FWD COVER INST.	80911001206-010
LWT-42 L02 AFT COVER INST.	80911001204-009
LWT-42 L02 AFT NON-SIPHON COVER INST.	80911001449-010
LWT-43 L02 AFT COVER INST.	80911001204-009
LWT-43 L02 FWD COVER INST.	80911001206-010
LWT-43 L02 AFT NON-SIPHON COVER INST.	80911001449-010
LWT-44 L02 FWD COVER INST.	80914081490-009

B. INCORPORATED BY WORD PROCESSOR UPDATE:

LWT-44 & UP L02 AFT COVER INST.	80911001204-009
LWT-44 & UP L02 FWD COVER INST.	80911001206-010

LWT-44 & UP LH2 AFT SIPHON COVER INST. 80911001449M019  
 LWT-44 & UP LH2 AFT NON-SIPHON COVER INST. 80911001449-019  
 LWT-45 & UP LH2 FWD COVER INST. 80914081490-009  
 THE CORRECTIVE ACTIONS TAKEN HERE ARE CONSIDERED TO BE  
 ADEQUATE WITH NO FURTHER ACTION NEEDED TO ADDRESS THE FLEET  
 (BUILT HARDWARE). BY TESTING, IT WAS SHOWN THAT THREE  
 THREAD ENGAGEMENT (SAME CONFIGURATION AS ON LWT-24) PROVIDED  
 PULL STRENGTH OF 8300 POUNDS FAR IN EXCESS OF FLIGHT LOADS OF  
 6340 POUNDS. FINALLY, IT MAY ALSO BE NOTED THAT THE  
 PROBABILITY OF THE OCCURRENCE OF THIS TYPE OF DAMAGE DURING  
 INSTALLATION IS CONSIDERED TO BE VERY LOW

**MSFC Response/Concurrence**

**ASSESSMENT ADDENDUM REPORT**

<b>MSFC Report#</b> A11138	<b>IFA#</b> --	<b>Contractor RPT#</b> S-074	<b>JSC#</b> --	<b>KSC#</b> --	<b>EICN#</b> --
<b>Asmnt Part#</b> 26L2-5H10	<b>Asmnt Part Name</b> BOLT	<b>Asmnt Serial/Lot#</b> N/A			
<b>HCRIT CD</b> --	<b>FCRIT CD</b> 1	<b>CAUSE CD</b> MAW - MFG-ASY-WORK	<b>FAIL MODE</b> UC - UNSAT		
<b>Asmnt FMEA</b> 2.10.6.1	<b>Asmnt FM</b> 1	<b>FMEA CSE</b> A	<b>FMEA SCSE</b> 1		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Correlated Part#</b> --	<b>Correlated Part#</b> --	<b>Correlated Part#</b> --			
<b>Associated LRU#</b> --	<b>Associated LRU#</b> --	<b>Associated LRU#</b> --			
<b>MAJOR DESIGN CHANGES</b>					
<b>APRV DATE</b> --	<b>DESCRIPTION OF CHANGES</b> --				
<b>ASSESSMENT TEXT</b>					

WHOLE RECORD REPORT( + ADDENDUM)

<b>MSFC Record #</b> A11139	<b>In-Flight Anomaly Number</b> --	<b>Contractor Report Number</b> P-060	<b>JSC#</b> --	<b>KSC#</b> --
<b>Problem Title</b> INTERIOR DEBRIS WAS FOUND UPON ENTRY OF LWT 24 LH2 TANK				
<b>EICN#</b> --	<b>ELEMENT</b> ET	<b>Contractor</b> MMMSS	<b>FSCM#</b> --	<b>FCRIT</b> 3
<b>HCRIT</b> --	<b>Sys_Lvl</b> N	<b>Misc Codes</b> A B C D E (X) F G H I J K L M N O		
<b>HARDWARE</b> EIM	<b>NOMENCLATURE</b> N/A	<b>PART#</b> N/A	<b>SER/LOT#</b> N/A	<b>MANUFACTURER</b> N/A
<b>HARDWARE</b> LRU	<b>NOMENCLATURE</b> LWT 24	<b>PART#</b> NOTED	<b>SER/LOT#</b> NOTED	<b>MANUFACTURER</b> NOTED
<b>HARDWARE</b> NCA	<b>NOMENCLATURE</b> LH2 TANK	<b>PART#</b> 80901010000-070	<b>SER/LOT#</b> 24	<b>MANUFACTURER</b> MMC
<b>Test/Operation</b> L - FLD	<b>Prevailing Condtion</b> N - INSPECTION	<b>F / U</b> UC	<b>Fail Mode</b> UC - UNSAT	<b>Cause</b> ES - EI-SHIP
<b>System</b> PROPULSION	<b>Defect</b> CN - CONTAM	<b>Material</b> N - HOLE	<b>Work Contact</b> C. CAMPBELL	<b>Fail Date</b> 12/24/1987
<b>Received at MSFC</b> 12/21/1987	<b>Date Isolated</b> --	<b>FMEA Reference</b> N/A	<b>IFA: Mission Phase</b> --	<b>Mission Elapsed Time</b> --
<b>Location</b> KSC		<b>Symptom</b> UC - UNSAT		<b>Time Cycle</b> --
<b>Effectivity Text</b> LWT 16 AND UP				
<b>Vehicle Effectivity Codes</b>				
<b>Vehicle 1</b> --	<b>Vehicle 2</b> --	<b>Vehicle 3</b> --	<b>Vehicle 4</b> --	<b>Vehicle 5</b> --
<b>Mission Effectivity Codes</b>				
<b>Mssn 1</b> --	<b>Mssn 2</b> --	<b>Mssn 3</b> --	<b>Mssn 4</b> --	<b>Mssn 5</b> --
<b>Estimated Completion Dates</b>				
<b>MSFC Approved Defer Until Date</b> --	<b>Contractor Req Defer Until Date</b> --	<b>LVL 3 Close</b> --	<b>Remark / Action</b> --	
<b>Investigation / Resolution Summary</b>				
<b>Last MSFC Update</b> 07/18/1988	<b>CN RSLV SBMT</b> 05/26/1988	<b>Defer Date</b> --	<b>Add Date</b> 12/22/1987	<b>R/C Codes</b> 2 - MFG -- --
<b>Assignee</b>				
<b>Design</b> P. MULLER	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> P. BRIDWELL
<b>Approval</b>				

<b>Design</b> A. JACKMAN	<b>Chief Engineer</b> J. NICHOLS	<b>S &amp; MA</b> R. JACKSON	<b>Project</b> M. PESSIN	<b>Project MGR</b> P. BRIDWELL	
<b>PAC Assignee</b> J.EL-IBRAHIM	<b>PAC Review Complete</b> JE	<b>MSFC Closure Date</b> 06/03/1988	<b>Status</b> C - CLOSED	<b>F/A Completion</b> --	
<b>Problem Type</b> --	<b>SEV</b> --	<b>Program Name</b> --	<b>REVL</b> --	<b>OPRINC</b> --	
<b>FUNC MOD</b> --	<b>Software Effectivity</b> -- - - - - -	<b>Software Fail CD</b> --		<b>SUBTYPE</b> --	<b>Software Closure CD</b> --
<b>RES PERSON L2</b> --	<b>Approval Signature L3</b> --				
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Related Document Type</b> --	<b>Related Document ID</b> --				
<b>Related Document Title</b> --					
<b>Contractor Status Summary</b>					
<b>Reliability/Quality Assurance Concerns, Recommendations:</b>					
<b>Problem Description</b>  UPON ENTRY OF LWT-24 LH2 TANK AT KSC A SMALL QUANTITY OF DEBRIS WAS OBSERVED IN THE AFT DOME AREA. AMONG THE PARTICLES WAS A PIECE OF SANDPAPER APPROXIMATELY 2 X 3 INCHES. THIS CAPS IS OPEN TO IMPLEMENT CORRECTIVE ACTIONS NECESSARY TO PRECLUDE A RECURRENCE OF ABNORMALLY LARGE PARTICLES SUCH AS THE SANDPAPER. THE SMALL PARTICLES ARE CONSIDERED NORMAL BASED UPON SAMPLES TAKEN ON OTHER TANKS. REF: MARS NO. ARK 7117, CAPS P-0608					
<b>Contractor Investigation/Resolution</b>  R/C: PROCEDURES, PROCESS INSTRUCTIONS AND TRAINING WERE REVIEWED AND REVISED BY MMMA CAUSE: EMPLOYEE ERROR 5/26/88 - GENERAL FORMAL RESPONSE TO THE PROBLEMS IDENTIFIED ON LWT-24 HAS BEEN TRANSMITTED TO KSC PER AR K7177 TASK I. FAILURE/PROBLEM INVESTIGATION ANALYSIS OF THE CONTAMINATION REMOVED FROM LWT-24 TANK SHOWS 191 INDIVIDUAL PARTICLES AND FIBERS RANGING FROM 12 MICRONS TO 68,000 (HUMAN HAIR) MICRONS PLUS A 2" X 3" PIECE OF SANDPAPER. EACH PARTICLE IS IDENTIFIED AND SIZED IN THE ATTACHED LABORATORY REPORT 87A483. THE 191 PARTICLES HAD A TOTAL WEIGHT OF 0.118 GRAMS (LESS SANDPAPER) WITH THE FOLLOWING DISTRIBUTION 0 - 200 MICRONS                      33					

200 - 500 MICRONS	31
500 - 750 MICRONS	28
750 -1000 MICRONS	21
1000 MICRONS	75

THE MAJORITY OF PARTICLES WERE METAL FLAKES (70), SLA (19), BLACK NEOPRENE RUBBER (24), SAND WITH METAL DUST (FROM SANDPAPER) (18), AND BLACK TAPE (12). THE PARTICLES WERE REMOVED FROM AN AREA OF APPROXIMATELY 1129 SQUARE FEET OF INTERNAL TANK SURFACE. THE PARTICLE SIZE DISTRIBUTION WAS COMPARED TO HISTORICAL DATA FROM LWT-11 THRU 15 LH2 TANKS SAMPLED DURING 1984. SAMPLES WERE COLLECTED FROM 15 SQUARE FEET OF INTERNAL SURFACE AREA FROM EACH TANK AFTER ALL WORK IN FINAL ASSEMBLY WAS ACCOMPLISHED AND THE QUALITY WALK-THROUGH AND BUY-OFF WERE COMPLETE. THE SAMPLES COLLECTED WERE REPRESENTATIVES OF THE CONTAMINATION LEVELS THAT WOULD BE PRESENT UPON DELIVERY OF THE TANK.

LWT-11 LH2 PRODUCED THE HIGHEST DISTRIBUTION OF PARTICLES:

0 - 200 MICRONS	780
200 - 500 MICRONS	360
500 - 750 MICRONS	129
750 -1000 MICRONS	222
1000 MICRONS	68

THE MAJORITY OF PARTICLES WERE POLYETHYLENE FIBERS, TEFLON FIBERS, PAPER FIBERS, METAL FLAKES, SOFI AND BLACK TAPE. SEE ATTACHEMENT #1 FOR DETAILS.

COMPARING THE LWT-24 LH2 PARTICLES GREATER THAN 500 MICRONS TO THE LWT-11 LH2 PARTICLE HISTORY GREATER THAN 500 MICRONS, THE LWT-11 PARTICLE HISTORY IS APPROXIMATELY 252 TIMES LARGER PER SQUARE FOOT OF SURFACE AREA THAN LWT-24. (419 PARTICLES OVER 15 FT-SQUARE VERSUS 124 PARTICLES OVER 1129 FT-SQUARE)

REVIEW OF THE LWT-24 TANK BUILD HISTORY DOCUMENTATION DETERMINED THAT SANDPAPER ENTERED THE TANK ONLY ONCE IN THE BUILD PROCESS. AT THE COMPLETION OF THE FINAL TANK ENTRY BEFORE THE MANHOLE COVER INSTALLATION AND CLOSEOUT IN FINAL ASSEMBLY, TWO SMALL SCRATCHES WERE DETECTED ON THE TANK SKIN AT THE -Z AXIS. THE SCRATCHES WERE DOCUMENTED AND REWORKED. SANDPAPER WAS CARRIED INTO THE TANK TO PERFORM THE REWORK AND THE SUBJECT PIECE OF SANDPAPER WAS INADVERTANTLY LEFT IN THE TANK. THE TANK ENTRY CONTROLS INCLUDE A TANK ENTRY MONITOR AND TANK ENTRY LOG. THE TANK ENTRY LOG SHOWS THE SAME NUMBER OF SHEETS OF SANDPAPER LEAVING THE TANK AS ENTERED IT. APPARENTLY THE SUBJECT PIECE OF SANDPAPER WAS TORN FROM A SHEET OF SANDPAPER AND THE MISSING PIECE WAS NOT DETECTED DURING THE EXIT ACCOUNTING.

TASK CLOSED

TASK II. CORRECTIVE ACTIONS

- A. REVIEW TANK ENTRY LOGS TO IDENTIFY THE INSTANCES OF SANDPAPER ENTRY ON EACH EXTERNAL TANK WHICH HAS BEEN THROUGH FINAL CLEANING
- B. REVISE TANK ENTRY LONG PROCEDURE FOR 100% ACCOUNTABILITY OF MATERIALS USED INSIDE EXTERNAL TANKS  
CLOSURE STATEMENT  
TASK COMPLETE. REFERENCE PRODUCT ASSURANCE PROCEDURE 17.6.22 REVISION 8 AND TANK ENTRY LOG FORM NUMBER MAF/MMA 37-064
- C. EVALUATE ELIMINATING THE NEED TO CUT SAFETY WIRE WHILE INSIDE EXTERNAL TANK  
CLOSURE STATEMENT  
ACTION IS COMPLETE. REFERENCE MEMO 3693-88-SC-020
- D. ISSUE A CREW TIP TO ALERT PERSONNEL TO THE ADVERSE POTENTIAL OF LESS THAN 100% ACCOUNTABILITY OF MATERIALS ENTERING EXTERNAL TANKS  
CLOSURE STATEMENT  
ACTION IS COMPLETE. REFERENCE CREW TIP 87-018
- E. EVALUATE TRAINING REQUIREMENTS AND IDENTIFY ANY DEFICIENCIES  
CLOSURE STATEMENT  
ACTION IS COMPLETE. REFERENCE MEMO 3720-88-001 WHICH DIRECTS USE OF THE CORRECT PROCEDURE FOR TANK ENTRY CONTROL AND MONITORING

F. EVALUATE CONTROLS FOR ALL TYPES OF MATERIALS TAKEN INSIDE OF THE EXTERNAL TANKS

ECD: 2/12/88

G. EVALUATE PROPOSALS MADE BY AMT IN TASK II.C. MAKE SPECIFIC RECOMMENDATIONS AS TO THE PROPOSAL TO ADOPT CLOSURE STATEMENT

PI2012 REVISED TO REQUIRE SAFETY WIRE TO BE HAND HELD WHEN CUT (REF. MEMO 3693-88-SA-080 AND 3513-88-010)

H. INCORPORATE ACCOUNTABILITY OF LIQUIDS INTO TANK ENTRY PROCEDURE CLOSURE STATEMENT  
LIQUID ACCOUNTABILITY CONTROLS IMPLEMENTED BY REVISION 9 OF P.A.P 17.6.22

TASK III. CLEARANCE OF EFFECTIVITIES

RATIONALE FOR CLEARANCE OF LH2 TANK (LWT-24):

LWT-11 THRU 15 LH2 TANK PARTICULATE QUANTITIES WERE FOUND ACCEPTABLE TO ENGINEERING. LWT-24 LH2 TANK PARTICULATE IS SMALLER IN SIZE AND DISTRIBUTION BY A FACTOR OF 252. THEREFORE, THE PARTICULATE FOUND IN THE LWT-24 LH2 TANK IS CONSIDERED TO BE A NORMAL OCCURRENCE SINCE THE SANDPAPER ENTERED THE LH2 TANK THROUGH THE AFT DOME AND ALL OF THE WORK OCCURRED ON THE AFT DOME, KSC INSPECTION WOULD HAVE DETECTED ALL OF THE REMAINING SANDPAPER. BASED ON THE ABOVE RATIONALE NO FURTHER ACTION IS REQUIRED INSIDE THE TANK

RATIONALE FOR CLEARANCE OF L02 TANK (LWT-24):

THE L02 TANK IS CLEANED PER PI 5009 AND SAMPLED TO A CLEAN LEVEL OF 5.0 MG/SQ. FT. FOR NON-VOLATILE RESIDUE AND 1000 MICRONS FOR PARTICULATE. THE TANK IS MAINTAINED CLEAN PER PI 5011 AND ALL TANK ENTRIES ARE MONITORED AND CONTROLLED PER PI 5011 AND P.A.P. 17.6.22 THE INCIDENCE OF PARTICLE GENERATION IS REDUCED FOR THE L02 TANK VERSUS THE LH2 TANK BY THE FOLLOWING REASONS:

- ALL TOOLING (INCLUDING HAND TOOLS) EQUIPMENT AND CLOTHING USED IN TANK ENTRY ARE CLEANED TO A VISUALLY CLEAN LEVEL BEFORE USE INSIDE THE TANK
- AFTER FINAL CLEANING IN CELL "E", NO LARGE INTERNAL ACCESS TOOLING IS USED FOR INTERNAL INSTALLATIONS
- NO ACCESS TOOLING CONTACTS THE L02 TANK INTERIOR DURING TANK ENTRY IN CELL "E" OR FINAL ASSEMBLY
- NO SLA IS IN CLOSE PROXIMITY TO THE ENTRY POINT OF THE L02 TANK THE LH2 TANK DOES HAVE SLA IN CLOSE PROXIMITY TO THE ENTRY POINT
- THE PURGE AIR FLOW FROM THE L02 TANK DURING TANK ENTRY IS GREATER THAN THE AIR FLOW FROM THE LH2 TANK

ADDITIONAL INSPECTIONS ARE PERFORMED ON THE L02 TANK DOME AS FINAL TANK EGRESS IS MADE. A NON-VOLATILE RESIDUE WIPE TEST AND A BLACK LIGHT INSPECTION ARE CONDUCTED IN THE AFT DOME AREA

BASED ON THE ABOVE RATIONALE, A TANK ENTRY INTO THE LOX TANK AT KSC IS NOT REQUIRED

RATIONALE FOR FLEET CLEARANCE - LH2 TANK:

THE DEBRIS (EXCLUDING THE SANDPAPER) DISCOVERED INSIDE THE LWT-24 LH2 TANK IS NORMAL AND INSIGNIFICANT. BOTH THE DEBRIS AND THE SANDPAPER WOULD POSE NO RISK FOR THE PROPELLANT SCREENS STRUCTURE AND FUNCTION THE SCREENS ARE APPROXIMATELY 2.5 TIMES LARGER IN SURFACE AREA THAN REQUIRED FOR THE PROPELLANT FLOW RATES. IN ADDITION, THE SCREEN MESH IS SIZED TO PRECLUDE PARTICULATE LARGE ENOUGH TO DAMAGE THE ENGINES FROM ENTERING THE FEEDLINE

RATIONALE FOR FLEET CLEARANCE - L02 TANK:

THE SAME RATIONALE APPLIES FOR THE L02 TANK AS FOR THE LH2 TANK PLUS THE L02 TANK IS LESS SUSCEPTIBLE TO DEBRIS INGESTION AS SHOWN IN THE LWT-24 L02 TANK DISCUSSION. IT WAS DETERMINED THUS FAR UNDER TASK II-A THAT SANDPAPER APPEARS ON THE TANK ENTRY LOGS OF LWTS-21 AND 26 RATIONALE FOR CLEARANCE OF THESE EFFECTIVITIES IS AS FOLLOWS:

LWT - 26

TANK ENTRY LOGS INDICATE THAT THE SANDPAPER WAS USED FOR REWORK OF AN IMPERFECTION ON THE FORWARD OGIVE ELECTRICAL FEEDTHRU SEALING SURFACE



THIS SEALING SURFACE. THE SEALING SURFACE IS LOCATED EXTERNAL OF THE L02 TANK. A CLEAN ROOM IS POSITIONED AROUND THE FORWARD OGIVE WHICH ENCOMPASSES THE LOCATION OF THE SEALING SURFACE DEFECT. AS A ROUTINE, THE TANK MONITOR LOGS ALL MATERIALS ENTERING THIS CLEAN ROOM. THIS IS DUE TO THE FACT THAT THE MONITOR IS POSITIONED OUTSIDE THE CLEAN ROOM AND MUST USE THE CLEAN ROOM THRESHOLD AS THE POINT OF ACCOUNTABILITY THE SANDPAPER IN THIS CASE WAS NEVER PHYSICALLY TAKEN INSIDE THE L02 TANK

LWT - 21

THE LWT-21 RECORDS INDICATE THAT RAISED METAL WAS DISCOVERED ON THE MANHOLE FITTING LIP AND ON THE TOP SIDE OF THE ANTI-VORTEX BAFFLE DURING SHAKEDOWN. THIS DISCOVERY WAS MADE AFTER ALL ELECTRICAL INSTALLATIONS HAD BEEN COMPLETED AND INSTALLATION OF THE SCREENS HAD BEEN ACCOMPLISHED. THIS ACTIVITY IS ACCOMPLISHED IMMEDIATELY AFTER THE TANK HAS BEEN INTERNALLY CLEANED IN CELL E. TO REMOVE THE RAISED METAL, TANK ENTRY RECORDS INDICATE THAT ONE PIECE OF SANDPAPER (600 GRIT) AND OTHER RELATED MATERIALS SUCH AS AN OPTICAL MICROMETER, 6" SCALE, P. H. PAPER, IRRIDITE, CLEAN CLOTH AND D.M. WATER, ENTERED AND EXITED THE TANK. ALL MATERIAL BY COUNT WAS ACCOUNTED FOR IN THE TANK ENTRY RECORDS LITTLE COMPARISON CAN BE MADE RELATIVE TO THE INTERNAL CONFIGURATIONS OF THE L02 VS. LH2 TANK. THE LH2 TANK HAS MANY FAYING SURFACES, STRINGERS, AND OTHER INTERNAL INSTALLATIONS WHICH REQUIRE VERY CLOSE VISUAL SCRUTINY DURING FINAL SHAKEDOWN TO DETECT ALL FOREIGN OBJECTS THE L02 TANK OFFERS NO VISUAL OBSTRUCTIONS AND ENTRAPMENT AREAS FORWARD AND AFT OF THE SLOSH BAFFLES. EVEN THOUGH THE ANTI-VORTEX BAFFLES AND PROPELLENT SCREENS ARE LOCATED IN THE +Z AXIS, THEY ARE VERY INSPECTABLE AND HAVE NO ENTRAPMENT AREAS FOR FOREIGN OBJECTS SINCE THE L02 TANK HAS A SMOOTH SKIN, ANY FOREIGN MATERIAL WOULD MIGRATE TO THE LOWEST POINT WITHIN THE TANK

IN FURTHERANCE OF THIS INVESTIGATION, THE TECHNICIAN AND ONE OF THE TANK ENTRY MONITORS WERE INTERVIEWED RELATIVE TO THE NORMAL PRACTICES AND PROCEDURES RELATING TO CELL E ACTIVITIES. IT WAS RELATED BY THEM THAT A MINIMUM AMOUNT OF MATERIAL IS TRANSPORTED INTO THE CLEAN TANK TO PERFORM ANY WORK. IN A TYPICAL CASE OF SANDPAPER, THE TECHNICIAN WHO WORKED LWT-21 RELATED THAT AN ASSESSMENT WOULD BE MADE RELATIVE TO THE AMOUNT OF RAISED METAL TO BE REMOVED. HE WOULD THEN EXIT THE TANK AND CUT ONLY THE SMALL QUANTITY OF PAPER REQUIRED TO REMOVE THE IMPERFECTION. AT NO TIME WOULD HE TEAR OR CUT SANDPAPER IN THE TANK THIS OBSERVATION WAS CONFIRMED BY THE TANK MONITOR. CELL E ACTIVITIES ARE ROUTINELY PERFORMED BY AN EXPERIENCED AND DEDICATED CREW. IN THIS SPECIFIC CASE, RECORDS INDICATE A SECOND SHAKEDOWN WAS MADE BY QUALITY AND DCAS TO ASCERTAIN A CLEAN SYSTEM. EVEN THOUGH THE DCAS INSPECTOR DOES NOT REMEMBER SPECIFICS RELATING TO LWT-21, AS A RULE A VERY THOROUGH INSPECTION IS MADE OF THE AFT DOME AREA. NO FURTHER TANK ENTRIES WERE MADE UNTIL THE TANK WAS IN FINAL ASSEMBLY

IN FINAL ASSEMBLY, A REQUIREMENT EXISTS IN THE PLANNING PAPER WHICH REQUIRED THAT THE AFT MANHOLE TOOLING COVER BE REMOVED A BLACK LIGHT INSPECTION BE PERFORMED FOR DETECTION OF HYDROCARBONS. RECORDS INDICATE THAT SCATTERED HYDROCARBON INDICATIONS WERE PERSENT ADJACENT TO THE MANHOLE COVER AND MARS T-78269 WAS WRITTEN. THROUGH THE REPEATED ATTEMPTS TO REMOVE THE CONTAMINATION STARTING WITH FREON PCA AND FINISHING WITH MEK, THE -Z PART OF THE DOME WOULD HAVE BEEN REPEATEDLY OBSERVED. WITH THE LIGHTS USED IN CONJUNCTION WITH THIS ACTIVITY, IF ANY SANDPAPER WERE IN THE AREA OF THE AFT DOME, IT WOULD BE VISUALLY DETECTABLE. FURTHERMORE, THE REPEATED BLACK LIGHT INSPECTIONS WOULD HAVE DETECTED AN SANDPAPER ON THE BOTTOM (-Z) OF THE DOME BASED UPON THE RATIONALE PRESENTED HEREIN, THERE IS NO REASON TO BELIEVE THAT ANYTHING WAS LEFT IN LWT-21 L02 TANK

TASK IV. CAPS CLOSEOUT SUMMARY

AS A RESULT OF PARTICULATE INCLUDING A PIECE OF SANDPAPER 2"x3" OBSERVED INSIDE OF LWT-24 LH2 TANK AT KSC, A COMPLETE REVIEW OF OTHER TANKS WAS PERFORMED AND PROCEDURAL ENHANCEMENTS WERE IMPLEMENTED

TO PREVENT A RECURRENCE OF THE PROBLEM  
 IN REVIEWING ALL TANK ENTRY RECORDS ON LWT-16 THROUGH LWT-45, WITH  
 SPECIFIC EMPHASIS ON PAPER USED INSIDE OF L02 TANKS, SANDPAPER ENTERED  
 LWTS 21, 43, 44 AND 45. SINCE THE TANKS ARE BLACK LIGHTED IN FINAL  
 ASSEMBLY, ANYTHING LEFT INSIDE OF A TANK WOULD BE DETECTED  
 PROCEDURES, PROCESS INSTRUCTIONS AND TRAINING WERE REVIEWED AND REVISED  
 AS DEEMED NECESSARY TO ENHANCE CONTROLS OF MATERIALS ENTERING THE  
 TANKS DURING PROCESSING. ADDITIONALLY, A CREW TIP WAS RELEASED TO  
 ADVISE PERSONNEL OF THE ADVERSE POTENTIAL OF LESS THAN 100%  
 ACCOUNTABILITY OF MATERIALS ENTERING TANKS  
 ALL ACTIONS REQUIRED OF THIS CAPS ARE COMPLETE. THEREFORE THIS CAPS  
 IS CLOSED  
 THIS PROBLEM CLOSURE IS SUBMITTED TO MSFC FOR CLOSURE REVIEW AND  
 APPROVAL

**MSFC Response/Concurrence**

**ASSESSMENT ADDENDUM REPORT**

<b>MSFC Report#</b> A11139	<b>IFA#</b> --	<b>Contractor RPT#</b> P-060	<b>JSC#</b> --	<b>KSC#</b> --	<b>EICN#</b> --
<b>Asmnt Part#</b> 80901010000-070	<b>Asmnt Part Name</b> LH2 TANK	<b>Asmnt Serial/Lot#</b> 24			
<b>HCRIT CD</b> --	<b>FCRIT CD</b> 3	<b>CAUSE CD</b> ES - EI-SHIP	<b>FAIL MODE</b> UC - UNSAT		
<b>Asmnt FMEA</b> N/A	<b>Asmnt FM</b> N/A	<b>FMEA CSE</b> N/A	<b>FMEA SCSE</b> N/A		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Asmnt FMEA</b> --	<b>Asmnt FM</b> --	<b>FMEA CSE</b> --	<b>FMEA SCSE</b> --		
<b>Correlated Part#</b> --	<b>Correlated Part#</b> --	<b>Correlated Part#</b> --			
<b>Associated LRU#</b> --	<b>Associated LRU#</b> --	<b>Associated LRU#</b> --			
<b>MAJOR DESIGN CHANGES</b>					
<b>APRV DATE</b> --	<b>DESCRIPTION OF CHANGES</b> --				
<b>ASSESSMENT TEXT</b>					