INDEPENDENT ORBITER ASSESSMENT

ANALYSIS
OF THE
LANDING/DECELERATION
SUBSYSTEM

12 JANUARY 1987
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Independent Orbiter Assessment
Analysis of the Landing/Deceleration Subsystem

1.0 EXECUTIVE SUMMARY

The McDonnell Douglas Astronautics Company (MDAC) was selected in June 1986 to perform an Independent Orbiter Assessment (IOA) of the Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL). Direction was given by the STS Orbiter and GFE Projects Office to perform the hardware analysis using the instructions and ground rules defined in NSTS 22206, Instructions for Preparation of FMEA and CIL, 10 October 1986. The IOA approach features a top-down analysis of the hardware to determine failure modes, criticality, and potential critical items. To preserve independence, this analysis was accomplished without reliance upon the results contained within the NASA FMEA/CIL documentation. This report documents (Appendix C) the independent analysis results corresponding to the Orbiter Landing/Deceleration Subsystem hardware.

The Landing/Deceleration Subsystem is utilized to allow the Orbiter to perform a safe landing, allowing for landing-gear deploy activities, steering and braking control throughout the landing rollout to wheel-stop, and to allow for ground-handling capability during the ground-processing phase of the flight cycle. Specifically, the Landing/Deceleration hardware consists of the following components:

- Nose Landing Gear (NLG)
  NLG Shock Strut Assembly
  NLG Doors and Uplock Mechanism
  NLG Wheels and Tires
- Main Landing Gear (MLG)
  MLG Shock Strut Assembly
  MLG Doors and Uplock Mechanisms
  MLG Wheels and Tires
- Brake & Antiskid (B&AS)
  B&AS Controls
  Brake Mechanisms
- Electrical Power Distribution and Controls (EPD&C)
- Nose Wheel Steering (NWS)
- Hydraulics Actuators

The IOA analysis process utilized available Landing/Deceleration hardware drawings and schematics for defining hardware assemblies, components, and hardware items. Each level of hardware was evaluated and analyzed for possible failure modes and effects. Criticality was assigned based upon the severity of the effect for each failure mode.

Figure 1 presents a summary of the failure criticalities for five of the six major subdivisions of the Landing/Deceleration Subsystem. The NWS analysis is not included with this report. The NWS was originally included with this subsystem, but in order to
conform with NASA alignment it has been identified as a separate subsystem. A summary of the number of failure modes, by criticality, is presented below with hardware criticality first and functional criticality second.

<table>
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<td>0</td>
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For each failure mode identified, the criticality and redundancy screens were examined to identify critical items. A summary of potential critical items is presented as follows:

<table>
<thead>
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<td>27</td>
<td>0</td>
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Due to the lack of redundancy in the Landing/Deceleration Subsystems there is a high number of critical items.
LANDING/DECELERATION ANALYSIS SUMMARY OVERVIEW

<table>
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LANDING/DECEL EPD&C CRITICALITY NUMBER

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HYDRAULICS CRITICALITY NUMBER

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NOSE LANDING GEAR CRITICALITY NUMBER

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NOSE WHEEL STEERING CRITICALITY NUMBER

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MAIN LANDING GEAR CRITICALITY NUMBER

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</tr>
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BRAKE & SKID CONTROL CRITICALITY NUMBER

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2.0 INTRODUCTION

2.1 Purpose

The 51-L Challenger accident prompted the NASA to readdress safety policies, concepts, and rationale being used in the National Space Transportation System (NSTS). The NSTS Office has undertaken the task of reevaluating the FMEA/CIL for the Space Shuttle design. The MDAC is providing an independent assessment of the Orbiter FMEA/CIL reevaluation results for completeness and technical accuracy.

2.2 Scope

The scope of the independent FMEA/CIL assessment activity encompasses those Shuttle Orbiter subsystems and GFE hardware identified in the Space Shuttle Independent FMEA/CIL Assessment Contractor Statement of Work. Each subsystem analysis addresses hardware, functions, internal and external interfaces, and operational requirements for all mission phases.

2.3 Analysis Approach

The independent analysis approach is a top-down analysis utilizing as-built drawings to breakdown the respective subsystem into components and low-level hardware items. Each hardware item is evaluated for failure mode, effects, and criticality. These data are documented in the respective subsystem analysis report, and are used to assess the NASA and Prime Contractor FMEA/CIL reevaluation results. The IOA analysis approach is summarized in the following Steps 1.0 through 3.0. Step 4.0 summarizes the assessment of the NASA and Prime Contractor FMEAs/CILs that is performed and documented at a later date.

Step 1.0 Subsystem Familiarization
   1.1 Define subsystem functions
   1.2 Define subsystem components
   1.3 Define subsystem specific ground rules and assumptions

Step 2.0 Define subsystem analysis diagram
   2.1 Define subsystem
   2.2 Define major assemblies
   2.3 Develop detailed subsystem representations

Step 3.0 Failure events definition
   3.1 Construct matrix of failure modes
   3.2 Document IOA analysis results
Step 4.0 Compare IOA analysis data to NASA FMEA/CIL
  4.1 Resolve differences
  4.2 Review in-house
  4.3 Document assessment issues
  4.4 Forward findings to Project Manager

2.4 Landing/Deceleration Ground Rules and Assumptions

The Landing/Deceleration ground rules and assumptions used in the IOA are defined in Appendix B. The subsystem specific ground rules were defined to limit the analysis to single-failed parts for each failure.
3.0 SUBSYSTEM DESCRIPTION

3.1 Design and Function

The Landing/Deceleration Subsystem consists of the hardware required to perform landing and rollout to a safe stop. In addition, the Landing/Deceleration Subsystem performs the function of transporting the Orbiter during the landing phase and towing during post mission operations. The Landing/Deceleration Subsystem consists of the following components:

1. The Nose Landing Gear Shock Strut Assembly (NGSSA) is the assembly that supports the nose of the Orbiter during landing and ground-handling operations. The NGSSA consists of the Shock Strut, Axle, Steering/Damping Actuator, Torque Arms, Drag Brace, Lock Brace, and attaching hardware (Figures 2 and 3).

2. The Nose Landing Gear Doors and Uplock/Release Mechanisms (Figures 2 and 3) consist of the following components that function when the landing gear deploy switch is activated:
   - Extend/Retract Hydraulic Strut Actuator
   - Door Extend Retract Mechanism
   - Door Over-Center Bungee
   - Gear Uplock Hook
   - Door Hooks
   - Door Hook Actuation Linkage
   - NLG Uplock Release Hydraulic Actuator
   - Backup Pyro Uplock Release Actuator
   - NLG Extension Booster Pyro Actuator
   - Door Bungee Assist Assembly

3. The data for the Nose Landing Gear Wheels and Tires are not currently available for use in the evaluation of the wheels or the tires. B. F. Goodrich drawings were requested through NASA, Rockwell International (Downey Operations) and through B. F. Goodrich (Troy, Ohio). Some analysis has been performed using the Rockwell Procurement Specifications which were available through NASA.

4. The two Main Landing Gear Shock Strut Assemblies (MGSSA) support the aft portion of the Orbiter during landing and ground handling activities. The MGSSA consists of the Shock Strut, Axle, Torque Arms, Drag Brace, Lock Brace, and attaching hardware (Figures 4 and 5).
5. The Main Landing Gear Doors and Uplock Mechanisms (Figures 4 and 5) consists of the following components that function when the landing gear deploy switch is activated:

- Extend/Retract Hydraulic Strut Actuator
- Door Extend Retract Mechanism
- Door Over-Center Bungee
- Gear Uplock Hook
- Door Hooks
- Door Hook Actuation Linkage
- MLG Uplock Release Hydraulic Actuator
- Backup Pyro Uplock Release Actuator
- Door Bungee Assist Mechanism

6. The data for the Main Landing Gear Wheels and Tires are not currently available for use in the evaluation of the wheels or the tires. B. F. Goodrich drawings were requested through NASA, Rockwell (Downey Operations) and through B. F. Goodrich (Troy, Ohio). Some analysis has been performed using the Rockwell Procurement Specifications which were available through NASA.

7. The data for the Brake and Antiskid Controls are limited and the assessment was performed using the data available in the Space Shuttle Systems Handbook, the Shuttle Flight Operations Manual, Volume 10D, the Rockwell Procurement Specification, Brake/Skid Control Subsystem, Wheel Brakes - Main Landing Gear, Orbiter, and the NASA Training Document on Landing/Deceleration Subsystems, LNDG/DECEL 2102. Data were requested on the Mark III Skid Control System, but we were informed that the data were proprietary and that the data would not be made available for the assessment. Current data were requested through NASA and Rockwell International, Downey Operations. The Brake and Antiskid Controls consist of the Rudder/Brake Pedal Assembly and the Brake/Skid Control System as identified in Figure 6.

8. The data for the Brake System are not currently available for use in the evaluation of the system. B. F. Goodrich drawings were requested through NASA, Rockwell International, Downey Operations, and through B. F. Goodrich (Troy, Ohio). Some analysis has been performed using the Rockwell Procurement Specifications which were available through NASA. Some data were found on the Orbiter braking system through Lockheed in Clear Lake through the notes from the AD HOC COMMITTEE - ORBITER BRAKING SYSTEM ASSESSMENT documents. The brake system consists of four electro-hydraulic disc-braking systems. Each assembly has nine discs: four rotors and five stators. The rotors are splined to the inside of the wheel and rotate with
the wheel. The stators are splined to the outside of the axle assembly and do not rotate. When the brakes are applied, eight hydraulic actuators in the brake assembly press the discs together, thus providing the braking torque. The hydraulic brake actuators are distributed evenly around the discs. Four of the actuators are manifolded into a brake chamber and are powered by a single hydraulic system. The remaining four are manifolded into a second braking chamber and are powered by a different hydraulic system.

9. The Rudder/Brake Pedal Assembly (R/PBA) is the mechanical assembly that allows the crew to make manual inputs into the Landing/Deceleration Subsystems. The R/PBA converts the manual inputs into electrical data that is transmitted to the flight control systems, the brake controls, and the nose wheel steering. Each R/PBA contains two brake-pedal transducer units called the Rudder Pedal Transducer Assemblies (RPTA). Each unit has four Linear Variable Differential Transducers (LVDT) which output 0-5 VDC brake signals to the brake/skid control boxes A and B. Each of the transducer units output four separate braking signals for the respective left/right-brake control for the associated braking system.

10. The Electrical Power Distribution and Control (EPD&C) consists of two subsystems within the Landing/Deceleration Subsystem: Landing Gear Control and Brake and Antiskid. The landing Gear Control system provides power to the Nose and Main Landing Gear Doors and uplock/Release Mechanisms on the orbiter (Figure 7.) The Brake and Antiskid subsystem transfers brake and skid control power to the Brake/Skid Control Boxes A and B (Figure 6). Power is also provided to the hydraulic brake-line heater coils for orbiter hydraulic fluid heating. EPD&C powers the electronics for sensing and monitoring the discrete position of moving parts and assemblies within the Landing/Deceleration subsystem.

11. The responsibility for the Nose Wheel Steering system has been assigned to the NWS Group. The FMEA's for the NWS were originally included in the Landing/Deceleration Subsystem. The mechanical-linkage portions of the NWS are still included in the Landing/Deceleration IOA reports as a portion of the Nose Landing Gear reports.

12. The Hydraulics Actuators on the Landing/Deceleration Subsystem consists of six actuators. Three actuators, one in each wheel well, activate the landing gear uplock mechanism that initiates the landing gear deploy sequence for that landing gear, and three actuators perform the task of extending or retracting the landing
Landing gear retraction can only be performed by Ground Support Equipment (GSE); a landing gear retraction cannot be supported on orbit. These actuators are actually components of the subsystems listed in paragraphs 3.1.2 and 3.1.5 of this section. However, for this report they are broken out separately for the purpose of clarity.

3.2 Interfaces and Locations

The Landing/Deceleration hardware consists of six major subcomponents located in the Orbiter's cabin area and on the under carriage of the Orbiter. The interfaces for the subsystem are relatively simple in that there is a limited number of interfaces with the other subsystems on the Orbiter. The interfaces with the other subsystems are basically limited to interfaces with the Data Processing System (DPS) for backup flight control for the NWS and for instrumentation on the Landing/Deceleration hardware, and the Hydraulics System (HYD) for hydraulics system pressure for the subsystem actuators and for the brakes. The remainder of the subsystem is capable of direct control, via wire, from the control device to the subsystem hardware.

3.3 Hierarchy

Figure 8 illustrates the hierarchy of the Landing/Deceleration Subsystem hardware and the corresponding subcomponents. Figures 2 through 7 comprise the detailed subsystem representations.
Figure 2 - NOSE LANDING GEAR - STOWED POSITION
Figure 3 - NOSE LANDING GEAR - EXTENDED POSITION
Figure 4 - MAIN LANDING GEAR - STOWED POSITION
Figure 5 - MAIN LANDING GEAR - EXTENDED POSITION
Figure 6 - BRAKE/SKID CONTROL SYSTEM OVERVIEW
Figure 7 - LANDING GEAR CONTROL SYSTEM OVERVIEW
4.0 ANALYSIS RESULTS

Detail analysis results for each of the identified failure modes are presented in Appendix C. Table I presents a summary of the failure criticalities. Further discussion of each of these subdivisions and the applicable failure modes is provided in subsequent paragraphs.

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</table>

Of the 256 failure modes analyzed, 63 resulted in the immediate loss of the crew or the vehicle, and 90 resulted in the loss of the crew or the vehicle with the failure of redundant operations. There were no failures that were identified that would result in the direct loss of the mission without the loss of the crew or the vehicle. A summary of the potential critical items (PCIs) is presented in Table II. Appendix D presents a cross reference between each PCI and a specific worksheet in Appendix C.

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4.1 Analysis Results NLG.

The NLG consists of the NLG Shock Strut Assembly, the NLG Doors and Uplock Mechanisms, and the NLG Wheels and Tires. Assessment of the wheels and tires were limited due to the nonavailability of data on these parts. Twenty-eight PCIs were identified, these items are listed in Appendix D.
4.2 Analysis Results MLG.

The MLG consists of the MLG Shock Strut Assembly, the MLG Doors and Uplock Mechanisms, and the MLG Wheels and Tires. Assessment of the wheels and tires were limited due to the nonavailability of data on these parts. Twenty-five PCIs were identified. These items are listed in Appendix D.

4.3 Analysis Results B&AS.

The B&AS consists of the Rudder/Brake Pedal Assembly, the Brakes, the Brake Control System, and the Antiskid Control System. Only seven PCI items were identified due primarily to the nonavailability of data on the hardware that was being assessed. The PCIs are listed in Appendix D.

4.4 Analysis Results EPD&C.

EPD&C provides power to the Landing Gear Control subsystem, Brake and Antiskid subsystem, and to sensing and monitoring functions within the Landing/Deceleration subsystem. Thirty-eight PCIs were identified and are listed in Appendix D.

4.5 Analysis Results NWS.

The analysis for the Landing and Deceleration, NWS, was performed by a separate working group that was established to align with the NASA alignment. Their report is separate and will not be incorporated with this report. The reason for the mention of their report is that the NSTS 82-0013 document included the FMEA reports for the NWS. The mechanical hardware required by the NWS is included in the NLG portion of this report.

4.6 Analysis Results HYD.

The hydraulics subsystem is the primary system supporting the six hydraulic actuators responsible for deploying the landing gear and for providing pressure to operate the orbiters brakes. Twenty-six PCIs were identified; all are listed in Appendix D.
5.0 REFERENCES

Reference documentation available from NASA and Rockwell was used in the analysis. The documentation used included the following:


7. NSTS-22206 Instructions For Preparation Of Failure Modes And Effects Analysis (FMEA) And Critical Items List (CIL), 10 October 1986.


20. VO70-510201 Mechanical Installation - Main Landing Gear. Revision D-10, 8 July 1986.


23. VO70-510301 Uplock Assembly - Main Landing Gear. Revision C-10, 30 November 1984.

24. VO70-510302 Fitting, Uplock, Assembly of, Main Landing Gear. Revision C-06, 20 September 1985.

25. VO70-510346 Hook, Center Door - Assembly of, Main Landing Gear. Revision B, 1 August 1978.


27. VO70-510476 Fitting, Inboard Trunion, Assembly of, Main Landing gear. Revision ?, 26 April 1986.


29. VO70-510502 Chassis Assembly - Nose Landing Gear. Revision E-09, 29 July 1986.

30. VO70-510550 Uplock Assembly - Nose Landing Gear. Revision B-10, 7 November 1985.


32. VO70-510711 Lock Assembly - Aft Door, Nose Landing Gear. Revision A-03, 9 February 1978.
33. VO70-510751 Bungee Assembly - Thruster, Nose Landing Gear. Revision B-05, 12 February 1982.

34. VO70-552001 Cartridge Installation - Nose Landing Gear Thrusters.


40. 1170100 MENASCO - Shock Strut Assembly - Main Landing Gear - Orbiter. Revision 2-H, Date Unreadable.

41. 1170101 MENASCO - Cylinder Assembly, Shock Strut - Main Landing Gear - Orbiter. Revision D, Date Unreadable.

42. 1170114 MENASCO - Pin Meetering, Shock Strut - Main Landing Gear - Orbiter. Revision C, Date Unreadable.


44. 1170300 MENASCO - Drag Brace Assembly - Main Landing Gear - Orbiter. Revision D, Date Unreadable.

45. 1170301 MENASCO - Drag Brace Assembly - Lower - Main Landing Gear - Orbiter. Revision A, Date Unreadable.


47. 1170493 MENASCO - Layout - Shock Strut - Main Landing Gear - Orbiter. Revision F, Date Unreadable.


<p>| AOA       | - Abort-Once-Around                      |
| ATO       | - Abort-To-Orbit                        |
| B&amp;AS      | - Brakes and Antiskid                   |
| BFC       | - Backup Flight Control                 |
| BFS       | - Backup Flight System                  |
| BITE      | - Built-In Test Equipment               |
| C&amp;W       | - Caution and Warning                   |
| CIL       | - Critical Items List                   |
| CPU       | - Central Processing Unit               |
| CRT       | - Cathode-Ray Tube                      |
| D/A       | - Digital to Analog                     |
| DPS       | - Data Processing System (Subsystem)     |
| EPDC      | - Electrical Power Distribution and Control |
| EVA       | - Extravehicular Activity               |
| FMEA      | - Failure Modes and Effects Analysis    |
| GFE       | - Government Furnished Equipment        |
| GPC       | - General Purpose Computer              |
| GSE       | - Ground Support Equipment              |
| HDC       | - Hybrid Driver Controller              |
| HYD       | - Hydraulics                            |
| IOA       | - Independent Orbiter Assessment        |
| LCA       | - Load Controller Assembly              |
| LNDG/DECEL| - Landing and Deceleration              |
| LVDT      | - Linear Variable Differential Transformer |
| MDAC      | - McDonnell Douglas Astronautics Company |
| MGSSA     | - Main Gear Shock Strut Assembly        |
| MLG       | - Main Landing Gear                     |
| NA        | - Not Applicable                        |
| NASA      | - National Aeronautics and Space Administration |
| NGSSA     | - Nose Landing Gear Shock Strut Assembly |
| NLG       | - Nose Landing Gear                     |
| NSTS      | - National Space Transportation System  |
| NWS       | - Nose-Wheel Steering                   |
| OMRSD     | - Operational Maintenance Requirements and Specifications Document |
| OPS       | - Operations Sequence                   |
| PCA       | - Power Control Assembly                |
| PCI       | - Potential Critical Item               |
| PIC       | - Pyro Initiator Controller             |
| R/BPA     | - Rudder/Pedal Brake Assembly           |
| REG       | - Regulate, Regulator                   |
| RI        | - Rockwell International                |
| RPTA      | - Rudder Pedal Transducer Assembly      |
| RTLS      | - Return-to-Landing Site                |
| SFTWE     | - Software                              |
| STS       | - Space Transportation System           |
| TAL       | - Transatlantic Abort Landing           |
| TD        | - Touch Down                            |
| THC       | - Thruster Hand Controller              |</p>
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APPENDIX B

DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.1 Definitions
B.2 Project Level Ground Rules and Assumptions
B.3 Subsystem-Specific Ground Rules and Assumptions
APPENDIX B
DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.1 Definitions

Definitions contained in NSTS 22206, Instructions For Preparation of FMEA/CIL, 10 October 1986, were used with the following amplifications and additions.

INTACT ABORT DEFINITIONS:

RTLS - begins at transition to OPS 6 and ends at transition to OPS 9, post-flight

TAL - begins at declaration of the abort and ends at transition to OPS 9, post-flight

AOA - begins at declaration of the abort and ends at transition to OPS 9, post-flight

ATO - begins at declaration of the abort and ends at transition to OPS 9, post-flight

CREDIBLE (CAUSE) - an event that can be predicted or expected in anticipated operational environmental conditions. Excludes an event where multiple failures must first occur to result in environmental extremes

CONTINGENCY CREW PROCEDURES - procedures that are utilized beyond the standard malfunction procedures, pocket checklists, and cue cards

EARLY MISSION TERMINATION - termination of onorbit phase prior to planned end of mission

EFFECTS/RATIONALE - description of the case which generated the highest criticality

HIGHEST CRITICALITY - the highest functional criticality determined in the phase-by-phase analysis

MAJOR MODE (MM) - major sub-mode of software operational sequence (OPS)

MC - Memory Configuration of Primary Avionics Software System (PASS)

MISSION - assigned performance of a specific Orbiter flight with payload/objective accomplishments including orbit phasing and altitude (excludes secondary payloads such as GAS cans, middeck P/L, etc.)
MULTIPLE ORDER FAILURE - describes the failure due to a single cause or event of all units which perform a necessary (critical) function

OFF-NOMINAL CREW PROCEDURES - procedures that are utilized beyond the standard malfunction procedures, pocket checklists, and cue cards

OPS - software operational sequence

PRIMARY MISSION OBJECTIVES - worst case primary mission objectives are equal to mission objectives

PHASE DEFINITIONS:

PRELAUNCH PHASE - begins at launch count-down Orbiter power-up and ends at moding to OPS Major Mode 102 (liftoff)

LIFTOFF MISSION PHASE - begins at SRB ignition (MM 102) and ends at transition out of OPS 1 (Synonymous with ASCENT)

ONORBIT PHASE - begins at transition to OPS 2 or OPS 8 and ends at transition out of OPS 2 or OPS 8

DEORBIT PHASE - begins at transition to OPS Major Mode 301 and ends at first main landing gear touchdown

LANDING/SAFING PHASE - begins at first main gear touchdown and ends with the completion of post-landing safing operations
APPENDIX B
DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.2 IOA Project Level Ground Rules and Assumptions

The philosophy embodied in NSTS 22206, Instructions for Preparation of FMEA/CIL, 10 October 1986, was employed with the following amplifications and additions.

1. The operational flight software is an accurate implementation of the Flight System Software Requirements (FSSRs).
   RATIONALE: Software verification is out-of-scope of this task.

2. After liftoff, any parameter which is monitored by system management (SM) or which drives any part of the Caution and Warning System (C&W) will support passage of Redundancy Screen B for its corresponding hardware item.
   RATIONALE: Analysis of on-board parameter availability and/or the actual monitoring by the crew is beyond the scope of this task.

3. Any data employed with flight software is assumed to be functional for the specific vehicle and specific mission being flown.
   RATIONALE: Mission data verification is out-of-scope of this task.

4. All hardware (including firmware) is manufactured and assembled to the design specifications/drawings.
   RATIONALE: Acceptance and verification testing is designed to detect and identify problems before the item is approved for use.

5. All Flight Data File crew procedures will be assumed performed as written, and will not include human error in their performance.
   RATIONALE: Failures caused by human operational error are out-of-scope of this task.
6. All hardware analyses will, as a minimum, be performed at the level of analysis existent within NASA/Prime Contractor Orbiter FMEA/CILs, and will be permitted to go to greater hardware detail levels but not lesser.

RATIONALE: Comparison of IOA analysis results with other analyses requires that both analyses be performed to a comparable level of detail.

7. Verification that a telemetry parameter is actually monitored during AOS by ground-based personnel is not required.

RATIONALE: Analysis of mission-dependent telemetry availability and/or the actual monitoring of applicable data by ground-based personnel is beyond the scope of this task.

8. The determination of criticalities per phase is based on the worst case effect of a failure for the phase being analyzed. The failure can occur in the phase being analyzed or in any previous phase, whichever produces the worst case effects for the phase of interest.

RATIONALE: Assigning phase criticalities ensures a thorough and complete analysis.

9. Analysis of wire harnesses, cables, and electrical connectors to determine if FMEAs are warranted will not be performed nor FMEAs assessed.

RATIONALE: Analysis was substantially complete prior to NSTS 22206 ground rule redirection.

10. Analysis of welds or brazed joints that cannot be inspected will not be performed nor FMEAs assessed.

RATIONALE: Analysis was substantially complete prior to NSTS 22206 ground rule redirection.

11. Emergency system or hardware will include burst discs and will exclude the EMU Secondary Oxygen Pack (SOP), pressure relief valves and the landing gear pyrotechnics.

RATIONALE: Clarify definition of emergency systems to ensure consistency throughout IOA project.
B.3 Landing/Deceleration - Specific Ground Rules and Assumptions

The IOA analysis was performed to the assembly or component level in the Landing/Deceleration Subsystem. The analysis considered the worst case effects of the hardware and the functional failures of the subsystem and their impacts on the mission and crew and vehicle safety.

1. Pyrotechnic devices were not considered as emergency devices that were to be used in contingency operations.

RATIONALE: The NLG Extension Booster Pyro Actuator functions every time that the NLG is operated to insure that the system is able to overcome any wind forces that are acting on the landing gear doors.

RATIONALE: The Backup Pyro Uplock Release Actuator is a backup or redundant actuator that operates one second after the deploy command is issued if it does not receive a signal that the Uplock Release Hook has functioned properly.

2. The Landing/Deceleration Subsystem considers that all ABORT MODES will be terminated post landing at the time of vehicle egress.

RATIONALE: Under the IOA specific rules an abort would fall under two definitions, deorbit and landing, the intent of this subsystem rule is to simplify the abort analysis.

3. Component age life will not be considered in the analysis.

RATIONALE: Component age analysis is beyond the scope of this task.
APPENDIX C
DETAILED ANALYSIS

This section contains the IOA analysis worksheets generated during the analysis of this subsystem. The information on these worksheets is intentionally similar to the NASA FMEAs. Each of these sheets identifies the hardware item being analyzed, and the parent assembly, as well as the function. For each failure mode, the possible causes are outlined, and the assessed hardware and functional criticality for each mission phase is listed, as described in the NSTS 22206, Instructions for Preparation of FMEA and CIL, 10 October 1986. Finally, effects are entered at the bottom of each sheet, and the worst case criticality is entered at the top.

LEGEND FOR IOA ANALYSIS WORKSHEETS
----------------------------------------

Hardware Criticalities:
1 = Loss of life or vehicle
2 = Loss of mission or next failure of any redundant item (like or unlike) could cause loss of life/vehicle
3 = All others

Functional Criticalities:
1R = Redundant hardware items (like or unlike) all of which, if failed, could cause loss of life or vehicle.
2R = Redundant hardware items (like or unlike) all of which, if failed, could cause loss of mission.

Redundancy Screen A:
1 = Is Checked Out PreFlight
2 = Is Capable of Check Out PreFlight
3 = Not Capable of Check Out PreFlight
NA = Not Applicable

Redundancy Screens B and C:
P = Passed Screen
F = Failed Screen
NA = Not Applicable
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS FLIGHT: 1/1
MDAC ID: 10101 ABORT: 1/1

ITEM: TIRES, NLG TYPE II
FAILURE MODE: RUPTURE

LEAD ANALYST: W. WEISSINGER
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR - TIRES
  2) TIRES
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  5)
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LOCATION: NOSE LANDING GEAR
PART NUMBER: 006-836 B. F. GOODRICH, MC194-0007-0002

CAUSES: OVERLOAD, CUTS, CONSTRUCTION FLAWS

EFFECTS/RATIONALE:
A RUPTURE OF A NOSE LANDING GEAR TIRE ON TOUCHDOWN WOULD PLACE TORQUE ON THE NOSE LANDING GEAR STRUT WHICH WOULD CAUSE THE AXLE TO ROTATE. THE SIDE LOADING ON THE SINGLE TIRE THAT REMAINS PLUS THE WEIGHT OF THE NOSE ON THE SINGLE TIRE WOULD CAUSE THE SECOND TIRE TO FAIL. OTHER COMPLICATIONS THAT COULD OCCUR INCLUDE FRACTURING THE AXLE, BREAKING THE STEERING COLLAR, SHEARING THE NOSE WHEEL STEERING ATTACH POINTS, AND OVERLOADING THE TORQUE ARM.

REFERENCES: MC194-0007 - THE ONLY DOCUMENT AVAILABLE FOR THE EVALUATION IS THE PROCUREMENT SPECIFICATION.

REPORT DATE 02/13/87 C-2
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 10201
HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 1/1
ABORT: 1/1

ITEM: NOSE LANDING GEAR TRUNION
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) SHOCK STRUT ATTACHING TRUNIONS
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5) 
6) 
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LOCATION: NOSE LANDING GEAR
PART NUMBER: 1170623 MENASCO, V070-782214 (001/002)

CAUSES: MECHANICAL SHOCK, OVERLOAD, MISHANDLING OR ABUSE, PIECE PART STRUCTURAL FAILURE - CORROSION - CRACKING

EFFECTS/RATIONALE:
THE STRUCTURAL FAILURE OF ONE OR BOTH OF THE SHOCK STRUT TRUNIONS WOULD RESULT IN A COLLAPSE OF THE NOSE LANDING GEAR. A FAILURE AT TOUCHDOWN COULD RESULT IN THE LOSS OF THE CREW AND THE VEHICLE.

REFERENCES: MC621-0012, V070-510501, V070-510502

REPORT DATE 02/13/87 C-3
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 10202

HIGHEST CRITICALITY
HDW/FUNC
FLIGHT: 1/1
ABORT: 1/1

ITEM: DRAG BRACE
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) DRAG BRACE ASSEMBLY
4) LOWER DRAG BRACE STRUT
5)
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LOCATION: NOSE LANDING GEAR
PART NUMBER: 1170801-1 MENASCO (LOWER DRAG BRACE), MC621-0012-0003

CAUSES: PIECE-PART STRUCTURAL FAILURE - CRACKING - MECHANICAL SHOCK, MISHANDLING OR ABUSE, OVERLOAD.

EFFECTS/RATIONALE:
A LOWER DRAG BRACE FAILURE WOULD CAUSE AN IMMEDIATE COLLAPSE OF THE NOSE LANDING GEAR THAT WOULD ALLOW THE NOSE OF THE ORBITER TO IMPACT THE RUNWAY SURFACE. A FAILURE OF THIS NATURE WOULD RESULT IN THE LOSS OF THE CREW AND THE VEHICLE.

REFERENCES: MC621-0012, VO70-510501, VO70-510502

REPORT DATE 02/13/87   C-4
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 10203  ABORT: 1/1

ITEM: DRAG BRACE TRUNION
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) DRAG BRACE ASSEMBLY
4) DRAG BRACE TRUNION (AT LOCK BRACE)
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LOCATION: NOSE LANDING GEAR
PART NUMBER: 1170804 MENASCO (AT LOCK BRACE)

CAUSES: PIECE-PART STRUCTURAL FAILURE - CRACKING - MECHANICAL SHOCK, MISHANDLING OR ABUSE, OVERLOAD.

EFFECTS/RATIONALE:
A LOSS OF THIS TRUNION AT TOUCHDOWN WOULD CAUSE A COLLAPSE OF THE NOSE LANDING GEAR. THE LOSS OF THE CREW AND THE VEHICLE WOULD BE A PROBABLE RESULT OF A FAILURE OF THIS NATURE.

REFERENCES: MC621-0012, VO70-510501, VO70-510502

REPORT DATE 02/13/87  C-5
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 10204
FLIGHT: 1/1
ABORT: 1/1

ITEM: LOCK BRACE ASSEMBLY
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) LOCK BRACE ASSEMBLY
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LOCATION: NOSE LANDING GEAR
PART NUMBER: 1170850-503 MENASCO, MC621-0012-0006

CAUSES: PIECE-PART STRUCTURAL FAILURE, MISHANDLING OR ABUSE.

EFFECTS/RATIONALE:
A STRUCTURAL FAILURE OF THE LOCK BRACE ASSEMBLY WOULD ALLOW THE NOSE LANDING GEAR TO COLLAPSE AT TOUCHDOWN. A FAILURE OF THIS NATURE WOULD CAUSE A LOSS OF THE CREW AND THE VEHICLE.

REFERENCES: MC621-0012, VO70-510501, VO70-510502

REPORT DATE 02/13/87 C-6
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS FLIGHT: 1/1
MDAC ID: 10205  ABORT: 1/1

ITEM: DOWNLOCK BUNGEE
FAILURE MODE: PHYSICAL BINDING / JAMMING

LEAD ANALYST: W. WEISSINGER  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) LOCK BRACE ASSEMBLY
4) DOWN LOCK BUNGEE

CRITICALITIES

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LOCATION: NOSE LANDING GEAR
PART NUMBER: 1170683-101 MENASCO

CAUSES: PIECE-PART STRUCTURAL FAILURE, MISHANDLING OR ABUSE.

EFFECTS/RATIONALE:

REFERENCES: MC621-0012, VO70-510501, VO70-510502

REPORT DATE 02/13/87  C-7
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 10206

ITEM: DOWNLOCK BUNGEE
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) LOCK BRACE ASSEMBLY
4) DOWN LOCK BUNGEE

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LOCATION: NOSE LANDING GEAR
PART NUMBER: 1170683-101 MENASCO

CAUSES: PIECE-PART STRUCTURAL FAILURE, MISHANDLING OR ABUSE.

EFFECTS/RATIONALE:

REFERENCES: MC621-0012, VO70-510501, VO70-510502

REPORT DATE 02/13/87 C-8
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 10207

ITEM: NLG - DOWN AND LOCK SENSOR
FAILUERE MODE: SHORTED - OPEN / CLOSED

LEAD ANALYST: W. WEISSINGER
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) TORQUE TUBE ASSEMBLY
4) NOSE LANDING GEAR - DOWN AND LOCK SENSOR
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LOCATION: NOSE LANDING GEAR
PART NUMBER: V070-510340

CAUSES: CORROSION, VIBRATION, LOOSE CONNECTION, WORN OR DAMMAGED WIRES

EFFECTS/RATIONALE:
THE SIGNAL IS NOT ACTIVATED UNTIL THE ARM ON THE TORQUE TUBE ASSEMBLY CONTACTS THE ELECTRICAL SENSOR. THE SENSOR SENDS THE SIGNAL OF GEAR DOWN AND LOCKED TO THE NOSE LANDING GEAR INDICATOR. IF THE NOSE LANDING GEAR HAS NOT BEEN DEPLOYED AND THE SENSOR IS SHORTED OPEN THE SIGNAL IN THE COCKPIT WILL SHOW BARBERPOLE, IF THE SENSOR IS SHORTED CLOSED AN ERRONEOUS DOWN AND LOCKED SIGNAL WILL BE SENT.

REFERENCES: MC621-0012, V070-510501, V070-510502

REPORT DATE 02/13/87 C-9
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86

SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 10208

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: NLG - DOWN AND LOCK SENSOR
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) TORQUE TUBE ASSEMBLY
4) NOSE LANDING GEAR - DOWN AND LOCK SENSOR
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LOCATION: NOSE LANDING GEAR
PART NUMBER: VO70-510340

CAUSES: MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK.

EFFECTS/RATIONALE:
THE SIGNAL IS NOT ACTIVATED UNTIL THE ARM ON THE TORQUE TUBE ASSEMBLY CONTACTS THE ELECTRICAL SENSOR. IF THE ARM IS BROKEN OR DAMAGED NO CONTACT WILL BE MADE AND THERE WILL BE A LOSS OF INPUT.

REFERENCES: MC621-0012, VO70-510501, VO70-510502
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/1R
MDAC ID: 10209  ABORT: 3/1R

ITEM: STEERING COLLAR ASSEMBLY
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) NOSE WHEEL STEERING ASSEMBLY
4) STEERING COLLAR ASSEMBLY
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LOCATION: NOSE LANDING GEAR
PART NUMBER: 1170604-101 MENASCO, MC621-0012

CAUSES: MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK.

EFFECTS/RATIONALE:
THE IMMEDIATE LOSSES WILL BE THE LOSS OF NOSE WHEEL STEERING AND THE LOSS OF NOSE WHEEL DAMPING.

REFERENCES: MC621-0012, VO70-510501, VO70-510502

REPORT DATE 02/13/87  C-11
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 10210  ABORT: 1/1

ITEM: STEERING DISCONNECT LOCK
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) NOSE WHEEL STEERING ASSEMBLY
4) TORQUE ARM ASSEMBLY
5) STEERING DISCONNECT LOCK
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LOCATION: NOSE LANDING GEAR
PART NUMBER: 1170622-101 MENASCO, 1170640-101 MENASCO

CAUSES: MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, VIBRATION.

EFFECTS/RATIONALE:

REFERENCES: MC621-0012, V070-510502

REPORT DATE 02/13/87  C-12
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 10211

ITEM: TORQUE ARM ASSEMBLY
FAILURE MODE: STRUCTURAL FAILURE
LEAD ANALYST: W. WEISSINGER
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) NOSE WHEEL STEERING ASSEMBLY
4) TORQUE ARM ASSEMBLY

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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC621-0012, 1170605 MENASCO, 1170629 MENASCO

CAUSES: MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK.

EFFECTS/RATIONALE:
A STRUCTURAL FAILURE OF THE TORQUE ARM ASSEMBLY AT THE NOSE LANDING GEAR SLAPDOWN COULD CAUSE A NOSE WHEEL ROTATION BEYOND THE SAFE RANGE RESULTING IN A NOSE LANDING GEAR COLLAPSE.
PROBABLE LOSS OF CREW AND VEHICLE.
RATIONALE: THE NOSE WHEEL IS DESIGNED TO BE ABLE TO ROTATE 360 DEGREES IF IT IS NOT RESTRICTED BY THE TORQUE ARM ASSEMBLY.

REFERENCES: MC621-0012, VO70-510502

REPORT DATE 02/13/87  C-13
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 10212  ABORT: 1/1

ITEM: NOSE WHEEL RETAINING BOLT
FAILURE MODE: CORROSION, STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) AXLE ASSEMBLY
4) NOSE WHEEL RETAINING BOLT
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LOCATION: NOSE LANDING GEAR
PART NUMBER: NAS1004-6, MC621-0012

CAUSES: MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK.

EFFECTS/RATIONALE:
A FAILURE OF THE BOLT COULD CAUSE SEPARATION OF ONE OF THE NOSE WHEELS AT OR SHORTLY AFTER TOUCHDOWN, CAUSING PROBABLE LOSS OF THE VEHICLE AND THE CREW.

REFERENCES: MC621-0012, VO70-510502

REPORT DATE 02/13/87  C-14
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 10213

ITEM: AXLE
FAILURE MODE: CORROSION, STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) AXLE ASSEMBLY
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LOCATION: NOSE LANDING GEAR
PART NUMBER: 1170631-1 MENASCO, MC621-0012-0001

CAUSES: MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK.

EFFECTS/RATIONALE:
A HARD NOSE WHEEL SLAPDOWN COULD CAUSE THE STRUCTURAL FAILURE OF THE AXLE

REFERENCES: MC621-0012, VO70-510502
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/3
MDAC ID: 10214  ABORT: 3/3

ITEM: WEIGHT ON WHEELS SENSORS - NLG
FAILURE MODE: ERONEOUS OUTPUT

LEAD ANALYST: W. WEISSINGER  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) WEIGHT ON WHEELS SENSOR
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LOCATION: NOSE LANDING GEAR
PART NUMBER: VO70-510340

CAUSES: MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK.

EFFECTS/RATIONALE:
SIGNAL APPEARS EARLY OR INTERMITTENTLY GIVING SIGNALS TO THE NOSE WHEEL STEERING THAT COULD CANCEL THE STEERING CAPABILITY

REFERENCES: MC621-0012, VO70-510502

REPORT DATE 02/13/87  C-16
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 10215  ABORT: 1/1

ITEM: SHOCK STRUT
FAILURE MODE: INTERNAL / EXTERNAL LEAKAGE (HYDRAULIC FLUID)

LEAD ANALYST: W. WEISSINGER  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) SHOCK STRUT
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LOCATION: NOSE LANDING GEAR
PART NUMBER: 1170600-507 MENASCO, MC621-0012-0008

CAUSES: SEAL FAILURE, MISHANDLING OR ABUSE

EFFECTS/RATIONALE:
COLLAPSE OF SHOCK STRUT DURING LANDING CAUSING MECHANICAL SHOCK TO SHOCK STRUT UPPER STRUCTURE AND TRUNIONS RESULTING IN NOSE LANDING GEAR COLLAPSE AT LANDING. A LOSS OF THE CREW AND THE VEHICLE WOULD BE PROBABLE.

REFERENCES: MC621-0012, VO70-510502

REPORT DATE 02/13/87  C-17
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 10216

HIGHEST CRITICALITY HDW/FUNC FLIGHT: 3/1R
ABORT: 3/1R

ITEM: SHOCK STRUT
FAILURE MODE: INTERNAL / EXTERNAL LEAKAGE (NITROGEN)

LEAD ANALYST: W. WEISSINGER
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) SHOCK STRUT
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LOCATION: NOSE LANDING GEAR
PART NUMBER: 1170600-507 MENASCO, MC621-0012-0008

CAUSES: SEAL FAILURE, MISHANDLING OR ABUSE

EFFECTS/RATIONALE:
PARTIAL LOSS OF EFFECTIVENESS. THE LOSS OF NITROGEN PRESSURE IN
THE SHOCK STRUT ASSEMBLY WOULD NOT PREVENT THE FUNCTIONING OF THE
HYDRAULIC PORTION OF THE SHOCK STRUT. THE SHOCK DESIGN
SPECIFICATION REQUIRES A SAFETY FACTOR THAT WILL ALLOW A LANDING
WITH ONE ATMOSPHERE OF NITROGEN PRESSURE IN THE SHOCK STRUT.

REFERENCES: MC621-0012, V070-510502

REPORT DATE 02/13/87 C-18
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 10217

ITEM: UPLOCK ROLLER RETAINING ASSEMBLY
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) UPLOCK ROLLER RETAINING ASSEMBLY

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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC621-0012, VO70-510550, 1170666 MENERASCO

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION

EFFECTS/RATIONALE:
THE NOSE LANDING GEAR WOULD NOT LOCK IN POSITION AND THE SHOCK STRUT ASSEMBLY AND ITS ATTACHMENTS WOULD BE LOOSE IN THE NOSE WHEEL AREA. THE WEIGHT OF THE NOSE LANDING GEAR AGAINST THE DOOR COULD CAUSE AN INADVERTANT LANDING GEAR DEPLOY DURING LAUNCH OR DURING DEORBIT

REFERENCES: VO70-510550

REPORT DATE 02/13/87 C-19
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 10217

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 1/1
ABORT: 1/1

ITEM: UPLOCK ROLLER RETAINING ASSEMBLY
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) UPLOCK ROLLER RETAINING ASSEMBLY

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LOCATION: NOSE LANDING GEAR
PART NUMBER: M621-0012, VO70-510550, 1170666 MENASCO

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION

EFFECTS/RATIONALE:
THE NOSE LANDING GEAR WOULD NOT LOCK IN POSITION AND THE SHOCK STRUT ASSEMBLY AND ITS ATTACHMENTS WOULD BE LOOSE IN THE NOSE WHEEL AREA. THE WEIGHT OF THE NOSE LANDING GEAR AGAINST THE DOOR COULD CAUSE AN INADVERTANT LANDING GEAR DEPLOY DURING LAUNCH OR DURING DEORBIT

REFERENCES: VO70-510550
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86

SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 10218

ITEM: WEIGHT ON WHEELS SENSORS - NLG
FAILURE MODE: SHORTED CLOSED

LEAD ANALYST: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) WEIGHT ON WHEELS SENSOR
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LOCATION: NOSE LANDING GEAR
PART NUMBER: V070-510340

CAUSES: MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK.

EFFECTS/RATIONALE:
THERE WOULD BE NO SIGNAL CHANGE AFTER NLG SLAPDOWN. THE SIGNAL IS ONE OF THREE THAT IS REQUIRED TO ACTIVATE THE NOSE WHEEL STEERING. NWS CAPABILITIES COULD BE LOST.

REFERENCES: MC621-0012, V070-510502

REPORT DATE 02/13/87
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 10219

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: WEIGHT ON WHEELS SENSORS - NLG
FAILURE MODE: SHORTED OPEN

LEAD ANALYST: W. WEISSINGER
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) WEIGHT ON WHEELS SENSOR
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LOCATION: NOSE LANDING GEAR
PART NUMBER: VO70-510340

CAUSES: MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK.

EFFECTS/RATIONALE:
THERE WOULD BE A CONSTANT ERRONEOUS SIGNAL TO THE NWS WHICH COULD CAUSE THE LOSS OF THE NWS CAPABILITY.

REFERENCES: MC621-0012, VO70-510502

REPORT DATE 02/13/87 C-22
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 10220  ABORT: 1/1

ITEM: TORQUE TUBE ASSEMBLY
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) TORQUE TUBE ASSEMBLY
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LOCATION: NOSE LANDING GEAR
PART NUMBER: 1170583-101 MENASCO, MC621-0012

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION

EFFECTS/RATIONALE:
The loss of the torque tube assembly would cause possible problems with the deploy of the nose landing gear. If broken, problems will be encountered with the hydraulic extension of the NLG and the NLG lockdown. If the assembly separates the NLG will collapse at NLG slapdown causing a probable loss of the crew and the vehicle.

REFERENCES: MC621-0012, VO70-510502

REPORT DATE 02/13/87  C-23
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 10221

HIGHEST CRITICALITY
HDW/FUNC
FLIGHT: 1/1
ABORT: 1/1

ITEM: DRAG BRACE
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) DRAG BRACE ASSEMBLY
4) UPPER DRAG BRACE STRUT (YOKE ASSEMBLY)
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LOCATION: NOSE LANDING GEAR
PART NUMBER: 1170802-1 MENASCO, MC621-0012-0003

CAUSES: PIECE-PART STRUCTURAL FAILURE - CRACKING - MECHANICAL SHOCK, MISHANDLING OR ABUSE, OVERLOAD.

EFFECTS/RATIONALE:

REFERENCES: MC621-0012, VO70-510502

REPORT DATE 02/13/87 C-24
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 10222  ABORT: 1/1

ITEM: DRAG BRACE TRUNION
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) DRAG BRACE ASSEMBLY
4) DRAG BRACE TRUNION (AT SHOCK STRUT)
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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC621-0012-0003, 1170632-1 MENASCO, 1170358-1 MENASCO (2EA)

CAUSES: PIECE-PART STRUCTURAL FAILURE - CRACKING - MECHANICAL SHOCK, MISHANDLING OR ABUSE, OVERLOAD.

EFFECTS/RATIONALE:
A LOSS OF THIS TRUNION AT TOUCHDOWN WOULD CAUSE A COLLAPSE OF THE NOSE LANDING GEAR. THE LOSS OF THE CREW AND THE VEHICLE WOULD BE A PROBABLE RESULT OF A FAILURE OF THIS NATURE.

REFERENCES: MC621-0012, V070-510502

REPORT DATE 02/13/87  C-25
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 10223  ABORT: 1/1

ITEM: DRAG BRACE TRUNION
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) DRAG BRACE ASSEMBLY
4) DRAG BRACE TRUNION (AT VEHICLE ATTACH POINT)
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LOCATION: NOSE LANDING GEAR
PART NUMBER: 1170806 MENASCO (AT VEHICLE ATTACH POINT), MC621-0012-0003

CAUSES: PIECE-PART STRUCTURAL FAILURE - CRACKING - MECHANICAL SHOCK, MISHANDLING OR ABUSE, OVERLOAD.

EFFECTS/RATIONALE:

REFERENCES: MC621-0012, VO70-510502

REPORT DATE 02/13/87  C-26
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86          HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS     FLIGHT: 1/1
MDAC ID:   10224          ABORT: 1/1

ITEM: SUPPORT BEAM
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER      SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) DRAG BRACE ASSEMBLY
4) SUPPORT BEAM

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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC621-0012-0003, 1170803-1 MENASCO

CAUSES: OVERLOAD, CORROSION / CRACKING, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, MISHANDLING OR ABUSE

EFFECTS/RATIONALE:
A STRUCTURAL FAILURE OF THE SUPPORT BEAM WOULD CAUSE TORSION ON THE DRAG BRACE ASSEMBLY THAT COULD CAUSE THE UPPER DRAG BRACE TRUNIONS TO FRACTURE DUE TO TORSION. A FAILURE OF THIS NATURE WOULD RESULT IN THE LOSS OF THE VEHICLE AND THE CREW.

REFERENCES: MC621-0012

REPORT DATE 02/13/87  C-27
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 10401

HIGHEST CRITICALITY
HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: NLG EXTEND / RETRACT HYD STRUT ACT
FAILURE MODE: BROKEN ROD / LINKAGE

LEAD ANALYST: J. COMPTON     SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR COMPARTMENT
2) NOSE LANDING GEAR
3) NOSE LANDING GEAR EXTEND / RETRACT HYDRAULIC STRUT ACTUATOR

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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: STRESS / FRACTURE, MISHANDLING OR ABUSE

EFFECTS/RATIONALE:
THE LANDING GEAR WILL NOT EXTEND OR RETRACT HYDRAULICALLY.
GRAVITY AND AIRFLOW WILL EXTEND THE LANDING GEAR.

REFERENCES: VO70-573001

REPORT DATE 02/13/87    C-28
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 2/1R
MDAC ID: 10402  ABORT: 2/1R

ITEM: NLG EXTEND / RETRACT HYD STRUT ACT
FAILURE MODE: LEAK, EXTERNAL

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR COMPARTMENT
2) NOSE LANDING GEAR
3) NOSE LANDING GEAR EXTEND / RETRACT HYDRAULIC STRUT ACTUATOR

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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: O-RING SEALS, VIBRATION, LOOSE BOLTS

EFFECTS/RATIONALE:
POSSIBLE LOSS OF HYDRAULICS SYSTEM 1 AND THE LANDING GEAR WILL NOT EXTEND OR RETRACT HYDRAULICALLY. THE LANDING GEAR WILL EXTEND BY GRAVITY AND AIRFLOW WITH THE ASSIST OF THE NOSE LANDING GEAR EXTENSION BOOSTER PYRO ACTUATOR.

REFERENCES: VO70-573001

REPORT DATE 02/13/87  C-29
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/3
MDAC ID: 10403  ABORT: 3/3

ITEM: NLG EXTEND / RETRACT HYD STRUT ACTUATOR
FAILURE MODE: LEAK, INTERNAL PISTON

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR COMPARTMENT
2) NOSE LANDING GEAR
3) NOSE LANDING GEAR EXTEND / RETRACT HYDRAULIC STRUT ACTUATOR
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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: SEAL DAMAGE, MISHANDLING OR ABUSE

EFFECTS/RATIONALE:
THE HYDRAULIC PUMP WILL COMPENSATE FOR THE LOSS OF FLUID.

REFERENCES: VO70-573001

REPORT DATE 02/13/87  C-30
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 10404

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 1/1
ABORT: 1/1

ITEM: NLG EXTEND / RETRACT HYD STRUT ACTUATOR
FAILURE MODE: RUPTURE

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR COMPARTMENT
2) NOSE LANDING GEAR
3) NOSE LANDING GEAR EXTEND / RETRACT HYDRAULIC STRUT ACTUATOR
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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: MATERIAL DEFECT, MISHANDLING OR ABUSE

EFFECTS/RATIONALE:
LOSS OF HYDRAULIC SYSTEM 1. GEAR MAY BE SLOW TO DEPLOY IF THE ACTUATOR JAMS UP OR IT MAY NOT DEPLOY AT ALL.

REFERENCES: VO70-573001

REPORT DATE 02/13/87 C-31
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/3
MDAC ID: 10405  ABORT: 3/3

ITEM: NLG EXTEND / RETRACT HYD STRUT ACTUATOR
FAILURE MODE: FILTER BLOCKED

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR COMPARTMENT
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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
THE HYDRAULIC PRESSURE WILL BE BLOCKED TO THE GEAR, BUT THE GEAR WILL DEPLOY DUE TO GRAVITY AND AIRFLOW AND WITH THE ASSIST OF THE NOSE LANDING GEAR EXTENSION BOOSTER PYRO ACTUATOR.

REFERENCES: VO70-573001

REPORT DATE 02/13/87  C-32
INDEPENDENT ORBITER ASSESSMENT
ORBiter SUBSYSTEM Analysis Worksheet

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 10406

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: NLG EXTEND / RETRACT HYD STRUT ACTUATOR
FAILURE MODE: CAVITATION ORIFICE BLOCKED

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR COMPARTMENT
2) NOSE LANDING GEAR
3) NOSE LANDING GEAR EXTEND / RETRACT HYDRAULIC STRUT ACTUATOR
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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
IF THE CAVITATION ORIFICE IS BLOCKED THE HYDRAULIC PRESSURE IS BLOCKED TO THE GEAR, BUT THE GEAR WILL DEPLOY DUE TO GRAVITY AND AIRFLOW AND WITH THE ASSIST OF THE NOSE LANDING GEAR EXTENSION BOOSTER PYRO ACTUATOR.

REFERENCES: VO70-573001
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 10407

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: NLG EXTEND / RETRACT HYD STRUT ACTUATOR
FAILURE MODE: CAVITATION CHECK VALVE - OPEN / CLOSED

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR COMPARTMENT
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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
The hydraulic pressure will be blocked to the gear, but the gear will deploy due to gravity and airflow and with the assist of the nose landing gear extension booster pyro actuator.

REFERENCES: VO70-573001

REPORT DATE 02/13/87 C-34
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/3
MDAC ID: 10407  ABORT: 3/3

ITEM: NLG EXTEND / RETRACT HYD STRUT ACTUATOR
FAILURE MODE: CAVITATION CHECK VALVE - OPEN / CLOSED

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR COMPARTMENT
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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
THE HYDRAULIC PRESSURE WILL BE BLOCKED TO THE GEAR, BUT THE GEAR
WILL DEPLOY DUE TO GRAVITY AND AIRFLOW AND WITH THE ASSIST OF THE
NOSE LANDING GEAR EXTENSION BOOSTER PYRO ACTUATOR.

REFERENCES: VO70-573001

REPORT DATE 02/13/87  C-35
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/3
MDAC ID: 10408  ABORT: 3/3

ITEM: NLG EXTEND / RETRACT HYD STRUT ACTUATOR
FAILURE MODE: SHUTTLE VALVE READY (OPEN)

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
THE NORMAL POSITION FOR INFLIGHT OPERATIONS IS OPEN.

REFERENCES: VO70-573001
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/3
MDAC ID: 10408  ABORT: 3/3

ITEM: NLG EXTEND / RETRACT HYD STRUT ACTUATOR
FAILURE MODE: SHUTTLE VALVE READY (OPEN)

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
THE NORMAL POSITION FOR INFLIGHT OPERATIONS IS OPEN.

REFERENCES: VO70-573001

REPORT DATE 02/13/87  C-37
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/3
MDAC ID: 10409  ABORT: 3/3

ITEM: NLG EXTEND / RETRACT HYD STRUT ACTUATOR
FAILURE MODE: HIGH PRESSURE RELIEF VALVE - OPEN

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR COMPARTMENT
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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: BROKEN SPRING

EFFECTS/RATIONALE:
THE RELIEF VALVE HELPS REGULATE THE FLUID FLOW DURING LANDING GEAR EXTENSION. THE LANDING GEAR WILL STILL DEPLOY.

REFERENCES: VO70-573001

REPORT DATE 02/13/87  C-38
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 10410

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: NLG EXTEND / RETRACT HYD STRUT ACTUATOR
FAILURE MODE: HIGH PRESSURE RELIEF VALVE - CLOSED

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
THE RELIEF VALVE HELPS REGULATE THE FLUID FLOW DURING LANDING GEAR EXTENSION. THE LANDING GEAR WILL STILL DEPLOY.

REFERENCES: VO70-573001

REPORT DATE 02/13/87 C-39
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/3
MDAC ID: 10411  ABORT: 3/3

ITEM: NLG EXTEND / RETRACT HYD STRUT ACTUATOR
FAILURE MODE: LOW PRESSURE RELIEF VALVE - OPEN

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR COMPARTMENT
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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
INTERNAL BYPASS OF FLUID RELIEVES PRESSURE WHEN THE GEAR IS RETRACTED.

REFERENCES: VO70-573001
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 10412

FLIGHT: 3/3
ABORT: 3/3

ITEM: NLG EXTEND / RETRACT HYD STRUT ACTUATOR
FAILURE MODE: CHECK VALVE - OPEN / CLOSED

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR COMPARTMENT
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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
THE CHECK VALVE HELPS REGULATE THE HYDRAULIC FLUID. IT IS NOT NEEDED FOR DEPLOYMENT.

REFERENCES: V070-573001

REPORT DATE 02/13/87 C-41
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS FLIGHT: 1/1
MDAC ID: 10413 ABORT: 1/1

ITEM: NLG EXTEND / RETRACT HYD STRUT ACTUATOR
FAILURE MODE: SHUTTLE VALVE (CLOSED)

LEAD ANALYST: J. COMPTON SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR COMPARTMENT
2) NOSE LANDING GEAR
3) NOSE LANDING GEAR EXTEND / RETRACT HYDRAULIC STRUT ACTUATOR

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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: BROKEN SPRING, CONTAMINATION

EFFECTS/RATIONALE:
THE LANDING GEAR CANNOT EXTEND IF THE VALVE IS CLOSED. HYDRAULIC FLUID CANNOT GET OUT OF THE BACK SIDE OF THE PISTON

REFERENCES: VO70-573001

REPORT DATE 02/13/87 C-42
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 10414  ABORT: 1/1

ITEM: NLG EXTEND / RETRACT HYD STRUT ACTUATOR
FAILURE MODE: TIMING ORIFICE BLOCKED

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR COMPARTMENT
2) NOSE LANDING GEAR
3) NOSE LANDING GEAR EXTEND / RETRACT HYDRAULIC STRUT ACTUATOR

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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
The timing orifice is used to help regulate the flow of hydraulic fluid during landing gear deployment. If the orifice is blocked, the gear will not extend or the time of extension will be increased.

REFERENCES: VO70-573001

REPORT DATE 02/13/87  C-43
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 10415

ITEM: NLG EXTEND / RETRACT HYD STRUT ACTUATOR
FAILURE MODE: LOW PRESSURE RELIEF - OPEN / CLOSED

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR COMPARTMENT
2) NOSE LANDING GEAR
3) NOSE LANDING GEAR EXTEND / RETRACT HYDRAULIC STRUT ACTUATOR
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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
THE GEAR WILL STILL DEPLOY. THE RELIEF VALVE WILL LIMIT THE FLUID LOSS IF THE LEAK IS ON THE GROSS SIDE

REFERENCES: VO70-573001

REPORT DATE 02/13/87  C-44
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86

SUBSYSTEM: LANDING/DECELERATION SYSTEMS

MDAC ID: 10415

ITEM: NLG EXTEND / RETRACT HYD STRUT ACTUATOR

FAILURE MODE: LOW PRESSURE RELIEF - OPEN / CLOSED

LEAD ANALYST: J. COMPTON

SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR COMPARTMENT
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3) NOSE LANDING GEAR EXTEND / RETRACT HYDRAULIC STRUT ACTUATOR

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LOCATION: NOSE LANDING GEAR

PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
THE GEAR WILL STILL DEPLOY. THE RELIEF VALVE WILL LIMIT THE FLUID LOSS IF THE LEAK IS ON THE GROSS SIDE

REFERENCES: V070-573001

REPORT DATE 02/13/87  C-45
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
MDAC ID: 10416

ITEM: NLG EXTEND / RETRACT HYD STRUT ACTUATOR
FAILURE MODE: TEMPERATURE TRANSDUCER BOSS LEAK

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR COMPARTMENT
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3) NOSE LANDING GEAR EXTEND / RETRACT HYDRAULIC STRUT ACTUATOR
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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: SEAL DAMAGE

EFFECTS/RATIONALE:
POSSIBLE LOSS OF HYDRAULIC SYSTEM 1 AND THE GEAR WILL NOT EXTEND HYDRAULICALLY. THE GEAR WILL EXTEND BY GRAVITY AND AIRFLOW AND WITH THE ASSIST OF THE NOSE LANDING GEAR EXTENSION BOOSTER PYRO ACTUATOR.

REFERENCES: VO70-573001

REPORT DATE 02/13/87

C-46
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 10501  ABORT: 1/1

ITEM: NLG DOOR EXTEND / RETRACT MECHANISM
FAILURE MODE: STRUCTURAL FAILURE, PHYSICAL BINDING / JAMMING

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) NOSE LANDING GEAR COMPARTMENT
3) NOSE LANDING GEAR DEPLOY MECHANISM
4) DOOR EXTEND / RETRACT MECHANISM
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LOCATION: NOSE LANDING GEAR
PART NUMBER: V070-510601

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION, MECHANICAL SHOCK, MISHANDLING OR ABUSE, DEBRIS LODGED IN LINKAGE.

EFFECTS/RATIONALE:
DOORS WON'T POSSIBLY OPEN. GEAR WILL TRY TO DEPLOY THROUGH THE DOORS. DOOR HOOK(S) DOWNSTREAM OF THE FAILURE WON'T RELEASE. GEAR WILL NOT DEPLOY IN TIME FOR LANDING.

REFERENCES: V070-510601, V070-510501, 13.1 SSSH, JSC 12770 - VOL. 10D

REPORT DATE 02/13/87  C-47
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 10501  ABORT: 1/1

ITEM: NLG DOOR EXTEND / RETRACT MECHANISM
FAILURE MODE: STRUCTURAL FAILURE, PHYSICAL BINDING / JAMMING

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
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2) NOSE LANDING GEAR COMPARTMENT
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LOCATION: NOSE LANDING GEAR

PART NUMBER: V070-510601

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION, MECHANICAL SHOCK, MISHANDLING OR ABUSE, DEBRIS LODGED IN LINKAGE.

EFFECTS/RATIONALE:
DOORS WON'T POSSIBLY OPEN. GEAR WILL TRY TO DEPLOY THROUGH THE DOORS. DOOR HOOK(S) DOWNSTREAM OF THE FAILURE WON'T RELEASE. GEAR WILL NOT DEPLOY IN TIME FOR LANDING.

REFERENCES: V070-510601, V070-510501, 13.1 SSSH, JSC 12770 - VOL. 10D
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/3
MDAC ID: 10601  ABORT: 3/3

ITEM: NLG DOOR OVER-CENTER BUNGEE
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) NOSE LANDING GEAR COMPARTMENT
3) NOSE LANDING GEAR DEPLOY MECHANISM
4) DOOR OVER-CENTER BUNGEE
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LOCATION: NOSE LANDING GEAR
PART NUMBER: V070-510630-001

CAUSES: PIECE-PART STRUCTURAL FAILURE, MISHANDLING OR ABUSE, DEBRIS LODGED IN LINKAGE.

EFFECTS/RATIONALE:
DOORS MAY NOT STAY FULLY OPEN AFTER NOSE LANDING GEAR IS DEPLOYED

REFERENCES: V070-510601, 13.1 SSSH, JSC 12770 - VOL. 10D

REPORT DATE 02/13/87  C-49
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86   HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS   FLIGHT: 1/1
MDAC ID: 10701   ABORT: 1/1

ITEM: NLG UPLOCK HOOK ASSEMBLY
FAILURE MODE: STRUCTURAL FAILURE, PHYSICAL BINDING / JAMMING

LEAD ANALYST: J. COMPTON   SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) NOSE LANDING GEAR COMPARTMENT
3) NOSE LANDING GEAR DEPLOY MECHANISM
4) GEAR UPLOCK HOOK ASSEMBLY
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LOCATION: NOSE LANDING GEAR
PART NUMBER: VO70-510550

CAUSES: PIECE-PART STRUCTURAL FAILURE, MISHANDLING OR ABUSE, DEBRIS LODGED IN LINKAGE.

EFFECTS/RATIONALE:
LANDING GEAR WILL NOT DEPLOY

REFERENCES: VO70-510550, VO70-510601, 13.1 SSSH, JSC 12770 - VOL. 10D

REPORT DATE 02/13/87   C-50
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 10901  ABORT: 1/1

ITEM: NLG DOOR HOOK ACT LINKAGE
FAILURE MODE: STRUCTURAL FAILURE, PHYSICAL BINDING / JAMMING

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) NOSE LANDING GEAR COMPARTMENT
3) NOSE LANDING GEAR DEPLOY MECHANISM
4) DOOR HOOK ACTUATION LIKAGE
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LOCATION: NOSE LANDING GEAR
PART NUMBER: V070-510701-001, V070-510711-001

CAUSES: PIECE-PART STRUCTURAL FAILURE, MISHANDLING OR ABUSE, DEBRIS LODGED IN LINKAGE.

EFFECTS/RATIONALE:
THE LANDING GEAR WILL NOT EXTEND IN TIME FOR LANDING

REFERENCES: V070-510601, 13.1 SSSH, JSC 12770 - VOL. 10D

REPORT DATE 02/13/87  C-51
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86            HIGHEST CRITICALITY   HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS    FLIGHT: 1/1
MDAC ID: 10901            ABORT: 1/1

ITEM: NLG DOOR HOOK ACT LINKAGE
FAILURE MODE: STRUCTURAL FAILURE, PHYSICAL BINDING / JAMMING

LEAD ANALYST: J. COMPTON    SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) NOSE LANDING GEAR COMPARTMENT
3) NOSE LANDING GEAR DEPLOY MECHANISM
4) DOOR HOOK ACTUATION LIKKAGE

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LOCATION: NOSE LANDING GEAR
PART NUMBER: V070-510701-001, V070-510711-001

CAUSES: PIECE-PART STRUCTURAL FAILURE, MISMANAGEMENT OR ABUSE, DEBRIS LODGED IN LINKAGE.

EFFECTS/RATIONALE:
THE LANDING GEAR WILL NOT EXTEND IN TIME FOR LANDING

REFERENCES: V070-510601, 13.1 SSSH, JSC 12770 - VOL. 10D

REPORT DATE 02/13/87    C-52
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 11003

ITEM: NLG UPLOCK ACTUATOR
FAILURE MODE: LEAK EXTERNAL

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR COMPARTMENT
2) NOSE LANDING GEAR
3) NOSE LANDING GEAR UPLOCK MECHANISM
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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC287-0033-0002

CAUSES: O-RING SEAL DAMAGE, VIBRATION, LOOSE BOLTS

EFFECTS/RATIONALE:
POSSIBLE LOSS OF HYDRAULIC SYSTEM 1 AND THE GEAR WILL NOT RELEASE HYDRAULICALLY. THE PYRO BACKUP WILL RELEASE THE GEAR ONE SECOND AFTER THE COMMAND TO DEPLOY IF THE LANDING GEAR HOOK IS NOT OPEN

REFERENCES: VO70-573001
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 11004

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 2/1R
ABORT: 2/1R

ITEM: NLG UPLOCK ACTUATOR
FAILURE MODE: BROKEN ROD / LINKAGE

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR COMPARTMENT
2) NOSE LANDING GEAR
3) NOSE LANDING GEAR UPLOCK MECHANISM
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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC287-0033-0002

CAUSES: STRESS / FRACTURE

EFFECTS/RATIONALE:
THE GEAR WILL NOT RELEASE HYDRAULICALLY. THE PYRO BACKUP WILL RELEASE THE GEAR ONE SECOND AFTER THE COMMAND TO DEPLOY IF THE LANDING GEAR HOOK IS NOT OPEN

REFERENCES: VO70-573001

REPORT DATE 02/13/87 C-54
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 2/1R
MDAC ID: 11005  ABORT: 2/1R

ITEM: NLG UPLOCK ACTUATOR
FAILURE MODE: RUPTURE

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR COMPARTMENT
2) NOSE LANDING GEAR
3) NOSE LANDING GEAR UPLOCK MECHANISM

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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC287-0033-0002

CAUSES: MATERIAL DEFECT

EFFECTS/RATIONALE:
HYDRAULIC SYSTEM 1 WILL BE LOST AND THE GEAR WILL NOT RELEASE HYDRAULICALLY. THE PYRO BACKUP WILL RELEASE THE GEAR ONE SECOND AFTER THE COMMAND TO DEPLOY IF THE LANDING GEAR HOOK IS NOT OPEN.

REFERENCES: VO70-573001

REPORT DATE 02/13/87  C-55
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/3
MDAC ID: 11006  ABORT: 3/3

ITEM: NLG UPLOCK ACTUATOR  FAILURE MODE: LEAK - INTERNAL PISTON

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR COMPARTMENT
2) NOSE LANDING GEAR
3) NOSE LANDING GEAR UPLOCK MECHANISM
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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC287-0033-0002

CAUSES: SEAL DAMAGE

EFFECTS/RATIONALE:
The hydraulic pump will compensate for the loss of fluid.

REFERENCES: VO70-573001
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 11101

ITEM: NLG B/U PYRO UPLOCK RELEASE MECH
FAILURE MODE: INADVERTANT FIRING

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) NOSE LANDING GEAR COMPARTMENT
3) NOSE LANDING GEAR DEPLOY MECHANISM
4) NOSE LANDING GEAR BACKUP PYRO UPLOCK RELEASE MECHANISM
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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC325-0006-0002 (GFE)

CAUSES: THERMAL, ERRONEOUS SIGNAL

EFFECTS/RATIONALE:
NOSE LANDING GEAR WILL EXTEND CAUSING LOSS OF VEHICLE. DURING ORBIT, RESCUE MUST BE MADE AVAILABLE.

REFERENCES: VO70-510601, VO70-510501, 13.1 SSSH, JSC 12770 - VOL. 10D

REPORT DATE 02/13/87 C-57
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 11102

ITEM: NLG B/U PYRO UPLOCK RELEASE MECH
FAILURE MODE: FAIL TO FIRE

LEAD ANALYST: J. COMPTON       SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) NOSE LANDING GEAR COMPARTMENT
3) NOSE LANDING GEAR DEPLOY MECHANISM
4) NOSE LANDING GEAR BACKUP PYRO UPLOCK RELEASE MECHANISM
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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC325-0006-0002 (GFE)

CAUSES: ELECTRICAL FAILURE, CARTRIDGE FAILURE

EFFECTS/RATIONALE:
NOSE LANDING GEAR WILL NOT DEPLOY IF HYDRAULIC SYSTEM 1 IS NOT FUNCTIONING.

REFERENCES: VO70-510601, VO70-510501, 13.1 SSSH, JSC 12770 - VOL. 10D
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
HDW/FUNC: HIGHEST CRITICALITY
MDAC ID: 11201
FLIGHT: 1/1
ABORT: 1/1

ITEM: NLG EXTENSION BOOSTER PYRO ACT
FAILURE MODE: INADVERTANT FIRING

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) NOSE LANDING GEAR COMPARTMENT
3) NOSE LANDING GEAR DEPLOY MECHANISM
4) NOSE LANDING GEAR EXTENSION BOOSTER PYRO ACTUATOR
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LOCATION: NOSE LANDING GEAR
PART NUMBER: MC325-0006-0002 (GFE)

CAUSES: THERMAL, ERRONEOUS SIGNAL

EFFECTS/RAIONALE:
PREMATURE OR INADVERTANT FIRING MAY CAUSE THE NLG TO DEPLOY AT AN
INOPPORTUNE TIME. IF THE ACTUATOR FIRES ON ORBIT THE NLG CANNOT
BE RETRACTED AND ENTRY WITH THE GEAR DEPLOYED WOULD CAUSE A LOSS
OF THE CREW AND VEHICLE. AN EARLY DEPLOY DURING DEORBIT
COULD CAUSE A LOSS OF VEHICLE CONTROL AND EXCESSIVE VEHICLE
DAMAGE DUE TO DYNAMIC PRESSURES DURING SUPERSONIC FLIGHT WITH
THE NLG DEPLOYED. FAILURES OF THIS NATURE WOULD CAUSE THE LOSS
OF THE CREW AND THE VEHICLE.

REFERENCES: VO70-510601, VO70-510501, 13.1 SSSH, JSC 12770 -
VOL. 10D

REPORT DATE 02/13/87
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86

SUBSYSTEM: LANDING/DECELERATION SYSTEMS

MDAC ID: 11202

HIGHEST CRITICALITY HDW/FUNC

FLIGHT: 1/1
ABORT: 1/1

ITEM: LG EXTENSION BOOSTER PYRO ACT

FAIL MODE: FAIL TO FIRE

LEAD ANALYST: J. COMPTON

SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) NOSE LANDING GEAR COMPARTMENT
3) NOSE LANDING GEAR DEPLOY MECHANISM
4) NOSE LANDING GEAR EXTENSION BOOSTER PYRO ACTUATOR

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LOCATION: NOSE LANDING GEAR

PART NUMBER: MC325-0006-0002 (GFE)

CAUSES: ELECTRICAL FAILURE, CARTRIDGE FAILURE

EFFECTS/RATIONALE:
LOSS OF CREW AND VEHICLE IF THE NOSE LANDING GEAR DOESN'T EXTEND IN TIME

REFERENCES: VO70-510601, VO70-510501, 13.1 SSSH, JSC 12770 - VOL. 10D

REPORT DATE 02/13/87 C-60
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 11301

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 1/1
ABORT: 1/1

ITEM: NLG DOOR BUNGEE ASSIST ASSY
FAILURE MODE: STRUCTURAL FAILURE, FAILS TO RELEASE

LEAD ANALYST: J. COMPTON    SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) NOSE LANDING GEAR COMPARTMENT
3) NOSE LANDING GEAR DEPLOY MECHANISM
4) NOSE LANDING GEAR DOOR BUNGEE ASSIST ASSEMBLY
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LOCATION: NOSE LANDING GEAR
PART NUMBER: V070-510751
CAUSES: PIECE-PART STRUCTURAL FAILURE, MISHANDLING OR ABUSE, PHYSICAL BINDING / JAMMING
EFFECTS/RATIONALE:
NOSE LANDING WILL FAIL TO EXTEND IN TIME FOR LANDING.

REFERENCES: V070-510601, V070-510751, 13.1 SSSH, JSC 12770 - VOL. 10D

REPORT DATE 02/13/87    C-61
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 11302  ABORT: 1/1

ITEM: NLG DOOR BUNGEE ASSIST ASSY
FAILURE MODE: STRUCTURAL FAILURE, INADVERTANT RELEASE

LEAD ANALYST: W. WEISSINGER  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) NOSE LANDING GEAR
2) NOSE LANDING GEAR COMPARTMENT
3) NOSE LANDING GEAR DEPLOY MECHANISM
4) NOSE LANDING GEAR DOOR BUNGEE ASSIST ASSEMBLY
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LOCATION: NOSE LANDING GEAR
PART NUMBER: VO70-510751

CAUSES: PIECE-PART STRUCTURAL FAILURE, MISHANDLING OR ABUSE, VIBRATIONS.

EFFECTS/RATIONALE:
POSSIBLE PARTIAL DOOR DEPLOY OR FULL DEPLOY OF THE NOSE LANDING GEAR. POSSIBLE DOOR AND DOOR UPLOCK MECHANISM DAMAGE IN THE AREA OF IMPACT FROM THE BUNGEE.

REFERENCES: VO70-510601, VO70-510751, 13.1 SSSH, JSC 12770 - VOL. 10D

REPORT DATE 02/13/87  C-62
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 20101  ABORT: 1/1

ITEM: TIRES, MLG TYPE I
FAILURE MODE: RUPTURE

LEAD ANALYST: W. WEISSINGER  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR - TIRES
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LOCATION: MAIN LANDING GEAR
PART NUMBER: 006-866-1 B. F. GOODRICH, MC194-0007-0003

CAUSES: OVERLOAD, CUTS, CONSTRUCTION FLAWS

EFFECTS/RATIONALE:
A RUPTURE OF A MAIN LANDING GEAR TIRE AT TOUCHDOWN WOULD CAUSE OVERLOADING ON THE SECOND TIRE ON THAT LANDING GEAR WHICH COULD RESULT IN A LOSS OF THE CREW AND THE VEHICLE DUE TO LOSS OF CONTROL. ADDITIONAL PROBLEMS COULD INCLUDE SHEARING AN AXLE, DAMAGING A TORQUE ARM, RUPTURING THE BRAKE LINES ON THE TORQUE ARM, AND CAUSING BRAKING / STEERING PROBLEMS FOR THE LANDING.

REFERENCES: MC194-0007 - THE ONLY DOCUMENT AVAILABLE FOR THE EVALUATION IS THE PROCUREMENT SPECIFICATION.

REPORT DATE 02/13/87 C-63
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20201

HIGHEST CRITICALITY
HDW/FUNC

FLIGHT: 1/1
ABORT: 1/1

ITEM: SHOCK STRUT STRUCTURE
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) SHOCK STRUT
4) 
5) 
6) 
7) 
8) 
9) 

CRITICALITIES

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LOCATION: MAIN LANDING GEAR
PART NUMBER: 1170100 MENASCO, MC621-0011

CAUSES: MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE - CORROSION - CRACKING, MECHANICAL SHOCK, OVERLOAD.

EFFECTS/RATIONALE:

REFERENCES: MC621-0011, 1170100, 1170101, 1170114, 1170182

REPORT DATE 02/13/87 C-64
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20202

HIGHEST CRITICALITY HDW/FUNC

FLIGHT: 1/1
ABORT: 1/1

ITEM: SHOCK STRUT PISTON ASSEMBLY

FAILURE MODE: INTERNAL / EXTERNAL LEAKAGE (HYDRAULIC FLUID)

LEAD ANALYST: W. WEISSINGER
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) SHOCK STRUT
4) SHOCK STRUT PISTON ASSEMBLY
5) 
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LOCATION: MAIN LANDING GEAR
PART NUMBER: 1170100 MENASCO, MC621-0011

CAUSES: MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE, SEAL FAILURE.

EFFECTS/RATIONALE:

REFERENCES: MC621-0011, 1170100, 1170101, 1170114, 1170182

REPORT DATE 02/13/87 C-65
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86       HIGHEST CRITICALITY  HDW/FUNC
Subsystem: LANDING/DECELERATION SYSTEMS  Flight: 3/1R
MDAC ID: 20203       Abort: 3/1R

Item: SHOCK STRUT PISTON ASSEMBLY
Failure mode: INTERNAL / EXTERNAL LEAKAGE (NITROGEN)

Lead Analyst: W. WEISSINGER          Subsys Lead: W. WEISSINGER

Breakdown hierarchy:
1) MAIN LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) SHOCK STRUT
4) SHOCK STRUT PISTON ASSEMBLY
5)
6)
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8)
9)

Criticalities

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Location: MAIN LANDING GEAR
Part number: 1170100 MENASCO, MC621-0011

Causes: MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE, SEAL FAILURE.

Effects/Rationale:
WITHOUT NITROGEN THERE WOULD BE A PARTIAL LOSS OF EFFECTIVENESS. THE LOSS OF NITROGEN PRESSURE IN THE SHOCK STRUT ASSEMBLY WILL NOT PREVENT THE FUNCTIONING OF THE HYDRAULIC PORTION OF THE SHOCK STRUT.

References: MC621-0011, 1170100, 1170101, 1170114, 1170182

REPORT DATE 02/13/87 C-66
### ORBITER SUBSYSTEM ANALYSIS WORKSHEET

#### 11/28/86

**SUBSYSTEM:** LANDING/DECELERATION SYSTEMS  
**MDAC ID:** 20204  
**ITEM:** TORQUE ARM ASSEMBLY  
**FAILURE MODE:** STRUCTURAL FAILURE  
**LEAD ANALYST:** W. WEISSINGER  
**SUBSYS LEAD:** W. WEISSINGER  

**BREAKDOWN HIERARCHY:**

1. MAIN LANDING GEAR  
2. SHOCK STRUT ASSEMBLY  
3. TORQUE ARM ASSEMBLY  
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**HIGHEST CRITICALITY HDW/FUNC**

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**REDUNDANCY SCREENS:**

- A [NA ]  
- B [NA ]  
- C [NA ]  

**LOCATION:** MAIN LANDING GEAR  
**PART NUMBER:** MC621-0012, 1170353-1 MENASCO  

**CAUSES:** MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK.  

**EFFECTS/RATIONALE:**

A STRUCTURAL FAILURE AT MLG TOUCHDOWN COULD CAUSE THE WHEELS TO ROTATE CAUSING THE AFFECTED MLG TO COLLAPSE. THE TORQUE ARM PREVENTS ROTATION OF THE PISTON AND AXLE ASSEMBLY. IF THE AXLE WERE TO ROTATE THE MAIN GEAR WOULD COLLAPSE CAUSING A PROBABLE LOSS OF THE CREW AND THE VEHICLE.  

**REFERENCES:** MC621-0011, V070-510001, 1170300  

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**REPORT DATE 02/13/87**
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20205
FLIGHT: 1/1
ABORT: 1/1

ITEM: AXLE KIT - MLG
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) AXLE KIT
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CRITICALITIES

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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC621-0011, 1170182-103 MENASCO, 1170190-101 MENASCO

CAUSES: MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, OVERLOAD.

EFFECTS/RATIONALE:
AN AXLE FAILURE AT TOUCHDOWN WOULD CAUSE A COLLAPSE OF THE AFFECTED MAIN LANDING GEAR. THERE WOULD BE A PROBABLE LOSS OF THE CREW AND THE VEHICLE AS A RESULT.

REFERENCES: MC621-0011, 1170182

REPORT DATE 02/13/87 C-68
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 20206  ABORT: 1/1

ITEM: LOWER DRAG BRACE STRUT
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) DRAG BRACE ASSEMBLY
4) LOWER DRAG BRACE STRUT
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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC621-0011-0009, 1170300-503 MENASCO, 1170301 MENASCO

CAUSES: MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE, OVERLOAD, MECHANICAL SHOCK.

EFFECTS/RATIONALE:
A LOWER DRAG BRACE STRUT FAILURE WOULD CAUSE AN IMMEDIATE COLLAPSE OF THE MAIN LANDING GEAR. THIS FAILURE COULD CAUSE THE LOSS OF THE VEHICLE AND THE CREW.

REFERENCES: MC621-0011, VO70-510201, 1170300, 1170301

REPORT DATE 02/13/87  C-69
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
FLIGHT: 1/1
MDAC ID: 20207
ABORT: 1/1

ITEM: UPPER DRAG BRACE TRUNIONS (2 EA)
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) DRAG BRACE ASSEMBLY
4) UPPER DRAG BRACE TRUNIONS
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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC621-0011-0009, 1170306-1 MENASCO

CAUSES: MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE - CORROSION - CRACKING, OVERLOAD, MECHANICAL SHOCK.

EFFECTS/RATIONALE:
The loss of either of the upper drag brace trunions on either main landing gear would cause failures that would cause the collapse of the main landing gear. A loss of the vehicle and the crew would be probable with this failure.

REFERENCES: MC621-0011, VO70-510201, 1170300, 1170301

REPORT DATE 02/13/87 C-70
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20208

ITEM: LOCK BRACE ASSEMBLY
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) LOCK BRACE ASSEMBLY

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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC621-0011-0011, 1170350-507 MENASCO

CAUSES: MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE - CORROSION - CRACKING, OVERLOAD, MECHANICAL SHOCK.

EFFECTS/RATIONALE:
A STRUCTURAL FAILURE OF THE LOCK BRACE ASSEMBLY ON EITHER MAIN LANDING GEAR WOULD ALLOW THAT GEAR TO COLLAPSE DURING LANDING. PROBABLE LOSS OF THE VEHICLE AND THE CREW.

REFERENCES: MC621-0011,VO70-510201, 1170350, 1170300, 1170301

REPORT DATE 02/13/87 C-71
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86

HIGHEST CRITICALITY: HDW/FUNC

SUBSYSTEM: LANDING/DECELERATION SYSTEMS

FLIGHT: 1/1

ABORT: 1/1

MDAC ID: 20209

ITEM: DOWN LOCK BUNGEE

FAILURE MODE: PHYSICAL BINDING / JAMMING (BENT BUNGEE)

LEAD ANALYST: W. WEISSINGER

SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:

1) MAIN LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) LOCK BRACE ASSEMBLY
4) DOWN LOCK BUNGEE
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LOCATION: MAIN LANDING GEAR

PART NUMBER: MC621-0011, 1170315-103 MENASCO

CAUSES: MISHANDLING OR ABUSE.

EFFECTS/RATIONALE:

THERE WOULD BE A POSSIBLE LOSS OF CREW AND VEHICLE AFTER THE HYDRAULICS SYSTEM 1 IS SHUT DOWN. THE LANDING GEAR COULD COLLAPSE IF THE BUNGEE WERE NOT AVAILABLE TO LOCK THE LOCK BRACE INTO THE SAFE POSITION. HYDRAULICS SYSTEM 1 WILL LOWER AND SECURE THE GEAR THROUGH ROLLOUT BUT WHEN THE APU'S ARE SHUT DOWN THE REDUNDANCY IS LOST AND THE GEAR COULD COLLAPSE DUE TO MINOR VEHICLE MOVEMENTS.

REFERENCES: MC621-0011, VO70-510201, 1170350, 1170300, 1170301
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 20210  ABORT: 1/1

ITEM: DOWN LOCK BUNGEE
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) LOCK BRACE ASSEMBLY
4) DOWN LOCK BUNGEE
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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC621-0011, 1170315-103 MENASCO

CAUSES: MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE - CORROSION - CRACKING, OVERLOAD, MECHANICAL SHOCK.

EFFECTS/RATIONALE:
THERE WOULD BE A POSSIBLE LOS OF CREW AND VEHICLE AFTER THE HYDRAULICS SYSTEM 1 IS SHUT DOWN. THE LANDING GEAR COULD COLLAPSE IF THE BUNGEE WERE NOT AVAILABLE TO LOCK THE LOCK BRACE INTO THE SAFE POSITION. HYDRAULICS SYSTEM 1 WILL LOWER AND SECURE THE GEAR THROUGH ROLLOUT BUT WHEN THE APU'S ARE SHUT DOWN THE REDUNDANCY IS LOST AND THE GEAR COULD COLLAPSE DUE TO MINOR VEHICLE MOVEMENTS.

REFERENCES: MC621-0011, VO70-510201, 1170350, 1170300, 1170301

REPORT DATE 02/13/87  C-73
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20211
HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: MLG DOWN AND LOCK SENSORS
FAILURE MODE: SHORTED OPEN
LEAD ANALYST: W. WEISSINGER
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) MAIN LANDING GEAR DOWN AND LOCK SENSORS
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LOCATION: MAIN LANDING GEAR
PART NUMBER: VO70-510340

CAUSES: MISHANDLING OR ABUSE, PIECE-PART FAILURE - CORROSION, VIBRATION.

EFFECTS/RATIONALE:
THE CREW WOULD NOT BE ABLE TO VERIFY THAT THE MAIN LANDING GEAR WAS DOWN AND LOCKED IN POSITION.

REFERENCES: MC621-0011, VO70-510201, 1170350

REPORT DATE 02/13/87  C-74
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS FLIGHT: 3/3
MDAC ID: 20212 ABORT: 3/3

ITEM: MLG DOWN AND LOCK SENSORS
FAILURE MODE: SHORTED CLOSED

LEAD ANALYST: W. WEISSINGER SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) MAIN LANDING GEAR DOWN AND LOCK SENSORS
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LOCATION: MAIN LANDING GEAR
PART NUMBER: VO70-510340

CAUSES: MISHANDLING OR ABUSE, PIECE-PART FAILURE – CORROSION, VIBRATION.

EFFECTS/RATIONALE:
THE CREW WOULD NOT BE ABLE TO VERIFY THAT THE MAIN LANDING GEAR WAS DOWN AND LOCKED IN POSITION.

REFERENCES: MC621-0011, VO70-510201, 1170350

REPORT DATE 02/13/87 C-75
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/3
MDAC ID: 20213  ABORT: 3/3

ITEM: MLG DOWN AND LOCK SENSORS
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) MAIN LANDING GEAR DOWN AND LOCK SENSORS

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LOCATION: MAIN LANDING GEAR
PART NUMBER: VO70-510340

CAUSES: MISHANDLING OR ABUSE, PIECE-PART FAILURE.

EFFECTS/RATIONALE:
CONTACT WOULD NOT BE MADE IF THE STRUCTURAL FAILURE OCCURRED, THEREFORE NO INPUT WOULD BE OBSERVED BY THE CREW.

REFERENCES: MC621-0011, VO70-510201, 1170350

REPORT DATE 02/13/87  C-76
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86   HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS   FLIGHT: 3/3
MDAC ID: 20214   ABORT: 3/3

ITEM: WEIGHT ON WHEELS SENSOR - MLG
FAILURE MODE: SHORTED OPEN

LEAD ANALYST: W. WEISSINGER   SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) WEIGHT ON WHEELS SENSOR - MLG
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LOCATION: MAIN LANDING GEAR
PART NUMBER: VO70-510340

CAUSES: MISHANDLING OR ABUSE, PIECE-PART FAILURE - CORROSION, VIBRATION.

EFFECTS/RATIONALE:
A FAILURE TO FUNCTION PROPERLY COULD RESULT IN A LOSS OF ANTI-SKID PROTECTION DURING ROLLOUT. THE BRAKES WILL FUNCTION WITHOUT THE ANTI-SKID FUNCTION.

REFERENCES: MC621-0011, VO70-510201

REPORT DATE 02/13/87   C-77
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/3
MDAC ID: 20215  ABORT: 3/3

ITEM: WEIGHT ON WHEELS SENSOR - MLG
FAILURE MODE: SHORTED CLOSED

LEAD ANALYST: W. WEISSINGER  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) WEIGHT ON WHEELS SENSOR - MLG
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LOCATION: MAIN LANDING GEAR
PART NUMBER: VO70-510340

CAUSES: MISHANDLING OR ABUSE, PIECE-PART FAILURE - CORROSION, VIBRATION.

EFFECTS/RATIONALE:
A FAILURE TO FUNCTION PROPERLY COULD RESULT IN A LOSS OF ANTI-SKID PROTECTION DURING ROLLOUT. THE BRAKES WILL FUNCTION WITHOUT THE ANTI-SKID FUNCTION.

REFERENCES: MC621-0011, VO70-510201

REPORT DATE 02/13/87  C-78
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86    HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS    FLIGHT: 1/1
MDAC ID: 20216    ABORT: 1/1

ITEM: UPLOCK ROLLER RETAINING ASSEMBLY
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER    SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) UPLOCK ROLLER RETAINING ASSEMBLY
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LOCATION: MAIN LANDING GEAR
PART NUMBER: 1170149 MENASCO, MC621-0011

CAUSES: MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, OVERLOAD, VIBRATION.

EFFECTS/RATIONALE:
IF THE UPLOCK ROLLER RETAINING ASSEMBLY WILL NOT SECURE THE MAIN LANDING GEAR IN POSITION, THE MAIN LANDING GEAR WILL BE LOOSE IN THE MAIN LANDING GEAR COMPARTMENT. THE WEIGHT OF THE MLG AGAINST THE DOOR COULD CAUSE AN INADVERTANT LANDING GEAR DEPLOY DURING LAUNCH OPERATIONS OF DURING DEORBIT. THIS WOULD CAUSE MAJOR DAMAGE TO THE VEHICLE AND AFFECT VEHICLE PERFORMANCE. THERE WOULD BE A PROBABLE LOSS OF THE CREW AND THE VEHICLE.

REFERENCES: MC621-0011, VO70-510201, VO70-510202, 1170100, 1170101

REPORT DATE 02/13/87    C-79
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20217

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 1/1
ABORT: 1/1

ITEM: TORQUE TUBE ASSEMBLY
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) TORQUE TUBE ASSEMBLY
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LOCATION: MAIN LANDING GEAR
PART NUMBER: 1170353-101 MENASCO, MC621-0011

CAUSES: MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE.

EFFECTS/RATIONALE:
A STRUCTURAL FAILURE OF THE MLG TORQUE TUBE ASSEMBLY COULD CAUSE THE GEAR TO NOT DEPLOY IN TIME FOR LANDING, THE MLG LOCK BRACE ASSEMBLY WOULD NOT FUNCTION PROPERLY, AND IT WOULD POSSIBLY NOT SECURE THE EXTENDED MLG. THIS COULD CAUSE A COLLAPSE OF THE MAIN LANDING GEAR WHICH WOULD CAUSE THE PROBABLE LOSS OF THE VEHICLE AND THE CREW.

REFERENCES: MC621-0011, VO70-510201, VO70-510202, 1170100, 1170101

REPORT DATE 02/13/87 C-80
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS FLIGHT: 1/1
MDAC ID: 20218 ABORT: 1/1

ITEM: SHOCK STRUT ATTACHING TRUNIONS
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) SHOCK STRUT ATTACHING TRUNIONS
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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC621-0011, VO70-510476

CAUSES: MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE - CORROSION - CRACKING, MECHANICAL SHOCK, OVERLOAD.

EFFECTS/RATIONALE:
The structural failure of one or both of the shock strut trunions would cause a collapse of the main landing gear. A failure at touchdown would cause a loss of the vehicle and probably the crew.

REFERENCES: MC621-0011, VO70-510201, VO70-510300, VO70-510476, 1170100

REPORT DATE 02/13/87 C-81
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20219
HIGHEST CRITICALITY HDW/FUNC: FLIGHT: 1/1
ABORT: 1/1

ITEM: UPPER DRAG BRACE STRUTS (2 EA)
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) DRAG BRACE ASSEMBLY
4) UPPER DRAG BRACE STRUTS
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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC621-0011-0009, 1170300-501 MENASCO, 1170300-503 MENASCO

CAUSES: MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE, OVERLOAD, MECHANICAL SHOCK.

EFFECTS/RATIONALE:

REFERENCES: MC621-0011, VO70-510201, VO70-510300, 1170300, 1170301

REPORT DATE 02/13/87 C-82
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
FLIGHT: 1/1
MDAC ID: 20220
ABORT: 1/1

ITEM: CENTER DRAG BRACE TRUNION (AT LOCK BRACE)
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) DRAG BRACE ASSEMBLY
4) CENTER DRAG BRACE TRUNION (AT LOCK BRACE)
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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC621-0011-0011, 1170301-1 MENASCO (2EA) OR, 1170301-3 MENASCO (2EA)

CAUSES: MIS HANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE - CORROSION - CRACKING, OVERLOAD, MECHANICAL SHOCK.

EFFECTS/RATIONALE:
THE LOSS OF THE CENTER DRAG BRACE TRUNION WOULD CAUSE AN IMMEDIATE COLLAPSE OF THE MAIN LANDING GEAR. LOSS OF THE CREW AND THE VEHICLE WOULD BE PROBABLE.

REFERENCES: MC621-0011, VO70-510201, 1170300, 1170301, 1170350

REPORT DATE 02/13/87  C-83
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 20221  ABORT: 1/1

ITEM: LOWER DRAG BRACE TRUNION (ATTACHES TO SHOCK STRUT)
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) DRAG BRACE ASSEMBLY
4) LOWER DRAG BRACE TRUNION (ATTACHES TO SHOCK STRUT)

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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC621-0011-0011

CAUSES: MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE - CORROSION - CRACKING, OVERLOAD, MECHANICAL SHOCK.

EFFECTS/RATIONALE:
THE LOSS OF THE LOWER DRAG BRACE TRUNION WOULD CAUSE AN IMMEDIATE COLLAPSE OF THE MAIN LANDING GEAR. LOSS OF THE CREW AND THE VEHICLE WOULD BE PROBABLE.

REFERENCES: MC621-0011, VO70-510201, 1170100, 1170301, 1170493

REPORT DATE 02/13/87  C-84
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 20222  ABORT: 1/1

ITEM: LOCK BRACE CENTER TRUNION
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) LOCK BRACE ASSEMBLY
4) LOCK BRACE CENTER TRUNION
5) 6) 7) 8) 9)

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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC621-0011-0011, 1170360-1 MENASCO (2EA), AND 1170361-1 MENASCO

CAUSES: MISHANDLING OR ABUSE, PIECE-PART STRUCTURAL FAILURE - CORROSION - CRACKING, OVERLOAD, MECHANICAL SHOCK.

EFFECTS/RATIONALE:
A FAILURE OF THE LOCK BRACE CENTRAL TRUNION WOULD CAUSE THE AFFECTED MLG TO NOT LOCK DOWN WHEN IT IS DEPLOYED. THE GEAR WOULD COLLAPSE AT LANDING AND A LOSS OF THE VEHICLE AND THE CREW WOULD BE PROBABLE.

REFERENCES: MC621-0011, VO70-510201, 1170350

REPORT DATE 02/13/87  C-85
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 20223  ABORT: 1/1

ITEM: SUPPORT BEAM  FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) SHOCK STRUT ASSEMBLY
3) DRAG BRACE ASSEMBLY
4) SUPPORT BEAM
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LOCATION: MAIN LANDING GEAR
PART NUMBER: 1170303 MENASCO, MC621-0011

CAUSES: OVERLOAD, CORROSION / CRACKING, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, MISHANDLING OR ABUSE

EFFECTS/RATIONALE:
A STRUCTURAL FAILURE OF THE SUPPORT BEAM WOULD CAUSE TORSION ON THE DRAG BRACE ASSEMBLY THAT COULD CAUSE THE UPPER DRAG BRACE TRUNIONS TO FRACTURE DUE TO TORSION. A FAILURE OF THIS NATURE WOULD RESULT IN THE LOSS OF THE VEHICLE AND THE CREW.

REFERENCES: MC621-0011

REPORT DATE 02/13/87  C-86
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20401
HDW/FUNC CRITICALITY: 3/3

FLIGHT: 3/3
ABORT: 3/3

ITEM: MLG EXTEND / RETRACT HYD STRUT ACT
FAILURE MODE: BROKEN ROD / LINKAGE

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR COMPARTMENT
2) MAIN LANDING GEAR
3) MAIN LANDING GEAR EXTEND / RETRACT HYDRAULIC STRUT ACTUATOR

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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: STRESS / FRACTURE, MISHANDLING OR ABUSE

EFFECTS/RATIONALE:
THE LANDING GEAR WILL NOT EXTEND OR RETRACT HYDRAULICALLY.
GRAVITY AND AIRFLOW WILL EXTEND THE LANDING GEAR.

REFERENCES: V070-573001
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86   HIGHEST CRITICALITY HDW/FUNC: FLIGHT: 2/1R
MDAC ID: 20402   ABORT: 2/1R

ITEM: MLG EXTEND / RETRACT HYD STRUT ACT
FAILURE MODE: LEAK, EXTERNAL

LEAD ANALYST: J. COMPTON    SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR COMPARTMENT
2) MAIN LANDING GEAR
3) MAIN LANDING GEAR EXTEND / RETRACT HYDRAULIC STRUT ACTUATOR
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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: O-RING SEALS, VIBRATION, LOOSE BOLTS

EFFECTS/RATIONALE:
POSSIBLE LOSS OF HYDRAULICS SYSTEM 1 AND THE LANDING GEAR WILL
NOT EXTEND OR RETRACT HYDRAULICALLY. THE LANDING GEAR WILL
EXTEND BY GRAVITY AND AIRFLOW.

REFERENCES: VO70-573001

REPORT DATE 02/13/87   C-88
### INDEPENDENT ORBITER ASSESSMENT
### ORBITER SUBSYSTEM ANALYSIS WORKSHEET

**DATE:** 11/28/86

**SUBSYSTEM:** LANDING/DECELERATION SYSTEMS

**MDAC ID:** 20403

**HIGHEST CRITICALITY**

**HDW/FUNC** FLIGHT: 3/3

**ABORT:** 3/3

**ITEM:** MLG EXTEND / RETRACT HYD STRUT ACT

**FAILURE MODE:** LEAK, INTERNAL PISTON

**LEAD ANALYST:** J. COMPTON

**SUBSYS LEAD:** W. WEISSINGER

**BREAKDOWN HIERARCHY:**

1) MAIN LANDING GEAR COMPARTMENT
2) MAIN LANDING GEAR
3) MAIN LANDING GEAR EXTEND / RETRACT HYDRAULIC STRUT ACTUATOR
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**REDUNDANCY SCREENS:** A [NA] B [NA] C [NA]

**LOCATION:** MAIN LANDING GEAR

**PART NUMBER:** MC287-0033-0007

**CAUSES:** SEAL DAMAGE, MISHANDLING OR ABUSE

**EFFECTS/RATIONALE:**

THE HYDRAULIC PUMP WILL COMPENSATE FOR THE LOSS OF FLUID.

**REFERENCES:** VO70-573001

**REPORT DATE 02/13/87 C-89**
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20404

HIGHEST CRITICALITY
HDW/FUNC

FLIGHT: 1/1
ABORT: 1/1

ITEM: MLG EXTEND / RETRACT HYD STRUT ACT
FAILURE MODE: RUPTURE

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR COMPARTMENT
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3) MAIN LANDING GEAR EXTEND / RETRACT HYDRAULIC STRUT ACTUATOR

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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: MATERIAL DEFECT, MISHANDLING OR ABUSE

EFFECTS/RATIONALE:
LOSS OF HYDRAULIC SYSTEM 1. GEAR MAY BE SLOW TO DEPLOY IF THE ACTUATOR JAMS UP OR IT MAY NOT DEPLOY AT ALL.

REFERENCES: VO70-573001

REPORT DATE 02/13/87 C-90
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86

SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20405

ABORT: 3/3

ITEM: MLG EXTEND / RETRACT HYD STRUT ACT

FAILURE MODE: FILTER BLOCKED

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR COMPARTMENT
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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
The hydraulic pressure will be blocked to the gear, but the gear will deploy due to gravity and airflow.

REFERENCES: VO70-573001

REPORT DATE 02/13/87
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
FLIGHT: 3/3
MDAC ID: 20406
ABORT: 3/3

ITEM: MLG EXTEND / RETRACT HYD STRUT ACT
FAILURE MODE: CAVITATION ORIFICE BLOCKED

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR COMPARTMENT
2) MAIN LANDING GEAR
3) MAIN LANDING GEAR EXTEND / RETRACT HYDRAULIC STRUT ACTUATOR
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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
IF THE CAVITATION ORIFICE IS BLOCKED THE HYDRAULIC PRESSURE IS
BLOCKED TO THE GEAR, BUT THE GEAR WILL DEPLOY DUE TO GRAVITY AND
AIRFLOW.

REFERENCES: VO70-573001

REPORT DATE 02/13/87 C-92
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86

HIGHEST CRITICALITY: HDW/FUNC

SUBSYSTEM: LANDING/DECELERATION SYSTEMS
FLIGHT: 3/3

MDAC ID: 20407
ABORT: 3/3

ITEM: MLG EXTEND / RETRACT HYD STRUT ACT

FAILURE MODE: CAVITATION CHECK VALVE - OPEN / CLOSED

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR COMPARTMENT
2) MAIN LANDING GEAR
3) MAIN LANDING GEAR EXTEND / RETRACT HYDRAULIC STRUT ACTUATOR

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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
THE HYDRAULIC PRESSURE WILL BE BLOCKED TO THE GEAR, BUT THE GEAR WILL DEPLOY DUE TO GRAVITY AND AIRFLOW.

REFERENCES: VO70-573001

REPORT DATE 02/13/87 C-93
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/3
MDAC ID: 20407  ABORT: 3/3

ITEM: MLG EXTEND / RETRACT HYD STRUT ACT
FAILURE MODE: CAVITATION CHECK VALVE - OPEN / CLOSED

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR COMPARTMENT
2) MAIN LANDING GEAR
3) MAIN LANDING GEAR EXTEND / RETRACT HYDRAULIC STRUT ACTUATOR
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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
THE HYDRAULIC PRESSURE WILL BE BLOCKED TO THE GEAR, BUT THE GEAR WILL DEPLOY DUE TO GRAVITY AND AIRFLOW.

REFERENCES: VO70-573001

REPORT DATE 02/13/87  C-94
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS FLIGHT: 3/3
MDAC ID: 20408 ABORT: 3/3

ITEM: MLG EXTEND / RETRACT HYD STRUT ACT
FAILURE MODE: CHECK VALVE - OPEN / CLOSED

LEAD ANALYST: J. COMPTON SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR COMPARTMENT
2) MAIN LANDING GEAR
3) MAIN LANDING GEAR EXTEND / RETRACT HYDRAULIC STRUT ACTUATOR
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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
THE CHECK VALVE HELPS REGULATE THE HYDRAULIC FLUID. IT IS NOT NEEDED FOR DEPLOYMENT.

REFERENCES: VO70-573001

REPORT DATE 02/13/87 C-95
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20408

HIGHEST CRITICALITY

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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
The check valve helps regulate the hydraulic fluid. It is not needed for deployment.

REFERENCES: VO70-573001

REPORT DATE 02/13/87
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/3
MDAC ID: 20409  ABORT: 3/3

ITEM: MLG EXTEND / RETRACT HYD STRUT ACT
FAILURE MODE: HIGH PRESSURE RELIEF VALVE - OPEN

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR COMPARTMENT
2) MAIN LANDING GEAR
3) MAIN LANDING GEAR EXTEND / RETRACT HYDRAULIC STRUT ACTUATOR

CRITICALITIES

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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: BROKEN SPRING

EFFECTS/RATIONALE:
THE RELIEF VALVE HELPS REGULATE THE FLUID FLOW DURING LANDING GEAR EXTENSION. THE LANDING GEAR WILL STILL DEPLOY.

REFERENCES: VO70-573001

REPORT DATE 02/13/87  C-97
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20410

ABORT: 3/3
FLIGHT: 3/3

ITEM: MLG EXTEND / RETRACT HYD STRUT ACT
FAILURE MODE: HIGH PRESSURE RELIEF VALVE - CLOSED

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR COMPARTMENT
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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
THE RELIEF VALVE HELPS REGULATE THE FLUID FLOW DURING LANDING GEAR EXTENSION. THE LANDING GEAR WILL STILL DEPLOY.

REFERENCES: VO70-573001

REPORT DATE 02/13/87  C-98
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC  FLIGHT: 3/3
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  ABORT: 3/3
MDAC ID: 20411

ITEM: MLG EXTEND / RETRACT HYD STRUT ACT
FAILURE MODE: LOW PRESSURE RELIEF VALVE - OPEN

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR COMPARTMENT
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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
INTERNAL BYPASS OF FLUID RELIEVES PRESSURE WHEN THE GEAR IS RETRACTED.

REFERENCES: VO70-573001

REPORT DATE 02/13/87  C-99
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/3
MDAC ID: 20412  ABORT: 3/3

ITEM: MLG EXTEND / RETRACT HYD STRUT ACT
FAILURE MODE: SHUTTLE VALVE READY (OPEN)

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR COMPARTMENT
2) MAIN LANDING GEAR
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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
THE NORMAL POSITION FOR INFLIGHT OPERATIONS IS OPEN.

REFERENCES: VO70-573001
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20413

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 1/1
ABORT: 1/1

ITEM: MLG EXTEND / RETRACT HYD STRUT ACT
FAILURE MODE: SHUTTLE VALVE (CLOSED)

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: BROKEN SPRING, CONTAMINATION

EFFECTS/RATIONALE:
THE LANDING GEAR CANNOT EXTEND IF THE VALVE IS CLOSED. HYDRAULIC FLUID CANNOT GET OUT OF THE BACK SIDE OF THE PISTON

REFERENCES: VO70-573001

REPORT DATE 02/13/87  C-101
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20414

HIGHEST CRITICALITY
HDW/FUNC: 1/1
FLIGHT: 1/1
ABORT: 1/1

ITEM: MLG EXTEND / RETRACT HYD STRUT ACT
FAILURE MODE: TIMING ORIFICE BLOCKED

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR COMPARTMENT
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LOCATION: MAIN LANDING GEAR PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
THE TIMING ORIFICE IS USED TO HELP REGULATE THE FLOW OF HYDRAULIC
FLUID DURING LANDING GEAR DEPLOYMENT. IF THE ORIFICE IS BLOCKED
THE GEAR WILL NOT EXTEND OR THE TIME OF EXTENSION WILL BE
INCREASED.

REFERENCES: VO70-573001

REPORT DATE 02/13/87 C-102
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20415

ITEM: MLG EXTEND / RETRACT HYD STRUT ACT
FAILURE MODE: LOW PRESSURE RELIEF – OPEN / CLOSED

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR COMPARTMENT
2) MAIN LANDING GEAR
3) MAIN LANDING GEAR EXTEND / RETRACT HYDRAULIC STRUT ACTUATOR

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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
THE GEAR WILL STILL DEPLOY. THE RELIEF VALVE WILL LIMIT THE FLUID LOSS IF THE LEAK IS ON THE GROSS SIDE

REFERENCES: VO70-573001

REPORT DATE 02/13/87  C-103
INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  
MDAC ID: 20415

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BREAKDOWN HIERARCHY:
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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
THE GEAR WILL STILL DEPLOY. THE RELIEF VALVE WILL LIMIT THE FLUID LOSS IF THE LEAK IS ON THE GROSS SIDE

REFERENCES: VO70-573001

REPORT DATE 02/13/87 C-104
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY: HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 2/1R
MDAC ID: 20416  ABORT: 2/1R

ITEM: MLG EXTEND / RETRACT HYD STRUT ACT
FAILURE MODE: TEMPERATURE TRANSDUCER BOSS LEAK

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR COMPARTMENT
2) MAIN LANDING GEAR
3) MAIN LANDING GEAR EXTEND / RETRACT HYDRAULIC STRUT ACTUATOR
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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC287-0033-0007

CAUSES: SEAL DAMAGE

EFFECTS/RATIONALE:
POSSIBLE LOSS OF HYDRAULIC SYSTEM 1 AND THE GEAR WILL NOT EXTEND HYDRAULICALLY. THE GEAR WILL EXTEND BY GRAVITY AND AIRFLOW.

REFERENCES: VO70-573001

REPORT DATE 02/13/87 C-105
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86

SUBSYSTEM: LANDING/DECELERATION SYSTEMS

MDAC ID: 20501

HIGHEST CRITICALITY HDW/FUNC

FLIGHT: 1/1
ABORT: 1/1

ITEM: DOOR EXTEND / RETRACT MECH

FAILURE MODE: STRUCTURAL FAILURE, PHYSICAL BINDING / JAMMING / BREAKING

LEAD ANALYST: J. COMPTON

SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) MAIN LANDING GEAR COMPARTMENT
3) MAIN LANDING GEAR DEPLOY MECHANISM
4) DOOR EXTEND / RETRACT MECHANISM

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LOCATION: MAIN LANDING GEAR

PART NUMBER: V070-510426

CAUSES: PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
DOORS WON'T POSSIBLY OPEN. GEAR WILL NOT DEPLOY IN TIME FOR LANDING

REFERENCES: V070-510201, 13.1 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87 C-106
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20501

HDW/FUNC
FLIGHT: 1/1
ABORT: 1/1

ITEM: DOOR EXTEND / RETRACT MECH
FAILURE MODE: STRUCTURAL FAILURE, PHYSICAL BINDING / JAMMING / BREAKING

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) MAIN LANDING GEAR COMPARTMENT
3) MAIN LANDING GEAR DEPLOY MECHANISM
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LOCATION: MAIN LANDING GEAR
PART NUMBER: V070-510426

CAUSES: PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
DOORS WON'T POSSIBLY OPEN. GEAR WILL NOT DEPLOY IN TIME FOR LANDING

REFERENCES: V070-510201, 13.1 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87 C-107
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 20501  ABORT: 1/1

ITEM: DOOR EXTEND / RETRACT MECH
FAILURE MODE: STRUCTURAL FAILURE, PHYSICAL BINDING / JAMMING / BREAKING

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) MAIN LANDING GEAR COMPARTMENT
3) MAIN LANDING GEAR DEPLOY MECHANISM
4) DOOR EXTEND / RETRACT MECHANISM

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LOCATION: MAIN LANDING GEAR
PART NUMBER: V070-510426

CAUSES: PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
DOORS WON'T POSSIBLY OPEN. GEAR WILL NOT DEPLOY IN TIME FOR LANDING

REFERENCES: V070-510201, 13.1 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87  C-108
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC  FLIGHT: 1/1  ABORT: 1/1

SUBSYSTEM: LANDING/DECELERATION SYSTEMS  MDAC ID: 20501

ITEM: DOOR EXTEND / RETRACT MECH  FAILURE MODE: STRUCTURAL FAILURE, PHYSICAL BINDING / JAMMING / BREAKING

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) MAIN LANDING GEAR COMPARTMENT
3) MAIN LANDING GEAR DEPLOY MECHANISM
4) DOOR EXTEND / RETRACT MECHANISM
5)
6)
7)
8)
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LOCATION: MAIN LANDING GEAR
PART NUMBER: V070-510426

CAUSES: PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
DOORS WONT POSSIBLY OPEN. GEAR WILL NOT DEPLOY IN TIME FOR LANDING

REFERENCES: V070-510201, 13.1 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87  C-109
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20501
FLIGHT: 1/1
ABORT: 1/1

ITEM: DOOR EXTEND / RETRACT MECH
FAILURE MODE: STRUCTURAL FAILURE, PHYSICAL BINDING / JAMMING / BREAKING

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) MAIN LANDING GEAR COMPARTMENT
3) MAIN LANDING GEAR DEPLOY MECHANISM
4) DOOR EXTEND / RETRACT MECHANISM

HIGHEST CRITICALITY HDW/FUNC

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LOCATION: MAIN LANDING GEAR
PART NUMBER: V070-510426

CAUSES: PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
DOORS WON'T POSSIBLY OPEN. GEAR WILL NOT DEPLOY IN TIME FOR LANDING

REFERENCES: V070-510201, 13.1 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87 C-110
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86

SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20501

ITEM: DOOR EXTEND / RETRACT MECH
FAILURE MODE: STRUCTURAL FAILURE, PHYSICAL BINDING / JAMMING / BREAKING

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) MAIN LANDING GEAR COMPARTMENT
3) MAIN LANDING GEAR DEPLOY MECHANISM
4) DOOR EXTEND / RETRACT MECHANISM

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LOCATION: MAIN LANDING GEAR
PART NUMBER: V070-510426

CAUSES: PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
DOORS WON'T POSSIBLY OPEN. GEAR WILL NOT DEPLOY IN TIME FOR LANDING

REFERENCES: VO70-510201, 13.1 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87
**INDEPENDENT ORBITER ASSESSMENT**

**ORBITER SUBSYSTEM ANALYSIS WORKSHEET**

**DATE:** 11/28/86  
**SUBSYSTEM:** LANDING/DECELERATION SYSTEMS  
**MDAC ID:** 20601  
**HIGHEST CRITICALITY:** HDW/FUNC  
**FLIGHT:** 3/3  
**ABORT:** 3/3  

**ITEM:** DOOR OVER-CENTER BUNGEE  
**FAILURE MODE:** STRUCTURAL FAILURE - BROKEN ROD  

**LEAD ANALYST:** J. COMPTON  
**SUBSYS LEAD:** W. WEISSINGER  

**BREAKDOWN HIERARCHY:**
1) MAIN LANDING GEAR  
2) MAIN LANDING GEAR COMPARTMENT  
3) MAIN LANDING GEAR DEPLOY MECHANISM  
4) DOOR OVER-CENTER BUNGEE  
5)  
6)  
7)  
8)  
9)  

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**REDUNDANCY SCREENS:**  
A [NA ]  
B [NA ]  
C [NA ]  

**LOCATION:** MAIN LANDING GEAR  
**PART NUMBER:** VO70-510440  

**CAUSES:** PIECE-PART STRUCTURAL FAILURE, VIBRATION, STRESS.  

**EFFECTS/RATIONALE:**  
DOOR MAY NOT STAY OPEN ONCE THE LANDING GEAR IS DEPLOYED  

**REFERENCES:** VO70-510201, 13.1 SSSH, JSC 12770 VOL. 10D  

**REPORT DATE 02/13/87**  
**C-112**
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 20601  ABORT: 1/1

ITEM: MLG UPLOCK HOOK ASSEMBLY
FAILURE MODE: STRUCTURAL FAILURE, PHYSICAL BINDING / JAMMING

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) MAIN LANDING GEAR COMPARTMENT
3) MAIN LANDING GEAR DEPLOY MECHANISM
4) GEAR UPLOCK HOOK ASSEMBLY
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LOCATION: MAIN LANDING GEAR
PART NUMBER: V070-510301

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION, STRESS, DEBRIS.

EFFECTS/RATIONALE:
GEAR WILL NOT DEPLOY.

REFERENCES: V070-510201, 13.1 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87  C-113
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20701

HIGHEST CRITICALITY
FLIGHT: 1/1
ABORT: 1/1

ITEM: MLG UPLOCK HOOK ASSEMBLY
FAILURE MODE: STRUCTURAL FAILURE, PHYSICAL BINDING / JAMMING

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) MAIN LANDING GEAR COMPARTMENT
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LOCATION: MAIN LANDING GEAR

PART NUMBER: V070-510301

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION, STRESS, DEBRIS.

EFFECTS/RATIONALE:
GEAR WILL NOT DEPLOY.

REFERENCES: V070-510201, 13.1 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87 C-114
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 20701  ABORT: 1/1

ITEM: MLG UPSLOCK HOOK ASSEMBLY
FAILURE MODE: STRUCTURAL FAILURE, PHYSICAL BINDING / JAMMING

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) MAIN LANDING GEAR COMPARTMENT
3) MAIN LANDING GEAR DEPLOY MECHANISM
4) GEAR UPSLOCK HOOK ASSEMBLY
5) 6) 7) 8) 9)

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LOCATION: MAIN LANDING GEAR
PART NUMBER: V070-510301

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION, STRESS, DEBRIS.

EFFECTS/RATIONALE:
GEAR WILL NOT DEPLOY.

REFERENCES: V070-510201, 13.1 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87  C-115
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 20701

ITEM: MLG UPLOCK HOOK ASSEMBLY
FAILURE MODE: STRUCTURAL FAILURE, PHYSICAL BINDING / JAMMING

LEAD ANALYST: J. COMPTON    SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) MAIN LANDING GEAR COMPARTMENT
3) MAIN LANDING GEAR DEPLOY MECHANISM
4) GEAR UPLOCK HOOK ASSEMBLY
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LOCATION: MAIN LANDING GEAR
PART NUMBER: V070-510301

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION, STRESS, DEBRIS.

EFFECTS/RATIONALE:
GEAR WILL NOT DEPLOY.

REFERENCES:  V070-510201, 13.1 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87    C-116
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20701

HIGHEST CRITICALITY
HDW/FUNC

ITEM: MLG UPLOCK HOOK ASSEMBLY
FAILURE MODE: STRUCTURAL FAILURE, PHYSICAL BINDING / JAMMING

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) MAIN LANDING GEAR COMPARTMENT
3) MAIN LANDING GEAR DEPLOY MECHANISM
4) GEAR UPLOCK HOOK ASSEMBLY

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LOCATION: MAIN LANDING GEAR
PART NUMBER: V070-510301

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION, STRESS, DEBRIS.

EFFECTS/RATIONALE:
GEAR WILL NOT DEPLOY.

REFERENCES: V070-510201, 13.1 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20701
FLIGHT: 1/1
ABORT: 1/1

ITEM: MLG UPLOCK HOOK ASSEMBLY
FAILURE MODE: STRUCTURAL FAILURE, PHYSICAL BINDING / JAMMING

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

HIERARCHY:
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2) MAIN LANDING GEAR COMPARTMENT
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LOCATION: MAIN LANDING GEAR
PART NUMBER: V070-510301

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION, STRESS, DEBRIS.

EFFECTS/RATIONALE:
GEAR WILL NOT DEPLOY.

REFERENCES: V070-510201, 13.1 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87  C-118
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20901

ITEM: DOOR HOOK ACTUATION LINKAGE
FAILURE MODE: STRUCTURAL FAILURE, PHYSICAL BINDING / JAMMING

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) MAIN LANDING GEAR COMPARTMENT
3) MAIN LANDING GEAR DEPLOY MECHANISM
4) DOOR HOOK ACTUATION LINKAGE

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LOCATION: MAIN LANDING GEAR
PART NUMBER: ME162-0009, V070-510201

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION, STRESS, DEBRIS.

EFFECTS/RATIONALE:
GEAR WILL NOT EXTEND IN TIME FOR LANDING. IF ANY HOOK GETS DISENGAGED, THE DOOR WILL PROBABLY CRACK OPEN DURING ENTRY RESULTING IN THE LOSS OF TILES AND A POSSIBLE BURN THROUGH.

REFERENCES: V070-510201, 13.1 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86

SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20901

ITEM: DOOR HOOK ACTUATION LINKAGE
FAILURE MODE: STRUCTURAL FAILURE, PHYSICAL BINDING / JAMMING

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) MAIN LANDING GEAR COMPARTMENT
3) MAIN LANDING GEAR DEPLOY MECHANISM
4) DOOR HOOK ACTUATION LINKAGE

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LOCATION: MAIN LANDING GEAR
PART NUMBER: ME162-0009, V070-510201

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION, STRESS, DEBRIS.

EFFECTS/RATIONALE:
GEAR WILL NOT EXTEND IN TIME FOR LANDING. IF ANY HOOK GETS DISENGAGED, THE DOOR WILL PROBABLY CRACK OPEN DURING ENTRY RESULTING IN THE LOSS OF TILES AND A POSSIBLE BURN THROUGH.

REFERENCES: V070-510201, 13.1 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87 C-120
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20901

HIGHEST CRITICALITY
HDW/func
FLIGHT: 1/1
ABORT: 1/1

ITEM: DOOR HOOK ACTUATION LINKAGE
FAILURE MODE: STRUCTURAL FAILURE, PHYSICAL BINDING / JAMMING

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) MAIN LANDING GEAR COMPARTMENT
3) MAIN LANDING GEAR DEPLOY MECHANISM
4) DOOR HOOK ACTUATION LINKAGE

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LOCATION: MAIN LANDING GEAR
PART NUMBER: ME162-0009, V070-510201

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION, STRESS, DEBRIS.

EFFECTS/RATIONALE:
GEAR WILL NOT EXTEND IN TIME FOR LANDING. IF ANY HOOK GETS DISENGAGED, THE DOOR WILL PROBABLY CRACK OPEN DURING ENTRY RESULTING IN THE LOSS OF TILES AND A POSSIBLE BURN THROUGH.

REFERENCES: V070-510201, 13.1 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87 C-121
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20901

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 1/1
ABORT: 1/1

ITEM: DOOR HOOK ACTUATION LINKAGE
FAILURE MODE: STRUCTURAL FAILURE, PHYSICAL BINDING / JAMMING

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
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2) MAIN LANDING GEAR COMPARTMENT
3) MAIN LANDING GEAR DEPLOY MECHANISM
4) DOOR HOOK ACTUATION LINKAGE
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LOCATION: MAIN LANDING GEAR
PART NUMBER: ME162-0009, V070-510201

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION, STRESS, DEBRIS.

EFFECTS/RATIONALE:
GEAR WILL NOT EXTEND IN TIME FOR LANDING. IF ANY HOOK GETS DISENGAGED, THE DOOR WILL PROBABLY CRACK OPEN DURING ENTRY RESULTING IN THE LOSS OF TILES AND A POSSIBLE BURN THROUGH.

REFERENCES: V070-510201, 13.1 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87 C-122
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 20901
FLIGHT: 1/1
ABORT: 1/1

ITEM: DOOR HOOK ACTUATION LINKAGE
FAILURE MODE: STRUCTURAL FAILURE, PHYSICAL BINDING / JAMMING

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
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2) MAIN LANDING GEAR COMPARTMENT
3) MAIN LANDING GEAR DEPLOY MECHANISM
4) DOOR HOOK ACTUATION LINKAGE
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LOCATION: MAIN LANDING GEAR
PART NUMBER: ME162-0009, V070-510201

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION, STRESS, DEBRIS.

EFFECTS/RATIONALE:
GEAR WILL NOT EXTEND IN TIME FOR LANDING. IF ANY HOOK GETS
DISENGAGED, THE DOOR WILL PROBABLY CRACK OPEN DURING ENTRY
RESULTING IN THE LOSS OF TILES AND A POSSIBLE BURN THROUGH.

REFERENCES: V070-510201, 13.1 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87 C-123
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
HIGHEST CRITICALITY

MDAC ID: 20901
FLIGHT: 1/1
ABORT: 1/1

ITEM: DOOR HOOK ACTUATION LINKAGE
FAILURE MODE: STRUCTURAL FAILURE, PHYSICAL BINDING / JAMMING

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
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LOCATION: MAIN LANDING GEAR
PART NUMBER: ME162-0009, V070-510201

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION, STRESS, DEBRIS.

EFFECTS/RATIONALE:
GEAR WILL NOT EXTEND IN TIME FOR LANDING. IF ANY HOOK GETS
DISENGAGED, THE DOOR WILL PROBABLY CRACK OPEN DURING ENTRY
RESULTING IN THE LOSS OF TILES AND A POSSIBLE BURN THROUGH.

REFERENCES: VO70-510201, 13.1 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87 C-124
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS FLIGHT: 2/1R
MDAC ID: 21003 ABORT: 2/1R

ITEM: MLG UPLOCK ACTUATOR
FAILURE MODE: LEAK EXTERNAL

LEAD ANALYST: J. COMPTON SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR COMPARTMENT
2) MAIN LANDING GEAR
3) MAIN LANDING GEAR UPLOCK MECHANISM
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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC287-0033-0002

CAUSES: O-RING SEAL DAMAGE, VIBRATION, LOOSE BOLTS

EFFECTS/RATIONALE:
POSSIBLE LOSS OF HYDRAULIC SYSTEM 1 AND THE GEAR WILL NOT RELEASE HYDRAULICALLY. THE PYRO BACKUP WILL RELEASE THE GEAR ONE SECOND AFTER THE COMMAND TO DEPLOY IF THE LANDING GEAR HOOK IS NOT OPEN

REFERENCES: VO70-573001

REPORT DATE 02/13/87 C-125
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 21004

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 2/1R
ABORT: 2/1R

ITEM: MLG UPLOCK ACTUATOR
FAILURE MODE: BROKEN ROD / LINKAGE

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR COMPARTMENT
2) MAIN LANDING GEAR
3) MAIN LANDING GEAR UPLOCK MECHANISM
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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC287-0033-0002

CAUSES: STRESS / FRACTURE

EFFECTS/RATIONALE:
The gear will not release hydraulically. The pyro backup will release the gear one second after the command to deploy if the landing gear hook is not open.

REFERENCES: VO70-573001

REPORT DATE 02/13/87 C-126
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86

HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 21005
FLIGHT: 2/1R
ABORT: 2/1R

ITEM: MLG UPLOCK ACTUATOR
FAILURE MODE: RUPTURE

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR COMPARTMENT
2) MAIN LANDING GEAR
3) MAIN LANDING GEAR UPLOCK MECHANISM
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LOCATION: MAIN LANDING GEAR

PART NUMBER: MC287-0033-0002

CAUSES: MATERIAL DEFECT

EFFECTS/RATIONALE:
HYDRAULIC SYSTEM 1 WILL BE LOST AND THE GEAR WILL NOT RELEASE HYDRAULICALLY. THE PYRO BACKUP WILL RELEASE THE GEAR ONE SECOND AFTER THE COMMAND TO DEPLOY IF THE LANDING GEAR HOOK IS NOT OPEN.

REFERENCES: VO70-573001

REPORT DATE 02/13/87 C-127
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/3
MDAC ID: 21006  ABORT: 3/3

ITEM: MLG UPLOCK ACTUATOR
FAILURE MODE: LEAK - INTERNAL PISTON

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR COMPARTMENT
2) MAIN LANDING GEAR
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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC287-0033-0002

CAUSES: SEAL DAMAGE

EFFECTS/RATIONALE:  THE HYDRAULIC PUMP WILL COMPENSATE FOR THE LOSS OF FLUID.

REFERENCES: VO70-573001

REPORT DATE 02/13/87  C-128
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86

SUBSYSTEM: LANDING/DECELERATION SYSTEMS

MDAC ID: 21101

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 1/1

ITEM: MLG PYRO UPLOCK RELEASE
FAILURE MODE: INADVERTENT FIRING

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) MAIN LANDING GEAR COMPARTMENT
3) MAIN LANDING GEAR DEPLOY MECHANISM
4) MAIN LANDING GEAR PYRO UPLOCK RELEASE

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LOCATION: MAIN LANDING GEAR

PART NUMBER: MC325-0019-0001

CAUSES: THERMAL, ERRONEOUS SIGNAL

EFFECTS/RATIONALE:
LANDING GEAR WILL EXTEND CAUSING LOSS OF THE VEHICLE, DURING ORBIT RESCUE WILL BE REQUIRED.

REFERENCES: V070-510201, 13.1 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87  C-129
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 21102  ABORT: 1/1

ITEM: MLG PYRO UPLOCK RELEASE
FAILURE MODE: FAIL TO FIRE

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) MAIN LANDING GEAR COMPARTMENT
3) MAIN LANDING GEAR DEPLOY MECHANISM
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LOCATION: MAIN LANDING GEAR
PART NUMBER: MC325-0019-0001

CAUSES: ELECTRICAL FAILURE, CARTRIDGE FAILURE

EFFECTS/RATIONALE:
LANDING GEAR WILL NOT LOWER, CAUSING PROBABLE LOSS OF CREW AND VEHICLE DURING LANDING. THIS IS A BACKUP SYSTEM, IT WILL NOT BE USED UNLESS THE PRIMARY SYSTEM FAILS.

REFERENCES: VO70-510201, 13.1 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87  C-130
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 21301

ITEM: MLG DOOR BOOSTER BUNGEE
FAILURE MODE: FAILS TO FUNCTION

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR
2) MAIN LANDING GEAR COMPARTMENT
3) MAIN LANDING GEAR RETAINING ASSEMBLY
4) MAIN LANDING GEAR DEPLOY MECHANISM
5) MAIN LANDING GEAR DOOR BOOSTER BUNGEE

CRITICALITIES

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LOCATION: MAIN LANDING GEAR
PART NUMBER: V070-510101

CAUSES: FAILURE OF LINKAGE OR SPRING, DEBRIS LOCKS UP SYSTEM

EFFECTS/RATIONALE:
MAIN GEAR FAILS TO EXTEND IN TIME FOR LANDING

REFERENCES: V070-510201, 13.1 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87  C-131
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/3
MDAC ID: 30101  ABORT: 3/3

ITEM: ANTI-SKID SELECT SWITCH
FAILURE MODE: SWITCH MALFUNCTION

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEMS
3) ANTI SKID SELECT SWITCH
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CRITICALITIES

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LOCATION: ORBITER CABIN AREA, FLIGHT CONTROL AREA

PART NUMBER: ME452-0102-7201

CAUSES: BROKEN CONNECTOR, CORROSION

EFFECTS/RATIONALE:
NONE; REDUNDANT SWITCH. EVEN IF REDUNDANCY IS LOST, THE VEHICLE CAN SAFELY BE LANDED IN THE MANUAL MODE.

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87  C-132
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 2/1R
MDAC ID: 30102  ABORT: 2/1R

ITEM: BRAKE PEDAL TRANSDUCER  FAILURE MODE: NO TRANSDUCER DEFORMATION

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) BRAKE PEDAL ASSEMBLY
3) BRAKE PEDAL TRANSDUCER ASSEMBLY
4) BRAKE PEDAL TRANSDUCER
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LOCATION: ORBITER CABIN AREA, FLIGHT CONTROL AREA
PART NUMBER: 40-899-1, MC621-0055

CAUSES: BINDING OR BROKEN LINKAGE

EFFECTS/RATIONALE:
NO SIGNAL OUTPUT FROM TRANSDUCER, THEREFORE NO BRAKING FOR THAT SIDE OF THE VEHICLE. THE OTHER SIDE OF THE VEHICLE HAS A REDUNDANT SYSTEM (THE OTHER PILOT).

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/1R
MDAC ID: 30103  ABORT: 3/1R

ITEM: BRAKE PEDAL TRANSDUCER
FAILURE MODE: SHORT / OPEN (LVDT)

LEAD ANALYST: J. COMPTON   SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) BRAKE PEDAL ASSEMBLY
3) BRAKE PEDAL TRANSDUCER ASSEMBLY
4) BRAKE PEDAL TRANSDUCER
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LOCATION: ORBITER CABIN AREA, FLIGHT CONTROL AREA
PART NUMBER: 40-899-1, MC621-0055

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
LOSS OF ONE LVDT WILL RESULT IN SLIGHT LOSS IN BRAKING EFFICIENCY FROM THAT BRAKE CONTROL. THE OTHER BRAKE CONTROL COULD COMPENSATE.

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87   C-134
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 30104

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 1/1
ABORT: 1/1

ITEM: BRAKE PEDAL TRANSDUCER
FAILURE MODE: SHORT / CLOSED (LVDT)

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) BRAKE PEDAL ASSEMBLY
3) BRAKE PEDAL TRANSDUCER ASSEMBLY
4) BRAKE PEDAL TRANSDUCER
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LOCATION: ORBITER CABIN AREA, FLIGHT CONTROL AREA
PART NUMBER: 40-899-1, MC621-0055

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
CLOSED LVDT WILL RESULT IN HALF-WHEEL LOCKUP WITH ANTI-SKID OFF
AT TOUCHDOWN CAUSING POSSIBLE LOSS OF THE VEHICLE. ANTI-SKID
WILL PROVIDE TOUCHDOWN PROTECTION IF IT IS ON

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87  C-135
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86

SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 30105

HIGHEST CRITICALITY HDW/FUNC

FLIGHT: 1/1
ABORT: 1/1

ITEM: BRAKE CIRCUIT
FAILURE MODE: OPEN OR SHORT CIRCUIT RESULTING IN AN OPEN VALVE

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEM
3) BRAKE / SKID CONTROL BOX
4) BRAKE CIRCUIT
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LOCATION: ORBITER CABIN AREA, FLIGHT CONTROL AREA
PART NUMBER: 42-40314 HYDRO-AIRE, MC621-0055

CAUSES: FAILURE OF A RESISTOR, TRANSDUCER, BROKEN WIRE, ETC...

EFFECTS/RATIONALE:
BRAKE PRESSURE IS APPLIED TO ONE WHEEL AT TOUCHDOWN CAUSING A LOSS OF THE ANTI-SKID PROTECTION AND BRAKE / WHEEL / TIRE DAMAGE. POSSIBLE LOSS OF CONTROL DURING ROLLOUT.

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D, ORBITER BRAKE AD HOC COMMITTEE VOL.I

REPORT DATE 02/13/87 C-136
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/1R
MDAC ID: 30106  ABORT: 3/1R

ITEM: BRAKE CIRCUIT
FAILURE MODE: OPEN OR SHORT CIRCUIT RESULTING IN A CLOSED VALVE

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEM
3) BRAKE / SKID CONTROL BOX
4) BRAKE CIRCUIT
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LOCATION: ORBITER CABIN AREA, FLIGHT CONTROL AREA
PART NUMBER: 42-40314 HYDRO-AIRE, MC621-0055

CAUSES: FAILURE OF A RESISTOR, TRANSDUCER, BROKEN WIRE, ETC..

EFFECTS/RATIONALE:
LOSS OF ONE-HALF OF THE BRAKE PRESSURE TO ONE WHEEL.

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D, ORBITER BRAKE AD HOC COMMITTEE VOL.I

REPORT DATE 02/13/87  C-137
INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET  

DATE: 11/28/86  
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  
MDAC ID: 30107  

HIGHEST CRITICALITY HDW/FUNC  
FLIGHT: 3/3  
ABORT: 3/3  

ITEM: SKID CIRCUIT  
FAILURE MODE: OPEN OR SHORT CIRCUIT RESULTING IN AN OPEN VALVE  

LEAD ANALYST: J. COMPTON  
SUBSYS LEAD: W. WEISSINGER  

BREAKDOWN HIERARCHY:  
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS  
2) SKID CONTROL SYSTEM  
3) BRAKE / SKID CONTROL BOX  
4) SKID CIRCUIT  
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LOCATION: ORBITER CABIN AREA, FLIGHT CONTROL AREA  
PART NUMBER: 42-40314 HYDRO-AIRE, MC621-0055  

CAUSES: FAILURE OF A RESISTOR, TRANSDUCER, BROKEN WIRE, ETC.  

EFFECTS/RATIONALE:  
WITH THE ANTI-SKID ON, THE BAD CIRCUIT WILL BE DESELECTED  
RESULTING IN REDUCED BRAKING.  

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D, ORBITER BRAKE AD HOC COMMITTEE VOL.I  

REPORT DATE 02/13/87 C-138
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86

SUBSYSTEM: LANDING/DECELERATION SYSTEMS

MDAC ID: 30108

HIGHEST CRITICALITY

FLIGHT: 3/3
ABORT: 3/3

ITEM: SKID CIRCUIT

FAILURE MODE: OPEN OR SHORT CIRCUIT RESULTING IN A CLOSED VALVE

LEAD ANALYST: J. COMPTON

SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEM
3) BRAKE / SKID CONTROL BOX
4) SKID CIRCUIT
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CRITICALITIES

FLIGHT PHASE HDW/FUNC ABORT HDW/FUNC
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LIFTOFF: 3/3 TAL: 3/3
ON ORBIT: 3/3 AOA: 3/3
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LANDING/SAFING: 3/3


LOCATION: ORBITER CABIN AREA, FLIGHT CONTROL AREA

PART NUMBER: 42-40314 HYDRO-AIRE, MC621-0055

CAUSES: FAILURE OF A RESISTOR, TRANSDUCER, BROKEN WIRE, ETC..

EFFECTS/RATIONALE:
WITH THE ANTI-SKID ON, THE BAD CIRCUIT WILL BE DESELECTED
RESULTING IN REDUCED BRAKING.

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D, ORBITER BRAKE AD HOC COMMITTEE VOL.I

REPORT DATE 02/13/87  C-139
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 30109

ITEM: ANTI-SKID FAIL CIRCUIT
FAILURE MODE: OPEN OR SHORT CIRCUIT

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEM
3) BRAKE / SKID CONTROL BOX
4) ANTI-SKID FAIL CIRCUIT
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LOCATION: ORBITER CABIN AREA, FLIGHT CONTROL AREA
PART NUMBER: 42-40314 HYDRO-AIRE, MC621-0055

CAUSES: FAILURE OF A RESISTOR, TRANSDUCER, BROKEN WIRE, ETC.

EFFECTS/RATIONALE:
CIRCUIT TO DETECT FAILURE MAY SHOW FAILURE WHEN THERE ISN'T ONE OR WON'T SHOW ONE WHEN THERE IS ONE. EITHER WAY, THIS BY ITSELF IS NOT A PROBLEM. COULD DESELECT A GOOD CIRCUIT OR VALVE RESULTING IN REDUCED BRAKING CAPABILITY.

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D.
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 30109
HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: ANTI-SKID FAIL CIRCUIT
FAILURE MODE: OPEN OR SHORT CIRCUIT

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEM
3) BRAKE / SKID CONTROL BOX
4) ANTI-SKID FAIL CIRCUIT
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LOCATION: ORBITER CABIN AREA, FLIGHT CONTROL AREA
PART NUMBER: 42-40314 HYDRO-AIRE, MC621-0055

CAUSES: FAILURE OF A RESISTOR, TRANSDUCER, BROKEN WIRE, ETC..

EFFECTS/RATIONALE:
CIRCUIT TO DETECT FAILURE MAY SHOW FAILURE WHEN THERE ISN'T ONE
OR WON'T SHOW ONE WHEN THERE IS ONE. EITHER WAY, THIS BY ITSELF
IS NOT A PROBLEM. COULD DESELECT A GOOD CIRCUIT OR VALVE
RESULTING IN REDUCED BRAKING CAPABILITY.

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D.

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<th>CAUSES:</th>
<th>BROKEN SPRING, CONTAMINATION</th>
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<tr>
<th>EFFECTS/RATIONALE:</th>
<th>3000PSI HYDRAULICS (S/B 1500PSI) BEING PROVIDED CAUSING HIGHER MODULATION ON BRAKING SYSTEM - TWO WHEELS. ON ABORT, EXTRA WEIGHT WILL CAUSE WHEEL BRAKE DOWN AND EXTRA PRESSURE.</th>
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REPORT DATE 02/13/87 C-142
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 30111

ITEM: HYD PRESS REG (SYS 2 & 3)
FAILURE MODE: FAILS CLOSED

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEM
3) BRAKE / SKID CONTROL MODULE
4) HYDRAULIC PRESSURE REGULATOR
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LOCATION: MAIN LANDING GEAR COMPARTMENT
PART NUMBER: 48-043, MC621-0055

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
NO EFFECT - SWITCHING VALVES WILL TRANSFER TO STANDBY SYSTEM.
THE FAILURE CAN BE DETECTED ON ORBIT WITH THE CIRC PUMPS OPERATING. SEE MDAC IOA # 30129

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D, ORBITER BRAKE AD HOC COMMITTEE VOL.I

REPORT DATE 02/13/87 C-143
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS FLIGHT: 2/1R
MDAC ID: 30112 ABORT: 2/1R

ITEM: INLET FILTER, HYD MODULE ASSY
FAILURE MODE: CLOGGED FILTER (SYSTEM 2 & 3)

LEAD ANALYST: J. COMPTON SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEM
3) BRAKE / SKID CONTROL MODULE
4) HYDRAULIC MODULE ASSEMBLY
5) INLET FILTER
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LOCATION: MAIN LANDING GEAR COMPARTMENT
PART NUMBER: 33-017 HYDRO-AIRE, MC621-0055

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
NO EFFECT - SWITCHING VALVES WILL TRANSFER TO STANDBY SYSTEM.
THE FAILURE CAN BE DETECTED ON ORBIT WITH THE CIRC PUMPS OPERATING. SEE MDAC IOA # 30130

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D, ORBITER BRAKE AD HOC COMMITTEE VOL.I

REPORT DATE 02/13/87 C-144
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 30113

HIGHEST CRITICALITY
HDW/FUNC

FLIGHT: 3/1R
ABORT: 3/1R

ITEM: DISPLACEMENT LIMITER, HYD MODULE ASSY
FAILURE MODE: CLOGGED LINE

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEM
3) BRAKE / SKID CONTROL MODULE
4) HYDRAULIC MODULE ASSEMBLY
5) DISPLACEMENT LIMITER
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LOCATION: MAIN LANDING GEAR COMPARTMENT
PART NUMBER: 33-017 HYDRO-AIRE, MC621-0055

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
LOSS OF OR PARTIAL LOSS OF HALF BRAKING PRESSURE TO ONE WHEEL.

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D, ORBITER BRAKE AD HOC COMMITTEE VOL.I

REPORT DATE 02/13/87 C-145
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86

SUBSYSTEM: LANDING/DECELERATION SYSTEMS

MDAC ID: 30114

HIGHEST CRITICALITY HDW/FUNC

ITEM: DISPLACEMENT LIMITER, HYD MODULE ASSY

FAILURE MODE: LEAKING LINE

LEAD ANALYST: J. COMPTON    SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEM
3) BRAKE / SKID CONTROL MODULE
4) HYDRAULIC MODULE ASSEMBLY
5) DISPLACEMENT LIMITER

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LOCATION: MAIN LANDING GEAR COMPARTMENT

PART NUMBER: 33-017 HYDRO-AIRE, MC621-0055

CAUSES: BAD FITTING OR SEAL

EFFECTS/RATIONALE:
LOSS OF SOME HYDRAULIC FLUID, HOWEVER, LIMITER WILL LIMIT LOSS. LOSS OF OR PARTIAL LOSS OF HALF BRAKING PRESSURE TO ONE WHEEL.

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D, ORBITER BRAKE AD HOC COMMITTEE VOL.I

REPORT DATE 02/13/87    C-146
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86       HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS FLIGHT: 3/3
MDAC ID: 30115        ABORT: 3/3

ITEM: BY - PASS VALVE, HYD MODULE ASSY
FAILURE MODE: FAILS TO CLOSE

LEAD ANALYST: J. COMPTON       SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEM
3) BRAKE / SKID CONTROL MODULE
4) HYDRAULIC MODULE ASSEMBLY
5) BY - PASS VALVE

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LOCATION: MAIN LANDING GEAR COMPARTMENT
PART NUMBER: 33-017 HYDRO-AIRE, MC621-0055

CAUSES: BROKEN SPRING, CONTAMINATION

EFFECTS/RATIONALE:
NO EFFECT - HYDRAULIC PRESSURE REMAINS AVAILABLE

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D, ORBITER BRAKE AD HOC COMMITTEE VOL.I

REPORT DATE 02/13/87

C-147
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86

HIGHEST CRITICALITY HDW/FUNC

SUBSYSTEM: LANDING/DECELERATION SYSTEMS

MDAC ID: 30116

FLIGHT: 2/1R

ABORT: 2/1R

ITEM: BY - PASS VALVE, HYD MODULE ASSY

FAILURE MODE: FAILS TO OPEN (SYSTEM 1)

LEAD ANALYST: J. COMPTON

SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEM
3) BRAKE / SKID CONTROL MODULE
4) HYDRAULIC MODULE ASSEMBLY
5) BY - PASS VALVE

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LOCATION: MAIN LANDING GEAR COMPARTMENT

PART NUMBER: 33-017 HYDRO-AIRE, MC621-0055

CAUSES: BROKEN SPRING, CONTAMINATION

EFFECTS/RATIONALE:
SYSTEM WILL SWITCH TO STANDBY SYSTEM IF PRESSURE ISN'T MAINTAINED
WITHIN LIMITS. SEE MDAC IOA # 30131

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D, ORBITER BRAKE AD HOC
COMMITTEE VOL.I

REPORT DATE 02/13/87 C-148
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 30117  ABORT: 1/1

ITEM: SELECTOR VALVE, HYD MODULE ASSY
FAILURE MODE: LEAKAGE

LEAD ANALYST: J. COMPTON   SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEM
3) BRAKE / SKID CONTROL MODULE
4) HYDRAULIC MODULE ASSEMBLY
5) SELECTOR VALVE
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LOCATION: MAIN LANDING GEAR COMPARTMENT
PART NUMBER: 33-017 HYDRO-AIRE, MC621-0055

CAUSES: SEAL FAILURE

EFFECTS/RATIONALE:
LEAK WILL DRAIN THE PRIMARY HYDRAULICS SYSTEM, THEN AFTER PRESSURE DROPS, DRAIN SECONDARY SYSTEM. WILL ONLY HAVE HALF BRAKING TO BOTH WHEELS.

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D, ORBITER BRAKE AD HOC COMMITTEE VOL.I

REPORT DATE 02/13/87  C-149
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY   HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS   FLIGHT: 3/1R
MDAC ID: 30118   ABORT: 3/1R

ITEM: SELECTOR VALVE, HYD MODULE ASSY
FAILURE MODE: JAMMED CLOSED

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEM
3) BRAKE / SKID CONTROL MODULE
4) HYDRAULIC MODULE ASSEMBLY
5) SELECTOR VALVE
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LOCATION: MAIN LANDING GEAR COMPARTMENT
PART NUMBER: 33-017 HYDRO-AIRE, MC621-0055

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
WON'T OPEN CAUSING LOSS OF HALF BRAKING TO BOTH WHEELS.

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D, ORBITER BRAKE AD HOC
COMMITTEE VOL.I

REPORT DATE 02/13/87  C-150
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 30119

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: SELECTOR VALVE, HYD MODULE ASSY
FAILURE MODE: JAMMED OPEN

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEM
3) BRAKE / SKID CONTROL MODULE
4) HYDRAULIC MODULE ASSEMBLY
5) SELECTOR VALVE
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LOCATION: MAIN LANDING GEAR COMPARTMENT
PART NUMBER: 33-017 HYDRO-AIRE, MC621-0055

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
NO EFFECT UNLESS LOSS OF THE PRIMARY HYDRAULIC SYSTEM.

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D, ORBITER BRAKE AD HOC COMMITTEE VOL. I

REPORT DATE 02/13/87  C-151
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 30120

HIGHEST CRITICALITY
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: BRAKE / SKID CONTROL VALVE
FAILURE MODE: LEAKAGE

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEM
3) BRAKE / SKID CONTROL MODULE
4) HYDRAULIC MODULE ASSEMBLY
5) BRAKE / SKID CONTROL VALVE

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LOCATION: MAIN LANDING GEAR COMPARTMENT
PART NUMBER: MC621-0055

CAUSES: SEAL FAILURE

EFFECTS/RATIONALE:
RESULTING IN SYSTEM CLOSING DOWN VALVE - LOSS HALF BRAKING CAPABILITY TO ONE TIRE.

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D, ORBITER BRAKE AD HOC COMMITTEE VOL.I

REPORT DATE 02/13/87  C-152
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 30121
HDW/FUNC HIGHEST CRITICALITY
FLIGHT: 1/1
ABORT: 1/1

ITEM: BRAKE / SKID CONTROL VALVE
FAILURE MODE: JAMMED OPEN

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEM
3) BRAKE / SKID CONTROL MODULE
4) HYDRAULIC MODULE ASSEMBLY
5) BRAKE / SKID CONTROL VALVE
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CRITICALITIES

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LOCATION: MAIN LANDING GEAR COMPARTMENT
PART NUMBER: MC621-0055

CAUSES: CONTAMINATION, FILTER CLOGGED, ORIFICE CLOGGED, ETC..

EFFECTS/RATIONALE:
CONTINUAL PRESSURE TO BRAKE RESULTING IN BRAKE / TIRE / WHEEL DAMAGE AND LOSS OF CONTROL ON LANDING.

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D, ORBITER BRAKE AD HOC COMMITTEE VOL.I

REPORT DATE 02/13/87 C-153
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/1R
MDAC ID: 30122  ABORT: 3/1R

ITEM: BRAKE / SKID CONTROL VALVE
FAILURE MODE: JAMMED CLOSED

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEM
3) BRAKE / SKID CONTROL MODULE
4) HYDRAULIC MODULE ASSEMBLY
5) BRAKE / SKID CONTROL VALVE
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LOCATION: MAIN LANDING GEAR COMPARTMENT
PART NUMBER: MC621-0055

CAUSES: CONTAMINATION, FILTER CLOGGED, ORIFICE CLOGGED, ETC..

EFFECTS/RATIONALE:
LOSS OF HALF BRAKING CAPABILITY TO THAT ONE TIRE

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D, ORBITER BRAKE AD HOC COMMITTEE VOL.I

REPORT DATE 02/13/87  C-154
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/3
MDAC ID: 30123  ABORT: 3/3

ITEM: EXCITER RING - WHEEL SENSOR
FAILURE MODE: SHORT OR NO INPUT

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEM
3) EXCITER RING - WHEEL SENSOR
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LOCATION: MAIN LANDING GEAR COMPARTMENT
PART NUMBER: MC621-0055

CAUSES: STRUCTURAL FAILURE, FOD, BROKEN WIRE

EFFECTS/RATIONALE:
NO WHEEL INFORMATION TO BRAKE / SKID CONTROL CIRCUIT, THEREFORE
NO SKID CONTROL. WILL DISABLE THE SYSTEM RESULTING IN LOSS OF
HALF BRAKING TO ONE WHEEL

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D, ORBITER BRAKE AD HOC COMMITTEE VOL.I

REPORT DATE 02/13/87  C-155
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/3
MDAC ID: 30123  ABORT: 3/3

ITEM: EXCITER RING - WHEEL SENSOR
FAILURE MODE: SHORT OR NO INPUT

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEM
3) EXCITER RING - WHEEL SENSOR
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LOCATION: MAIN LANDING GEAR COMPARTMENT
PART NUMBER: MC621-0055

CAUSES: STRUCTURAL FAILURE, FOD, BROKEN WIRE

EFFECTS/RATIONALE:
NO WHEEL INFORMATION TO BRAKE / SKID CONTROL CIRCUIT, THEREFORE
NO SKID CONTROL. WILL DISABLE THE SYSTEM RESULTING IN LOSS OF
HALF BRAKING TO ONE WHEEL

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D, ORBITER BRAKE AD HOC
COMMITTEE VOL.I

REPORT DATE 02/13/87  C-156
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 30123
HDW/FUNC CRITICALITY HIGHEST
FLIGHT: 3/3
ABORT: 3/3

ITEM: EXCITER RING - WHEEL SENSOR
FAILURE MODE: SHORT OR NO INPUT

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEM
3) EXCITER RING - WHEEL SENSOR
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LOCATION: MAIN LANDING GEAR COMPARTMENT
PART NUMBER: MC621-0055

CAUSES: STRUCTURAL FAILURE, FOD, BROKEN WIRE

EFFECTS/RATIONALE:
NO WHEEL INFORMATION TO BRAKE / SKID CONTROL CIRCUIT, THEREFORE
NO SKID CONTROL. WILL DISABLE THE SYSTEM RESULTING IN LOSS OF
HALF BRAKING TO ONE WHEEL

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D, ORBITER BRAKE AD HOC COMMITTEE VOL.I

REPORT DATE 02/13/87  C-157
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS FLIGHT: 3/3
MDAC ID: 30123 ABORT: 3/3

ITEM: EXCITER RING - WHEEL SENSOR
FAILURE MODE: SHORT OR NO INPUT

LEAD ANALYST: J. COMPTON SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEM
3) EXCITER RING - WHEEL SENSOR
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LOCATION: MAIN LANDING GEAR COMPARTMENT
PART NUMBER: MC621-0055

CAUSES: STRUCTURAL FAILURE, FOD, BROKEN WIRE

EFFECTS/RATIONALE:
NO WHEEL INFORMATION TO BRAKE / SKID CONTROL CIRCUIT, THEREFORE NO SKID CONTROL WILL DISABLE THE SYSTEM RESULTING IN LOSS OF HALF BRAKING TO ONE WHEEL

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D, ORBITER BRAKE AD HOC COMMITTEE VOL.1

REPORT DATE 02/13/87 C-158
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS FLIGHT: 1/1
MDAC ID: 30124 ABORT: 1/1

ITEM: STATORS, ROTORS, CLIPS
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) WHEEL AND BRAKE ASSEMBLY
3) STATORS, ROTORS, CLIPS

CRITICALITIES

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LOCATION: MAIN LANDING GEAR COMPARTMENT
PART NUMBER: MC621-0051

CAUSES: THERMAL, TORSION, HYDRAULIC RESONANCE, ETC..

EFFECTS/RATIONALE:
WHEEL LOCKUP CAUSING BLOWN TIRE AND POSSIBLE LOSS OF CREW AND VEHICLE WITH HEAVY WEIGHT.

REFERENCES: 13.2 SSSH, JSC 12770 VOL. 10D, ORBITER BRAKE AD HOC COMMITTEE VOL.I

REPORT DATE 02/13/87  C-159
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 1/1
MDAC ID: 30125  ABORT: 1/1

ITEM: RUDDER / BRAKE PEDAL ASSEMBLY
FAILURE MODE: STRUCTURAL FAILURE

LEAD ANALYST: W. WEISSINGER  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) FLIGHT CONTROLS
2) RUDDER / BRAKE PEDAL ASSEMBLY
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LOCATION: ORBITER CABIN AREA, FLIGHT CONTROL AREA
PART NUMBER: VO70-573001

CAUSES: OVERLOAD, CORROSION / CRACKING, PIECE-PART STRUCTURAL FAILURE, MISHANDLING OR ABUSE

EFFECTS/RATIONALE:
A STRUCTURAL FAILURE OF THE RUDDER / BRAKE PEDAL ASSEMBLY THAT CAUSED A BINDING OF THE CONTROLS WOULD CAUSE FLIGHT CONTROL PROBLEMS DURING ENTRY THAT WOULD CAUSE A LOSS OF THE VEHICLE AND THE CREW.

REFERENCES: VO70-573001

REPORT DATE 02/13/87  C-160  C-3
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 30126

ITEM: RUDDER / BRAKE PEDAL ASSEMBLY
FAILURE MODE: BINDING / JAMMING

LEAD ANALYST: W. WEISSINGER
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) FLIGHT CONTROLS
2) RUDDER / BRAKE PEDAL ASSEMBLY
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LOCATION: ORBITER CABIN AREA, FLIGHT CONTROL AREA
PART NUMBER: V070-573001

CAUSES: DEBRIS, FOREIGN OBJECTS

EFFECTS/RATIONALE:
DEBRIS OR FOREIGN OBJECTS IN THE CONTROL SYSTEMS DURING DEORBIT OR LANDING OPERATIONS THAT CAUSED BINDING OR JAMMING OF THE CONTROLS COULD CAUSE THE VEHICLE TO BECOME UNCONTROLLABLE. A FAILURE OF THIS NATURE WOULD CAUSE A LOSS OF THE CREW AND VEHICLE.

REFERENCES: V070-573001

REPORT DATE 02/13/87 C-161
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS FLIGHT: 3/3
MDAC ID: 30127 ABORT: 3/3

ITEM: TRANSDUCERS, SENSORS (INSTRUMENTATION)
FAILURE MODE: FAILURE - NO DATA

LEAD ANALYST: J. COMPTON SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) LANDING / DECELERATION SUBSYSTEMS
2) TRANSDUCERS, SENSORS
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LOCATION: ORBITER CABIN AREA, FLIGHT CONTROL AREA

PART NUMBER:

CAUSES: CONTAMINATION, SHOCK

EFFECTS/RATIONALE:
ALL SENSOR TRANSDUCERS ON THE LANDING / DECELERATION SUBSYSTEM ARE DOWNLIST DATA. FAILURE WILL ONLY RESULT IN THE LOSS OF DATA EXCEPT FOR THE NOSE WHEEL STEERING DATA.

REFERENCES:

REPORT DATE 02/13/87 C-162
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 3/1R
MDAC ID: 30128  ABORT: 3/1R

ITEM: BRAKE HYDRAULIC LINE HEATERS
FAILURE MODE: BROKEN WIRE, THERMOSTAT FAILS OFF

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) MAIN LANDING GEAR COMPARTMENT
2) MAIN LANDING GEAR
3) BRAKE HYDRAULIC LINE HEATERS

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LOCATION: MAIN LANDING GEAR COMPARTMENT
PART NUMBER: MC363-0044, MC363-0046

CAUSES: SHOCK CONTAMINATION

EFFECTS/RATIONALE:
HEATERS ARE USED TO KEEP TO KEEP THE HYDRAULIC FULID WARM BETWEEN THE BRAKE / SKID CONTROL MODULE AND THE BRAKE MASTER CYLINDER. THE HEATERS HAVE TRIPLE REDUNDANCY ON EACH LINE.

REFERENCES: MC363-0044, MC363-0046
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86
HIGHEST CRITICALITY
SUBSYSTEM: LANDING/DECELERATION SYSTEMS
MDAC ID: 30129
FLIGHT: 2/1R
ABORT: 2/1R

ITEM: HYD PRESS REG (SYS 1)
FAILURE MODE: FAILS CLOSED

LEAD ANALYST: J. COMPTON
SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEM
3) BRAKE SKID CONTROL MODULE
4) HYDRAULIC PRESSURE REGULATOR
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LOCATION: MAIN LANDING GEAR COMPARTMENT
PART NUMBER: 48-043, MC621-0055

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
NO EFFECT - SWITCHING VALVES WILL TRANSFER TO THE STANDBY SYSTEM.
SEE MDAC IOA # 30111.

REFERENCES: 13.2 SSSH, JSC 12770 VOL.10D, ORBITER BRAKE AD HOC COMMITTEE VOL. I
INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET  

DATE: 11/28/86  HIGHEST CRITICALITY  HDW/FUNC  
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 2/1R  
MDAC ID: 30130  ABORT: 2/1R  

ITEM: INLET FILTER, HYD MODULE ASSY (SYS 1)  
FAILURE MODE: FILTER CLOGGED  

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER  

BREAKDOWN HIERARCHY:  
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS  
2) SKID CONTROL SYSTEM  
3) BRAKE SKID CONTROL MODULE  
4) HYDRAULIC MODULE ASSEMBLY  
5) INLET FILTER  
6) 
7) 
8) 
9) 

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LOCATION: MAIN LANDING GEAR COMPARTMENT  
PART NUMBER: 33-017 HYDRO-AIRE, MC621-0055  

CAUSES: CONTAMINATION  

EFFECTS/RATIONALE:  
NO EFFECT - SWITCHING VALVES WILL TRANSFER TO THE STANDBY SYSTEM.  
SEE MDAC IOA # 30112.  

REFERENCES: 13.2 SSSH, JSC 12770 VOL.10D, ORBITER BRAKE AD HOC COMMITTEE VOL. I  

REPORT DATE 02/13/87  C-165
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/28/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: LANDING/DECELERATION SYSTEMS  FLIGHT: 2/1R
MDAC ID: 30131  ABORT: 2/1R

ITEM: BY-PASS VALVE, HYD MODULE ASSY (SYS 2&3)
FAILURE MODE: FAILS TO OPEN

LEAD ANALYST: J. COMPTON  SUBSYS LEAD: W. WEISSINGER

BREAKDOWN HIERARCHY:
1) BRAKES AND ANTI-SKID CONTROL SYSTEMS
2) SKID CONTROL SYSTEM
3) BRAKE SKID CONTROL MODULE
4) HYDRAULIC MODULE ASSEMBLY
5) BY-PASS VALVE
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LOCATION: MAIN LANDING GEAR COMPARTMENT
PART NUMBER: 33-017 HYDRO-AIRE, MC621-0055

CAUSES: BROKEN SPRING, CONTAMINATION

EFFECTS/RATIONALE:
SYSTEM WILL SWITCH TO STANDBY SYSTEM IF PRESSURE ISN'T MAINTAINED
WITHIN LIMITS. A FAILURE OF THE SYSTEM WILL BE DETECTED ON ORBIT
WITH THE CIRC PUMPS OPERATING. SEE MDAC IOA# 30116.

REFERENCES: 13.2 SSSH, JSC 12770 VOL.10D, ORBITER BRAKE AD HOC
COMMITTEE VOL. I

REPORT DATE 02/13/87  C-166
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/05/86
SUBSYSTEM: EP&D&C
MDAC ID: 31100

HIGHEST CRITICALITY

HDW/FUNC

FLIGHT: 3/3
ABORT: 3/3

ITEM: ISOLATION DIODE (12), 1 AMP
FAILURE MODE: ELEMENT OPENS, HIGH RESISTANCE, SHORTS

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) PANELS F6A5 & F8A5
3) ISOLATION DIODES (12, 6 PER PANEL F6A5 & F8A5)

CRITICALITIES

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: PNLS F6A5 & F8A5 34V73A6A5-A1CRL,2,3,4,5,6
34V73A8A5-A1CRL,2,3,4,5,6
PART NUMBER: JANTXV1N4246

CAUSES: MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
SUPPRESSOR DIODES TO LD GR EVENT INDICATOR COILS, LOSS OF EVENT INDICATION NOT CRITICAL TO FLIGHT.

REFERENCES: VS70-510109 ZONES 4,7,82,84,101,103

REPORT DATE 02/13/87 C-167
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/04/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EP&G C  FLIGHT: 2/1R
MDAC ID: 31101  ABORT: 2/1R

ITEM: PROXIMITY SENSOR BOX (2)  
FAILURE MODE: INADVERTENT OUTPUT

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FORWARD MOTOR CONTROL ASSEMBLIES 2 AND 3
3) PROXIMITY SENSOR ELECTRONIC BOXES 1 & 2
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8)
9) 05-6BA

CRITICALITIES

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LOCATION: AREA 81 FWD AVIONICS BAY NO. 1, 81V51A1 AREA 82 FWD
AVIONICS BAY NO. 2, 82V51A2
PART NUMBER: MC452-0124-0009

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK,
ERRONEOUS INPUT, THERMAL STRESS

EFFECTS/RATIONALE:
PROVIDES THE ELECTRONICS FOR SENSING THE DISCRETE POSITION OF
MOVING PARTS/ASSEMBLIES WITHIN THE LANDING GEAR CONTROL SUB-
SYSTEM. PROVIDES POWER, REG., AMPLIFICATION, SELF-TEST &
SIGNALIZATION THROUGH CIRCUIT CARD CHANNELS TO DESIGNATED REMOTE
SENSORS. INADVERTENT POWER OUTPUT FROM ONE OF TEN POSSIBLE CHANNELS WITHIN
ONE OF TWO PROXIMITY SWITCH PACKAGES. TWO FAILURES: (1) LOSS OF
REDUNDANT SENSOR BOX AND (2) MIGHT NOT FIRE NLG EXTENSION PYRO
BACKUP UPLock RELEASE EVEN IF HYD. SYSTEM RELEASED NLG.
LOSS OF LANDING GEAR PYRO ASSIST FUNCTION AFTER TWO FAILURES
COULD RESULT IN LOSS OF CREW/VEHICLE IF AIR LOADS PRECLUDE DOOR
OPENING DURING LANDING.

REFERENCES: VS70-510109 ZONES 6,12,18,78,84,91,102,109

REPORT DATE 02/13/87 C-168
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/04/86
SUBSYSTEM: EPD&C
MDAC ID: 31102

HIGHEST CRITICALITY
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: PROXIMITY SENSOR BOX (2)
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FORWARD MOTOR CONTROL ASSEMBLIES 2 AND 3
3) PROXIMITY SENSOR ELECTRONIC BOXES 1 & 2

CRITICALITIES

FLIGHT PHASE HDW/FUNC ABORT HDW/FUNC
PRELAUNCH: 3/3 RTLS: 3/1R
LIFTOFF: 3/1R TAL: 3/1R
ONORBIT: 3/1R AOA: 3/1R
DEORBIT: 3/1R ATO: 3/1R
LANDING/SAFING: 3/1R


LOCATION: AREA 81 FWD AVIONICS BAY NO. 1, 81V51A1 AREA 82 FWD AVIONICS BAY NO. 2, 82V51A2
PART NUMBER: MC452-0124-0009

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
PROVIDES THE ELECTRONICS FOR SENSING THE DISCRETE POSITION OF MOVING PARTS/ASSEMBLIES WITHIN THE LANDING GEAR CONTROL SUBSYSTEM. PROVIDES POWER, REGULATION, AMPLIFICATION, SELF-TEST & SIGNALIZATION THROUGH CIRCUIT CARD CHANNELS TO DESIGNATED REMOTE SENSORS. LOSS OF OUTPUT ON BOTH SENSOR BOXES WILL NOT PREVENT THE FIRING OF NLG EXTENSION PYRO POWERED ASSIST WHEN COMMANDED, BUT WILL PREVENT THE FIRING OF NLG EXTENSION PYRO BACKUP UPLOCK RELEASE. HYD. SYSTEM WILL STILL EXTEND THE NLG. FUNCTIONAL CRITICALITY EFFECT - POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF ABILITY TO EXTEND THE NLG.

REFERENCES: VS70-510109 ZONES 6,12,18,78,84,91,102,109

REPORT DATE 02/13/87 C-169
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/05/86
SUBSYSTEM: EPD&C
MDAC ID: 31103

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: ISOLATION DIODE (3), 1 AMP
FAILURE MODE: ELEMENT OPENS, HIGH RESISTANCE, SHORTS

LEAD ANALYST: G. BEAIRD SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FPCA 1,2,3
3) ISOLATION DIODES (3), LDG 'ARM' STATUS/PWR MONITORS
4)...
5)...
6)...
7)...
8)...
9) 05-6BA

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FPCA - 1,2,3 81V76A22A1CR17, 82V76A23A1CR18, 83V76A24A1CR12
PART NUMBER: JANTXV1N4246

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
PROVIDES ISOLATION BETWEEN DIFFERENT MAIN DC BUSSSES SUPPLYING POWER TO MDM MONITORS AND PANEL ANNUNCIATORS THROUGH EACH 'ARM' RELAY. NOT CRITICAL TO VEHICLE OPERATION OR CREW SAFETY.

REFERENCES: VS70-510109 ZONES 33,37,39

REPORT DATE 02/13/87 C-170
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/06/86                      HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C                      FLIGHT: 3/3
MDAC ID: 31104                       ABORT: 3/3

ITEM: ISOLATION DIODE (3), 1 AMP
FAILURE MODE: ELEMENT OPENS, HIGH RESISTANCE, SHORTS

LEAD ANALYST: G. BEAIRD           SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FPCA 1,2,3
3) ISOLATION DIODES (3), LDG GR 'DOWN' STATUS/PWR MONITORS
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8) 05-6BA
9) 05-6BA

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: FPCA - 1,2,3  81V76A22A1CR18, 82V76A23A1CR17, 83V76A24A1CR13
PART NUMBER: JANTXV1N4246

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
PROVIDES ISOLATION BETWEEN DIFFERENT MAIN DC Busses supplying power to MDM monitors and annunciators through each 'DOWN' relay. NOT CRITICAL TO VEHICLE OPERATION OR CREW SAFETY.

REFERENCES: VS70-510109 ZONES 33,37,39

REPORT DATE 02/13/87  C-171
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/05/86
SUBSYSTEM: EPD&C
MDAC ID: 31105

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: TRANSIENT SUPPRESSOR DIODE (4), 3 AMPS
FAILURE MODE: ELEMENT OPENS, HIGH RESISTANCE, SHORTS

LEAD ANALYST: G. BEAIRD    SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FPCA 1 & 2
3) TRANSIENT SUPPRESSOR DIODES (4)
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   6)
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   8)
   9) 05-6BA

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: FPCA 1 & 2 81V76A22-A1CR13, 81V76A22-A1CR14,
82V76A23-A1CR15, 82V76A23-A1CR16
PART NUMBER: JANTXV1N5551

CAUSES: MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
LOSS OF TRANSIENT SUPPRESSION CAPABILITY. REPEATED CIRCUIT
OPERATION OF COILS WOULD POSSIBLY DAMAGE RELAY CONTACTS BECAUSE
OF ARcing CAUSED BY INDUCED VOLTAGE ON REMOVAL OF POWER FROM
SOLENOID COIL.

REFERENCES: VS70-510109 ZONES 58, 69

REPORT DATE 02/13/87    C-172
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/05/86
SUBSYSTEM: EP&D&C
MDAC ID: 31107

HIGHEST CRITICALITY
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: BLOCKING DIODE (2) 12 AMP, 400V
FAILURE MODE: ELEMENT OPENS, HIGH RESISTANCE

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD PCA - 2 & 3
3) BLOCKING DIODES (2, 1 PER FPCA - 2 & 3)

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LOCATION: FWD PCA 2 & 3 82V76A23-CR14 83V76A24-CR9
PART NUMBER: JANTX1N1204RA

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK

EFFECTS/RATIONALE:
DIODES ISOLATE RETURN BUSSES BETWEEN FWD PCA 2 AND FWD PCA 3.
POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF ELECTRICAL POWER TO REDUNDANT SHUTOFF VALVE.

REFERENCES: VS70-510109 ZONES 58,61

REPORT DATE 02/13/87 C-173
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/05/86

SUBSYSTEM: EPD&C

MDAC ID: 31108

HIGHEST CRITICALITY

FLIGHT: 3/3

ABORT: 3/3

ITEM: BLOCKING DIODE (2) 12 AMP, 400V

FAILURE MODE: SHORTS, LOW RESISTANCE

LEAD ANALYST: G. BEAIRD

SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD PCA - 2 & 3
3) BLOCKING DIODES (2, 1 PER FPCA - 2 & 3)
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9) 05-6BA

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FWD PCA 2 & 3 82V76A23-CR14 83V76A24-CR9

PART NUMBER: JANTX1N1204RA

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK

EFFECTS/RATIONALE:
DIODES ISOLATE RETURN BUSINES BETWEEN FWD PCA 2 AND FWD PCA 3.
POSSIBLE LOSS OF RETURN BUS ISOLATION BETWEEN FWD PCA NUMBERS 2 & 3 AND POSSIBLE CIRCULATING CURRENT BETWEEN FWD PCA 2 & 3.

REFERENCES: VS70-510109 ZONES 58,61

REPORT DATE 02/13/87 C-174
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/05/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C    FLIGHT: 3/1R
MDAC ID: 31109      ABORT: 3/1R

ITEM: BLOCKING DIODE (2) 12 AMP
FAILURE MODE: ELEMENT OPENS, HIGH RESISTANCE

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD PCA - 2 & 3
3) BLOCKING DIODES (2, 1 PER FPCA - 2 & 3), RPC POWER
4) 
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9) 05-6BA

CRITICALITIES

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LOCATION: FWD PCA 2 & 3  82V76A23-CR15  83V76A24-CR10
PART NUMBER: JANTX1N1204RA

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK

EFFECTS/RATIONALE:
ISOLATES TWO DIFFERENT MAIN DC BUS VOLTAGES AT THE RPC'S OUTPUT FOR POWERING THE REDUNDANT SHUTOFF VALVE IN PARALLEL. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF ELECTRICAL POWER TO REDUNDANT SHUTOFF VALVE FROM AN RPC.

REFERENCES: VS70-510109 ZONES 57,61

REPORT DATE 02/13/87  C-175
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/05/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C  FLIGHT: 3/3
MDAC ID: 31110  ABORT: 3/3

ITEM: BLOCKING DIODE (2) 12 AMP, 400V
FAILURE MODE: SHORTS

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD PCA - 2 & 3
3) BLOCKING DIODES (2, 1 PER FPCA - 2 & 3), RPC POWER
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9) 05-6BA

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: FWD PCA 2 & 3  82V76A23-CR15  83V76A24-CR10
PART NUMBER: JANTX1N1204RA

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK

EFFECTS/RATIONALE:
ISOLATES TWO DIFFERENT MAIN DC BUS VOLTAGES AT THE RPC'S OUTPUT FOR POWERING THE REDUNDANT SHUTOFF VALVE IN PARALLEL. LOSS OF UNIT CAPABILITY TO ISOLATE THE TWO RPC OUTPUTS.

REFERENCES: VS70-510109  ZONES 57,61

REPORT DATE 02/13/87  C-176
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/08/86
SUBSYSTEM: EPD&C
MDAC ID: 31111

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: CIRCUIT BREAKERS (2), LG SENSORS
FAILURE MODE: FAILS OPEN

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) PANEL L4
3) CIRCUIT BREAKERS CB59 & CB62
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9) 05-6BA

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LOCATION: PANEL L4 31V73A4-CB59 31V73A4-CB62
PART NUMBER: MC454-0026-2030

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
PROVIDES CIRCUIT PROTECTION TO THE PROXIMITY SENSOR BOXES.
POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF LANDING GEAR SENSOR INFORMATION. VISUAL POWER INDICATION FOR SENSOR BOXES.

REFERENCES: VS70-510109 ZONES 12,79

REPORT DATE 02/13/87 C-177
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/08/86
SUBSYSTEM: EPD&C
MDAC ID: 31112

HIGHEST CRITICALITY
HDW/FUNC

FLIGHT: 3/3
ABORT: 3/3

ITEM: CIRCUIT BREAKERS (2), LG SENSORS
FAILURE MODE: FAILS CLOSED, SHORTED CONTACTS

LEAD ANALYST: G. BEAIRD SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) PANEL L4
3) CIRCUIT BREAKERS CB59 & CB62

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| DEORBIT      | 3/3      | ATO: 3/3 |
| LANDING/SAFING| 3/3    |       |

REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: PANEL L4 31V73A4-CB59 31V73A4-CB62
PART NUMBER: MC454-0026-2030

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
PROVIDES CIRCUIT PROTECTION TO THE PROXIMITY SENSORS BOXES.
FAILURE HAS NO EFFECT ON SUBSYSTEM.

REFERENCES: VS70-510109 ZONES 12,79

REPORT DATE 02/13/87  C-178
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/25/86
SUBSYSTEM: EPD&C
MDAC ID: 31113

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: PUSHBUTTON SWITCH (2), LANDING GEAR DOWN
FAILURE MODE: FAILS OPEN (SWITCHES NORMALLY OPEN)

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) PANELS F6A5 & F8A5
3) LANDING GEAR DOWN PUSHBUTTON SWITCHES (2), ILLUMINATED

CRITICALITIES

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LOCATION: PANELS F6A5 & F8A5 S2
PART NUMBER: ME452-0061-4145

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
Provides redundant manual 'ON' control of 28VDC from control bus to latching relays for landing gear down circuit; actuation switch light comes on when pushed. Two identical switches provide redundant control bus power to common load. Possible loss of crew/vehicle because of loss of electrical control power.

REFERENCES: VS70-510109 ZONES 27,31

REPORT DATE 02/13/87  C-179
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/03/86
SUBSYSTEM: EPD&C
MDAC ID: 31114

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: PUSHBUTTON SWITCH (2), LANDING GEAR DOWN
FAILURE MODE: FAILS CLOSED, SHORTED CONTACTS

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) PANELS F6A5 & F8A5
3) LANDING GEAR DOWN PUSHBUTTON SWITCHES (2), ILLUMINATED
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9) 05-6BA

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: PANELS F6A5 & F8A5 S2
PART NUMBER: ME452-0061-4145

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
PROVIDES REDUNDANT MANUAL 'ON' CONTROL OF 28VC FROM CONTROL BUS TO LATCHING RELAYS FOR LANDING GEAR DOWN CIRCUIT. FAILURE POWERS RELAY PICK UP COIL(S) AND LANDING GEAR DOWN CONTACTS ARE ENERGIZED, SERIES CONTACTS PREVENT ACTUATION OF LANDING GEAR.
NO EFFECT ON CREW/VEHICLE.

REFERENCES: VS70-510109 ZONES 27,31

REPORT DATE 02/13/87 C-180
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/03/86
SUBSYSTEM: EPD&C
MDAC ID: 31115

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: LANDING GEAR TOGGLE SWITCH, S13
FAILURE MODE: Fails open (switch normally open), fails closed

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) PANEL A12
3) LDG GEAR TOGGLE SWITCH (S13)
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: PANEL A12 36V73A12-S13
PART NUMBER: ME452-0102-7256

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
Provides maintained 'OFF' and momentary 'ON' power to the landing gear arm/down reset circuit. Resets latching relays in applicable circuits, the use of reset circuit is normally a ground function. Failure has no effect on subsystem. CB60 remains off' until needed.

REFERENCES: VS70-510109 ZONE 37

REPORT DATE 02/13/87 C-181
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/03/86
SUBSYSTEM: EPD&C
MDAC ID: 31117
HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: PUSHBUTTON SWITCH, LDG GR ARM, 4PDT, ILLUMINATED
FAILURE MODE: FAILS OPEN (SWITCHES NORMALLY OPEN)

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) PANELS F6A5 & F8A5
3) LANDING GEAR ARM PUSHBUTTON SWITCHES (2)

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LOCATION: PANELS F6A5 & F8A5  34V73A6A5-S1  34V73A8A5-S1
PART NUMBER: ME452-0061-4146

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
PROVIDES REDUNDANT MANUAL 'ON' CONTROL OF 28VDC FROM CONTROL BUS TO LATCHING RELAYS FOR LANDING GEAR ARM CIRCUIT ACTUATION AND STATUS MONITORS. TWO IDENTICAL SWITCHES PROVIDE REDUNDANT CONTROL BUS POWER TO COMMON LOAD. SERIES CONTACT PREVENTS ACTUATION OF LANDING GEAR (DOWN CIRCUIT OPEN). POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF ELECTRICAL CONTROL POWER.

REFERENCES: VS70-510109 ZONES 43,47

REPORT DATE 02/13/87  C-182
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C FLIGHT: 3/3
MDAC ID: 31118 ABORT: 3/3

ITEM: PUSHBUTTON SWITCH, LDG GR ARM, 4 PDT, ILLUMINATED
FAILURE MODE: FAILS CLOSED, SHORTED CONTACTS

LEAD ANALYST: G. BEAIRD SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
   2) PANELS F6A5 & F8A5
   3) LANDING GEAR ARM PUSHBUTTON SWITCHES (2)
   4) 5) 6)
   7) 8) 9) 05-6BA

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: PANELS F6A5 & F8A5 34V73A6A5-S1 34V73A8A5-S1
PART NUMBER: ME452-0061-4146

CAUSES: PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
PROVIDES REDUNDANT MANUAL 'ON' CONTROL OF 28VDC FROM CONTROL BUS
TO LATCHING RELAYS FOR LANDING GEAR 'ARM' CIRCUIT.
FOR HW CRITICALITY - LOSS OF CAPABILITY TO REMOVE POWER FROM
RELAY SET (PICKUP) COIL, NO EFFECT ON CREW/VEHICLE.

REFERENCES: VS70-510109 ZONES 43,47
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/25/86
SUBSYSTEM: EPD&C
MDAC ID: 31119

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: EVENT INDICATORS (6)
FAILURE MODE: ERRATIC OPERATION, FAILS TO OPERATE

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) PANELS F6 & F8
3) PANELS F6A5 & F8A5
4) EVENT INDICATORS (LANDING GEAR)
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9) 05-6BA

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: PANELS F6A5 & F8A5  LG GR-NOSE(DS-1) LEFT (DS-2)
RIGHT (DS-3)-UP/DN

PART NUMBER: MC432-0222-0023

CAUSES: PIECE-PART STRUCTURAL, MECHANICAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
PROVIDES VISUAL INDICATION OF UP OR DOWN STATUS FOR THE INDIVIDUAL OPERATION OF THE NOSE, LEFT, AND RIGHT LANDING GEAR. THE UNIT 'BARBER POLES' WITHOUT POWER AND DISPLAYS THE APPLICABLE POSITION WITH POWER APPLIED.

REFERENCES: VS70-510109  ZONES 4,7,81,84,100,103

REPORT DATE 02/13/87  C-184
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/08/86
SUBSYSTEM: EPD&C
MDAC ID: 31120

ITEM: BLOCKING DIODE (6) 3 AMP SHORTS, LOW RESISTANCE

LEAD ANALYST: G. BEAIRD SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FLCA - 2 & 3
3) BLOCKING DIODES (6)
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLCA 2 & 3 82V76A17CR (3) 83V76A18CR (3)
PART NUMBER: JANTXV1N5551

CAUSES: MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
LOSS OF HYBRID DEVICE CONTROLLER LEAKAGE CURRENT PREVENTION TO NLG, RMG, & LMG BRAKE UPLock RELEASE PIC'S 1 & 2. NOT CRITICAL TO CREW/VEHICLE.

REFERENCES: VS70-510109 ZONES 13,19,54,63,85,94

REPORT DATE 02/13/87 C-185
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/08/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: EPD&C  FLIGHT: 3/1R
MDAC ID: 31121  ABORT: 3/1R

ITEM: BLOCKING DIODE (6) 3 AMP
FAILURE MODE: ELEMENT OPENS, HIGH RESISTANCE

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FLCA - 2 & 3
3) BLOCKING DIODES (6)
4) 5) 6) 7) 8) 9) 05-6BA

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LOCATION: FLCA 2 & 3  82V76A17CR (3)  83V76A18CR (3)
PART NUMBER: JANTXV1N5551

CAUSES: MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
LOSS OF ARM SIGNAL TO PIC'S FOR NLG, RMG, & LMG 'BACKUP' UPLOCK RELEASE MECHANISMS, CAUSING POSSIBLE LOSS OF CREW/VEHICLE.

REFERENCES: VS70-510109 ZONES 13,19,54,63,85,94

REPORT DATE 02/13/87  C-186
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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| ITEM:     | BLOCKING DIODE (2) 1 AMP |
| FAILURE MODE: | ELEMENT OPENS, HIGH RESISTANCE, SHORTS |

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD PCA2
3) BLOCKING DIODES (2), POSITION INDICATOR PWR LG STRUT ACTUATORS

CRITICALITIES

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REDUNDANCY SCREENS:  A [ ]  B [ ]  C [ ]


PART NUMBER:  JANTXV1N4246

CAUSES:  PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
MONITORING FUNCTION NOT CRITICAL TO VEHICLE OR CREW.

REFERENCES:  VS70-510109 ZONE 140

REPORT DATE 02/13/87  C-187
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/12/86
SUBSYSTEM: EPD&C
MDAC ID: 31123

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: CIRCUIT BREAKER (3 AMP)
FAILURE MODE: FAILS OPEN (CB NORMALLY OPEN), FAILS CLOSED

LEAD ANALYST: G. BEAIRD SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) PANEL R15
3) CIRCUIT BREAKER (3 AMP), LG ARM/DN RESET
4) 
5) 
6) 
7) 
8) 
9) 05-6BA

CRITICALITIES

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: PANEL R15 32V73A15-CB60
PART NUMBER: MC454-0026-2030

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
PROVIDES CIRCUIT PROTECTION BETWEEN BUSES 1BC AND THE LANDING GEAR ARM/DN RESET LATCHING RELAYS. NO EFFECT, CIRCUIT BREAKER NORMALLY OPEN, EXCEPT FOR GROUND TEST. MANUAL SWITCH PREVENTS PREMATURE RESET OF RELAYS.

REFERENCES: VS70-510109 ZONE 37

REPORT DATE 02/13/87 C-188
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/13/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C  FLIGHT: 3/1R
MDAC ID: 31125  ABORT: 3/1R

ITEM: GENERAL PURPOSE FUSE (5 AMP)
FAILURE MODE: OPENS, PREMATURELY OPENS

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) LANDING GEAR ARM CIRCUIT
3) FWD PCA NO. 1
4) GENERAL PURPOSE FUSE (5 AMP)

CRITICALITIES

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LOCATION: FWD PCA-1 81V76A22-F9
PART NUMBER: ME451-0009-1021

CAUSES: MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION, CHEMICAL DEGRADED MATERIALS

EFFECTS/RATIONALE:
PROVIDES OVERLOAD PROTECTION TO LANDING GEAR CONTROL ("ALL LDG GR DOWN") AND PUMP VALVES. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF ELECTRICAL POWER.

REFERENCES: VS70-510109 ZONE 69

REPORT DATE 02/13/87 C-189
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/13/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: EPD&C  FLIGHT: 3/1R
MDAC ID: 31126  ABORT: 3/1R

ITEM: GENERAL PURPOSE FUSE, (8), 1 AMP
FAILURE MODE: OPENS, PREMATURELY OPENS

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) PANELS F6A5 & F8A5
3) GENERAL PURPOSE FUSES (8)
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8)
9) 05-6BA

CRITICALITIES

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LOCATION: PANELS F6A5 & F8A5  34V73A6A5-F5,F7,F6,F8
          34V73A8A5-F5,F7,F6,F8
PART NUMBER: ME451-0018-0100

CAUSES: MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION, CHEMICAL
        DEGRADED MATERIALS

EFFECTS/RATIONALE:
        PROVIDES OVERLOAD PROTECTION TO THE MAIN LANDING GEAR "DOWN"
        CONTROL CIRCUIT. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS
        OF CONTROL ELECTRICAL POWER.

REFERENCES: VS70-510109  ZONES 27,32

REPORT DATE 02/13/87  C-190
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/13/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: EPD&C  FLIGHT: 3/1R
MDAC ID: 31127  ABORT: 3/1R

ITEM: GENERAL PURPOSE FUSE (1 AMP)
FAILURE MODE: OPENS, PREMATURELY OPENS

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) PANELS F6A5 & F8A5
3) GENERAL PURPOSE FUSES (8); 1 AMP, LANDING GEAR "ARM" CKT
4) 5) 6) 7) 8) 9) 05-6BA

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LOCATION: PANELS F6A5 & F8A5  34V73A6A5-F1,F2,F3,F4
34V73A8A5-F1,F2,F3,F4
PART NUMBER: ME451-0018-0100

CAUSES: MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION, CHEMICAL DEGRADED MATERIALS

EFFECTS/RATIONALE:
PROVIDES OVERLOAD PROTECTION TO THE MAIN LANDING GEAR "ARM" CONTROL CIRCUIT. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF CONTROL BUS ELECTRICAL POWER.

REFERENCES: VS70-510109 ZONES 43,47

REPORT DATE 02/13/87  C-191
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FLCA 2 & 3
3) RESISTOR (12), PIC ARM CIRCUITS
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9) 05-6BA

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LOCATION: FLCA 2 & 3 82V76A17-R(6) 83V76A18-R(6)

PART NUMBER: RWR80S10R2BR

CAUSES: MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
PROVIDES CURRENT LIMITING BETWEEN HDC "ARM" SIGNAL OUTPUT AND THE LANDING GEAR PIC'S. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF PIC ARM CAPABILITY.

REFERENCES: VS70-510109 ZONES 13,19,54,63,85,94

REPORT DATE 02/13/87 C-192
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86  HIGHEST CRITICALITY HDW/FUNC FLIGHT: 3/3
SUBSYSTEM: EPD&C ABORT: 3/3
MDAC ID: 31129

ITEM: RESISTOR (12), 10.2 OHMS, 2W FAILURE MODE: SHORTS, LOW RESISTANCE

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FLCA 2 & 3
3) RESISTOR (12), PIC ARM CIRCUITS
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9) 05-6BA

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLCA 2 & 3 82V76A17-R(6) 83V76A18-R(6)

PART NUMBER: RWR80S10R2BR

CAUSES: MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE: PROVIDES CURRENT LIMITING BETWEEN HDC "ARM" SIGNAL OUTPUT AND THE LANDING GEAR PIC'S. FAILS SHORTED CONDITION WOULD STILL CONDUCT "ARM" SIGNAL TO PIC ARM CIRCUITRY EVEN THOUGH PIC OVERCURRENT PROTECTION HAS BEEN LOST.

REFERENCES: VS70-510109 ZONES 13,19,54,63,85,94

REPORT DATE 02/13/87  C-193
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C  FLIGHT: 3/3
MDAC ID: 31130  ABORT: 3/3

ITEM: ISOLATION RESISTORS (18); 5.1K, 1/4W
FAILURE MODE: ELEMENT OPENS, SHORTS

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) VARIOUS MDM MONITORING CIRCUITS
3) ISOLATION RESISTOR (18)

CRITICALITIES

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: VARIOUS LOCATIONS
PART NUMBER: RLR0705101GR

CAUSES: MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION, CHEMICAL DEGRADED MATERIALS

EFFECTS/RATIONALE:
LIMITS CURRENT IN LDG GEAR SENSING CONTROL, AND POWER MONITORING CIRCUITS BETWEEN LINE TO MDM'S FOR LDG GEAR CONTROL SUBSYSTEM. NONCRITICAL FUNCTION.

REFERENCES: VS70-510109

REPORT DATE 02/13/87  C-194
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EPD&C
MDAC ID: 31131

HIGHEST CRITICALITY

ITEM: RESISTOR, 7.5K, 2W
FAILURE MODE: ELEMENT OPENS, SHORTS

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) PNL A12
3) RESISTOR, 7.5K, 2W

CRITICALITIES

FLIGHT PHASE HDW/FUNC ABORT HDW/FUNC
PRELAUNCH: 3/3 RTLS: 3/3
LIFTOFF: 3/3 TAL: 3/3
ONORBIT: 3/3 AOA: 3/3
DEORBIT: 3/3 ATO: 3/3
LANDING/SAFING: 3/3

REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: PNL A12 36V73A12-A13-R1
PART NUMBER: RLR42C7501GM

CAUSES: MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
LIMITS CURRENT IN THE ARM/DN RESET POWER STATUS CIRCUIT BETWEEN ESSENTIAL BUS AND MDM MONITORING CIRCUIT.

REFERENCES: VS70-510109 ZONE 37

REPORT DATE 02/13/87 C-195
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EPD&C
MDAC ID: 31132

HIGHEST CRITICALITY
HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: RESISTOR (3), 1.2K, 2W
FAILURE MODE: ELEMENT OPENS, SHORTS

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD PCA 1,2,3
3) RESISTOR (3), ARM STATUS/MONITOR
4)
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FWD PCA 1,2,3 81V76A22-A1R93 82V76A23-A1R99 83V76A24-A1R86
PART NUMBER: RWR80S1211FR

CAUSES: MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
PROVIDES CIRCUIT PROTECTION BY LIMITING CURRENT BETWEEN A MAIN DC BUSS AND "ARM" RELAY MONITORING CIRCUITS. NONCRITICAL FUNCTION.

REFERENCES: VS70-510109 ZONES 33,36,39

REPORT DATE 02/13/87 C-196
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EPD&C
MDAC ID: 31133

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: RESISTOR (6), 100K, 1/8W
FAILURE MODE: ELEMENT OPENS, SHORTS

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FLCA 2 & 3
3) RESISTOR (6), GSE TEST CIRCUITS
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9) 05-6BA

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLCA 2 & 3
PART NUMBER: RLR05C1003GR

CAUSES: MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
LIMITS CURRENT BETWEEN ORBITER GSE TEST CONNECTIONS AND TESTING OF ORBITER LANDING GEAR UPLOCK CIRCUITRY. GROUND TEST ONLY, NONCRITICAL FUNCTION.

REFERENCES: VS70-510109 ZONES 8,81,104

REPORT DATE 02/13/87 C-197
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EPD&C
MDAC ID: 31134

HIGHEST CRITICALITY
HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: RESISTOR (2), 1.8K, 1/4W
FAILURE MODE: ELEMENT OPENS, SHORTS

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD PCA 1,2,3
3) RESISTOR (2), BLEED-OFF, RPC/MDM MONITORING
4) 05-6BA

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FWD PCA 2 & 3 82V76A23-A1R80 83V76A24-A1R74
PART NUMBER: RLRC7C1801GR

CAUSES: MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

PROVIDES A BLEED-OFF LINE TO THE RETURN BUSS IN CASE OF A LEAKING BLOCKING DIODE IF THE ALTERNATE PARALLEL RPC IS USED TO POWER THE REDUNDANT SHUTOFF VALVE. ALSO PREVENTS FALSE TRIGGERING OF MDM'S OF2 OR OF3.

REFERENCES: VS70-510109 ZONES 57,60

REPORT DATE 02/13/87 C-198
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EPD&C
MDAC ID: 31135

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: RESISTOR (8), 17.4K, 1/4W
FAILURE MODE: ELEMENT OPENS, SHORTS

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FLCA 1 & 2
3) RESISTOR (8), GSE PROX. SENSOR BOX 1 & 2
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9) 05-6BA

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLCA 1 & 2 81V76A16-R(4) 82V76A17-R(4)
PART NUMBER: RBR54L17401BR

CAUSES: MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
LIMITS CURRENT BETWEEN GSE COMMANDS AND PROX. SENSOR BOXES WHEN PERFORMING GROUND TARGET TEST.

REFERENCES: VS70-510109 ZONES 9,76
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86

SUBSYSTEM: EPD&C

MDAC ID: 31136

HIGHEST CRITICALITY HDW/FUNC

FLIGHT: 3/3

ABORT: 3/3

ITEM: RESISTOR (3), 1.2K, 2W

FAILURE MODE: ELEMENT OPENS, SHORTS

LEAD ANALYST: G. BEAIRD

SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD PCA 1,2,3
3) RESISTOR (3), DOWN STATUS/MONITOR
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9) 05-6BA

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FWD PCA 1,2,3 81V76A22-A1R94 82V76A23-A1R98 83V76A24-A1R87

PART NUMBER: RWR80S1211FR

CAUSES: MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
PROVIDES CIRCUIT PROTECTION BY LIMITING CURRENT BETWEEN A MAIN DC BUSS AND "DOWN" RELAY MONITORING CIRCUITS. NONCRITICAL FUNCTION.

REFERENCES: VS70-510109 ZONES 31,36,39

REPORT DATE 02/13/87 C-200
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EPD&C
MDAC ID: 31137

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 2/1R
ABORT: 2/1R

ITEM: GENERAL PURPOSE FUSE (2), 5 AMP
FAILURE MODE: OPENS, PREMATURELY OPENS

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FPCA 2 & 3
3) FUSE (2), 5 AMP
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9) 05-6BA

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LOCATION: FPCA 2 & 3 82V76A23-F24 83V76A24-F6
PART NUMBER: ME451-0018-0500

CAUSES: MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION, CHEMICAL DEGRADED MATERIALS

EFFECTS/RATIONALE:
PROVIDES OVERLOAD PROTECTION BETWEEN A MAIN DC BUS AND THE LANDING GEAR SUBSYSTEM LOADS CONSISTING OF PIC'S - 1 & 2 FIRING CIRCUITS FOR: PYRO UPLock RELEASE NLG PYRO ASSIST AND REDUNDANT SHUTOFF VALVE. LOSS OF REDUNDANT POWER AND NLG MAY FAIL TO EXTEND IN REQUIRED TIME RESULTING IN CREW/VEHICLE LOSS.

REFERENCES: VS70-510109 ZONES 56, 62

REPORT DATE 02/13/87 C-201
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EPD&C
MDAC ID: 31138

ITEM: RESISTOR (2), 2.2K, 1/2W
FAILURE MODE: ELEMENT OPENS, SHORTS

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD PCA 2 & 3
3) RESISTOR (2), RPC OUTPUT/MDM MONITOR

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FWD PCA 2 & 3 82V76A23-A1R45 83V76A24-A1R42
PART NUMBER: RLR20C2201GR

CAUSES: MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
LIMITS CURRENT BETWEEN RPC OUTPUT AND MDM MONITORING FOR RPC OPERATING STATUS.

REFERENCES: VS70-510109 ZONES 57,60

REPORT DATE 02/13/87 C-202
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EPD&C
MDAC ID: 31139

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: RESISTOR, 1.2K, 2W
FAILURE MODE: ELEMENT OPENS, SHORTS

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD PCA 2
3) RESISTOR, 1.2K, 2W
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FWD PCA 2 82V76A23-A1R88
PART NUMBER: RWR8051211FR

CAUSES: MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
LIMITS CURRENT IN LANDING GEAR STRUT ACTUATOR POSITION INDICATORS FOR NLG, LMG, AND RMG DOOR BOOSTER SPRING LOCKS AND SHUTTLE VALVE INDICATORS.

REFERENCES: VS70-510109 ZONE 140

REPORT DATE 02/13/87 C-203
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

| DATE:     | 12/21/86 |
| SUBSYSTEM: | EPD&C     |
| MDAC ID:  | 31140     |

**ITEM:** HYBRID DRIVER CONTROLLER (TYPE 1)
**FAILURE MODE:** LOSS OF OUTPUT

**LEAD ANALYST:** G. BEAIRD  **SUBSYS LEAD:** SCHMECKPEPER

**BREAKDOWN HIERARCHY:**
1) LANDING GEAR CONTROL
2) FWD LCA 2 & 3
3) HYBRID DRIVER CONTROLLER (2), TYPE 1
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9) 05-6BA

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**LOCATION:** FWD LCA 2 & 3 82V76A17-AR 83V76A18-AR
**PART NUMBER:** MC477-0261-0002

**CAUSES:** PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

**EFFECTS/RATIONALE:**
WHEN THE "NLG NO-WOW" SIGNAL IS RECEIVED THROUGH A PROX. SENSOR ELE. BOX, THE HDC CONNECTS MAIN DC BUSS POWER TO WOW CIRCUITS WITHIN A BRAKE/SKID CONTROL BOX AND SIGNALS A MONITORING MDM. POSSIBLE LOSS OF CREW/VEHICLE WITH LOSS OF CAPABILITY TO SEND "NLG NO-WOW" SIGNALS TO BRAKE/SKID BOXES A AND B.

**REFERENCES:** VS70-510109 ZONES 103,110 VS70-520109

REPORT DATE 02/13/87 C-204
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86  HIGHEST CRITICALITY
SUBSYSTEM: EPD&C  FLIGHT: 3/3
MDAC ID: 31141  ABORT: 3/3

ITEM: HYBRID DRIVER CONTROLLER (TYPE 1)
FAILURE MODE: INADVERTENT OUTPUT

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA 2 & 3
3) HYBRID DRIVER CONTROLLER (2), TYPE 1
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9) 05-6BA

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: FWD LCA 2 & 3  82V76A17-AR  83V76A18-AR
PART NUMBER: MC477-0261-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
WHEN THE "NLG NO-WOW" SIGNAL IS RECEIVED THROUGH A PROX. SENSOR ELE. BOX, THE HDC CONNECTS MAIN DC BUSS POWER TO WOW CIRCUITS WITHIN A BRAKE/SKID CONTROL BOX AND SIGNAL A MONITORING MDM. PREMATURELY CONDUCTS ONE OF TWO "NLG NO-WOW" SIGNALS TO BRAKE AND ANTI-SKID SUBSYSTEM; NO EFFECT.

REFERENCES: VS70-510109: ZONES 103,110; VS70-520109

REPORT DATE 02/13/87  C-205
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EPD&C
MDAC ID: 31142

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: HYBRID DRIVER CONTROLLER (TYPE 1)
FAILURE MODE: LOSS OF OUTPUT, INADVERTENT OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA-2
3) HYBRID DRIVER CONTROLLER, TYPE 1

REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FWD LCA-2 82V76A17-AR
PART NUMBER: MC477-0261-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
WHEN THE NLG DOWNLOCKED SIGNAL IS RECEIVED THROUGH A PROX. SENSOR ELE. BOX, THE HDC CONNECTS A MAIN DC BUSS POWER TO DOWN COILS OF THE TWO NOSE LANDING GEAR EVENT INDICATORS AND SIGNAL A MONITORING MDM. NONCRITICAL MONITOR.

REFERENCES: VS70-510109 ZONE 101

REPORT DATE 02/13/87 C-206
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86                HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C                  FLIGHT: 3/1R
MDAC ID: 31143                  ABORT: 3/1R

ITEM: HYBRID DRIVER CONTROLLER (TYPE 1)
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA-2
3) HYBRID DRIVER CONTROLLER, TYPE 1
4) 6)
5) 7)
6) 8)
9) 05-6BA

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LOCATION: FWD LCA-2 82V76A17-AR
PART NUMBER: MC477-0261-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
WHEN THE NLG UPLocked SIGNAL IS RECEIVED THROUGH A PROX. SENSOR ELE. BOX, THE HDC CONNECTS MAIN DC BUSS POWER FOR ARMING LOGIC TO NLG UPLK PIC #2 AND NLG UPLock AND EVENT INDICATORS, AND SIGNALS A MONITORING MDM. POSSIBLE LOSS OF CREW/VEHICLE WITH LOSS OF CAPABILITY TO CONDUCT POWER TO ARM PIC-2.

REFERENCES: VS70-510109 ZONE 104
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EPD&C
MDAC ID: 31144

HIGHEST CRITICALITY: HDW/FUNC
FLIGHT: 2/1R
ABORT: 2/1R

ITEM: HYBRID DRIVER CONTROLLER (TYPE 1)
FAILURE MODE: INADVERTENT OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA-2
3) HYBRID DRIVER CONTROLLER, TYPE 1
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9) 05-6BA

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LOCATION: FWD LCA-2 82V76A17-AR
PART NUMBER: MC477-0261-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
WHEN THE NLG UNLOCKED SIGNAL IS RECEIVED THROUGH A PROX. SENSOR ELE. BOX, THE HDC CONNECTS MAIN DC BUSS POWER FOR ARMING LOGIC TO NLG UPLK PIC #2 AND NLG UNLOCK AND EVENT INDICATORS AND SIGNAL A MONITORING MDM. POSSIBLE LOSS OF CREW/VEHICLE WITH LOSS OF CAPABILITY TO ASSIST NLG EXTENSION.

REFERENCES: VS70-510109 ZONE 104

REPORT DATE 02/13/87 C-208
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EP&C
MDAC ID: 31145

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: HYBRID DRIVER CONTROLLER (TYPE 1)
FAILURE MODE: LOSS OF OUTPUT, INADVERTENT OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA 2 & 3
3) HYBRID DRIVER CONTROLLER (4), TYPE 1

REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FWD LCA 2 & 3 82V76A17-AR(2) 83V76A18-AR(2)
PART NUMBER: MC477-0261-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
WHEN THE LEFT/RIGHT MG UPLOCK AND/OR MG DOOR UPLOCK SIGNALS ARE RECEIVED THROUGH A PROX. SENSOR ELE. BOX, THE HDC CONNECTS MAIN DC BUSS POWER TO THE RELATED MONITORING FUNCTIONS (I.E. LEFT/RIGHT MG EVENT INDICATORS, AND MDM'S. LOSS OF CAPABILITY: (1) TO ENERGIZE EVENT INDICATORS (DS2 & DS3) AND (2) SIGNAL STATUS TO AN MDM. ALTERNATE MONITORING STATUS PROVIDED.

REFERENCES: VS70-510109 ZONES 8,18,81,94
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EPD&C
MDAC ID: 31146

ITEM: HYBRID DRIVER CONTROLLER (TYPE 1)
FAILURE MODE: LOSS OF OUTPUT, INADVERTENT OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA 2 & 3
3) HYBRID DRIVER CONTROLLER (2), TYPE 1
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9) 05-6BA

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FWD LCA 2 & 3 82V76A17-AR(2) 83V76A18-AR(2)
PART NUMBER: MC477-0261-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
WHEN THE LEFT/RIGHT MG DOWNLOCKED SIGNAL IS RECEIVED THROUGH A PROX. SENSOR ELE. BOX, THE HDC CONNECTS MAIN DC BUS POWER TO THE DOWN COILS OF THE LEFT/RIGHT MG EVENT INDICATORS AND SIGNALS A MONITORING MDM. NONCRITICAL MONITOR.

REFERENCES: VS70-510109 ZONES 5,84

REPORT DATE 02/13/87 C-210
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C FLIGHT: 3/1R
MDAC ID: 31147 ABORT: 3/1R

ITEM: HYBRID DRIVER CONTROLLER (TYPE 1)
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: G. BEAIRD SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA 3
3) HYBRID DRIVER CONTROLLER, TYPE 1
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9) 05-6BA

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LOCATION: FWD LCA-3 83V76A18-AR
PART NUMBER: MC477-0261-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
WHEN THE NLG DOOR UPLCKED SIGNAL IS RECEIVED THROUGH A PROX. SENSOR ELE. BOX, THE HDC CONNECTS MAIN DC BUSS POWER FOR ARMING LOGIC TO PIC #1 AN NLG UPLCK AND EVENT INDICATORS, AND SIGNALS A MONITORING MDM. POSSIBLE LOSS OF CREW/VEHICLE WITH LOSS OF CAPABILITY TO CONDUCT POWER TO ARM PIC-1.

REFERENCES: VS70-510109 ZONE 109
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EPD&C
MDAC ID: 31148

ITEM: HYBRID DRIVER CONTROLLER (TYPE 1)
FAILURE MODE: LOSS OF OUTPUT, INADVERTENT OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA-2
3) HYBRID DRIVER CONTROLLER, TYPE 1
4) ...
5) ...
6) ...
7) ...
8) ...
9) 05-6BA

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FWD LCA-2 82V76A17-AR
PART NUMBER: MC477-0261-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
WHEN THE NLG UPLOCK AND NLG DOOR UPLOCK SIGNALS ARE RECEIVED THROUGH A PROX. SENSOR ELE. BOX, THE HDC CONNECTS MAIN DC BUSS POWER TO "UP" COILS OF NLG EVENT INDICATORS, AND SIGNALS A MONITORING MDM. NONCRITICAL MONITORING FUNCTION.

REFERENCES: VS70-510109 ZONE 106

REPORT DATE 02/13/87 C-212
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86  HIGHEST CRITICALITY: HDW/FUNC
SUBSYSTEM: EPD&C  FLIGHT: 2/1R
MDAC ID: 31149  ABORT: 2/1R

ITEM: HYBRID DRIVER CONTROLLER (TYPE 1)
FAILURE MODE: INADVERTENT OUTPUT

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA-3
3) HYBRID DRIVER CONTROLLER, TYPE 1
4) ...
5) ...
6) ...
7) ...
8) ...
9) 05-6BA

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LOCATION: FWD LCA-3 83V76A18-AR
PART NUMBER: MC477-0261-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
WHEN THE NLG DOOR UPLOCKED SIGNAL IS RECEIVED THROUGH A PROX. SENSOR ELE. BOX, THE HDC CONNECTS MAIN DC BUSS POWER FOR ARMING LOGIC TO PIC #1 AND NLG UPLOCK AND EVENT INDICATORS, AND SIGNALS A MONITORING MDM. POSSIBLE LOSS OF CREW/VEHICLE WITH LOSS OF CAPABILITY TO ASSIST NLG EXTENSION.

REFERENCES: VS70-510109 ZONE 109

REPORT DATE 02/13/87  C-213
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EPD&C
MDAC ID: 31150

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 2/1R
ABORT: 2/1R

ITEM: HYBRID DRIVER CONTROLLER (TYPE 1)
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA - 2 & 3
3) HYBRID DRIVER CONTROLLER (4), TYPE 1
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9) 05-6BA

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LOCATION: FWD LCA - 2 & 3 82V76A17-AR(2) 83V76A18-AR(2)
PART NUMBER: MC477-0261-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
AFTER RECEIVING THE NLG "DOWN" STIMULI, THE HDC'S CONDUCT "FIRE" COMMAND TO NLG PIC'S 1 & 2 FIRE-1 & FIRE-2 CIRCUITS FOR CHARGE INITIATION OF NLG EXTENSION POWERED ASSIST SUBSYSTEM. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF SECOND FAILURE; NLG MAY FAIL TO EXTEND IN THE REQUIRED TIME.

REFERENCES: VS70-510109 ZONES 127,130

REPORT DATE 02/13/87 C-214
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EPD&C
MDAC ID: 31151

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: HYBRID DRIVER CONTROLLER (TYPE 1)
FAILURE MODE: INADVERTENT OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA - 2 & 3
3) HYBRID DRIVER CONTROLLER (4), TYPE 1
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9) 05-6BA

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LOCATION: FWD LCA - 2 & 3  82V76A17-AR(2)  83V76A18-AR(2)
PART NUMBER: MC477-0261-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
AFTER RECEIVING THE NLG "DOWN" STIMULI, THE HDC'S CONDUCT "FIRE" COMMANDS TO NLG PIC'S 1 & 2 FIRE-1 & FIRE-2 CIRCUITS FOR CHARGE INITIATION OF NLG EXTENSION POWERED ASSIST SUBSYSTEM. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF PREMATURE COMPLETION OF PIC FIRING SEQUENCE.

REFERENCES: VS70-510109 ZONES 127,130

REPORT DATE 02/13/87  C-215
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C  FLIGHT: 2/1R
MDAC ID: 31152  ABORT: 2/1R

ITEM: HYBRID DRIVER CONTROLLER (TYPE II)
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA - 2 & 3
3) HYBRID DRIVER CONTROLLER (4), TYPE II

CRITICALITIES
FLIGHT PHASE HDW/FUNC ABORT HDW/FUNC
PRELAUNCH: 3/3 RTLS: 2/1R
LIFTOFF: /NA TAL: 2/1R
ONORB: /NA AOA: 2/1R
DEORBIT: 2/1R ATO: 2/1R
LANDING/SAFING: 2/1R


LOCATION: FWD LCA - 2 & 3  82V76A17-AR(2)  83V76A18-AR(2)
PART NUMBER: MC477-0262-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL
SHOCK, VIBRATION

EFFECTS/RATIONALE:
WHEN THE "ARM & DOWN" SIGNALS ARE RECEIVED, THE HDC CONNECTS
INPUT POWER (AFTER A ONE SECOND DELAY) TO THE FIRE-1 CIRCUIT AND
SIGNALS A SERIES HDC WHICH DELAYS FIRE-2 COMMAND FOR ONE SECOND.
THEN A SIGNAL IS SENT TO THE ASSOCIATED PIC FOR NLG EXTENSION
POWERED ASSIST FUNCTION. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE
OF SECOND FAILURE; THE NLG MAY FAIL TO EXTEND IN REQUIRED TIME.

REFERENCES: VS70-510109 ZONES 127,130

REPORT DATE 02/13/87 C-216
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C  FLIGHT: 3/1R
MDAC ID: 31153  ABORT: 3/1R

ITEM: HYBRID DRIVER CONTROLLER (TYPE II)
FAILURE MODE: INADVERTENT OUTPUT

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA - 2 & 3
3) HYBRID DRIVER CONTROLLER (4), TYPE II
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LOCATION: FWD LCA - 2 & 3  82V76A17-AR(2)  83V76A18-AR(2)
PART NUMBER: MC477-0262-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
WHEN THE "ARM & DOWN" SIGNALS ARE RECEIVED, THE HDC CONNECTS INPUT POWER (AFTER A ONE SECOND DELAY) TO THE FIRE-1 CIRCUIT AND SIGNALS A SERIES HDC WHICH DELAYS FIRE-2 COMMAND FOR ONE SECOND. THEN A SIGNAL IS SENT TO THE ASSOCIATED PIC FOR NLG EXTENSION POWERED ASSIST FUNCTION. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF PREMATURE COMPLETION OF PIC FIRING SEQUENCE.

REFERENCES: VS70-510109 ZONES 127,130

REPORT DATE 02/13/87  C-217
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EPD&C
MDAC ID: 31154

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: HYBRID DRIVER CONTROLLER (TYPE 3)
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA - 2 & 3
3) HYBRID DRIVER CONTROLLER (2), TYPE III

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LOCATION: FWD LCA - 2 & 3 82V76A17-AR 83V76A18-AR
PART NUMBER: MC477-0263-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
WHEN ARM & DOWN COMMANDS ARE RECEIVED BY NLG PIC'S 1 & 2, THE HDC CONNECTS INPUT POWER TO THE PIC'S ARM LOGIC AND ENABLES THE FIRE-2 AND PYRO ASSIST FOR NLG EXTENSION. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF ELECTRICAL POWER TO ARM PIC'S.

REFERENCES: VS70-510109 ZONES 54,63

REPORT DATE 02/13/87 C-218
INDEPENDENT ORBITER ASSESSMENT
ORBTER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EPD&C
MDAC ID: 31155

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: HYBRID DRIVER CONTROLLER (TYPE 3)
FAILURE MODE: INADVERTENT OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA - 2 & 3
3) HYBRID DRIVER CONTROLLER (2), TYPE III
4) 5) 6) 7) 8) 9) 05-6BA

CRITICALITIES
FLIGHT PHASE HDW/FUNC ABORT HDW/FUNC
PRELAUNCH: 3/3 RTLS: 3/1R
LIFTOFF: /NA TAL: 3/1R
ONORBIT: /NA AOA: 3/1R
DEORBIT: 3/1R ATO: 3/1R
LANDING/SAFING: 3/1R


LOCATION: FWD LCA - 2 & 3 82V76A17-AR 83V76A18-AR
PART NUMBER: MC477-0263-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
WHEN ARM & DOWN COMMANDS ARE RECEIVED BY NLG PIC'S 1 & 2, THE HDC CONNECTS INPUT POWER TO THE PIC'S ARM LOGIC AND ENABLES THE FIRE-2 AND PYRO ASSIST FOR NLG EXTENSION. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF PREMATURE COMPLETION OF PIC FIRING SEQUENCE.

REFERENCES: VS70-510109 ZONES 54, 63

REPORT DATE 02/13/87 C-219
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EPD&C
MDAC ID: 31156

ITEM: HYBRID DRIVER CONTROLLER (TYPE 1)
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA - 2 & 3
3) HYBRID DRIVER CONTROLLER (6), TYPE 1
4)
5)
6)
7)
8)
9) 05-6BA

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LOCATION: FWD LCA - 2 & 3 82V76A17-AR(3) 83V76A18-AR(3)
PART NUMBER: MC477-0261-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
WHEN FIRE COMMAND IS RECEIVED, THE HDC CONNECTS DC INPUT POWER TO THE FIRING CIRCUIT WITHIN A PIC. THE HDC'S ARE USED FOR THE FIRING CIRCUIT (FIRE-1) FOR THE LANDING GEAR PIC'S. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF ELECTRICAL POWER TO FIRE PIC'S.

REFERENCES: VS70-510109 ZONES 16,21,54,63,88,96

REPORT DATE 02/13/87 C-220
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C  FLIGHT: 3/1R
MDAC ID: 31157  ABORT: 3/1R

ITEM: HYBRID DRIVER CONTROLLER (TYPE 1)
FAILURE MODE: INADVERTENT OUTPUT

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA - 2 & 3
3) HYBRID DRIVER CONTROLLER (6), TYPE 1
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9) 05-6BA

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LOCATION: FWD LCA - 2 & 3 82V76A17-AR(3) 83V76A18-AR(3)
PART NUMBER: MC477-0261-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
WHEN FIRE COMMAND IS RECEIVED, THE HDC CONNECTS DC INPUT POWER TO THE FIRING CIRCUIT WITH A PIC. THE HDC'S ARE USED FOR THE FIRING CIRCUIT (FIRE-1) FOR THE LANDING GEAR PIC'S. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF PREMATURE COMPLETION OF PIC FIRING SEQUENCE.

REFERENCES: VS70-510109 ZONES 16,21,54,63,88,96

REPORT DATE 02/13/87  C-221
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EPD&C
MDAC ID: 31158

HIGHEST CRITICALITY
FLIGHT: 3/3
ABORT: 3/3

ITEM: HYBRID DRIVER CONTROLLER (TYPE 1)
FAILURE MODE: LOSS OF OUTPUT, INADVERTENT OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA - 2 & 3
3) HYBRID DRIVER CONTROLLER (2), TYPE 1
4) 5) 6) 7) 8) 05-6BA

CRITICALITIES

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FWD LCA - 2 & 3 82V76A17-AR 83V76A18-AR
PART NUMBER: MC477-0261-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
WHEN THE LEFT/RIGHT (MG-NO-WOW) SIGNAL IS RECEIVED THROUGH A PROX. SENSOR ELE. BOX, THE HDC CONNECTS A MAIN DC BUSS POWER FOR STATUS INDICATION OF LEFT/RIGHT MG-NO-WOW, AND THEN SIGNALS A MONITORING MDM. NONCRITICAL MONITOR.

REFERENCES: VS70-510109 ZONES 7,80

REPORT DATE 02/13/87 C-222
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EPD&C
MDAC ID: 31159

HIGHEST CRITICALITY: HDW/FUNC
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: HYBRID DRIVER CONTROLLER (TYPE II)
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA - 2 & 3
3) HYBRID DRIVER CONTROLLER (2), TYPE II
4) 5) 6) 7) 8) 9) 05-6BA

CRITICALITIES

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LOCATION: FWD LCA 82V76A17-AR 83V76A18-AR
PART NUMBER: MC477-0262-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
WHEN THE "ARM", "DOWN", AND "NLG UPLOCK" SIGNALS ARE RECEIVED, THE HDC CONNECTS INPUT POWER (AFTER A ONE SECOND DELAY) TO THE FIRE-2 SIGNAL INPUT OF THE "NLG BACKUP UPLOCK RELEASE" CIRCUITRY OF A NLG PIC. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF FIRE-2 SIGNAL TO ONE OF THE TWO PIC'S.

REFERENCES: VS70-510109 ZONES 54,63

REPORT DATE 02/13/87 C-223
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EPD&C
MDAC ID: 31160

ITEM: HYBRID DRIVER CONTROLLER (TYPE II)
FAILURE MODE: INADVERTENT OUTPUT

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA – 2 & 3
3) HYBRID DRIVER CONTROLLER (2), TYPE II
4) 5)
6) 7)
8) 9) 05-6BA

CRITICALITIES

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LOCATION: FWD LCA 82V76A17-AR 83V76A18-AR
PART NUMBER: MC477-0262-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
WHEN THE "ARM", "DOWN", AND "NLG UPLOCK" SIGNALS ARE RECEIVED, THE HDC CONNECTS INPUT POWER (AFTER A ONE SECOND DELAY) TO THE FIRE-2 SIGNAL INPUT OF THE "NLG BACKUP UPLOCK RELEASE" CIRCUITRY OF A NLG PIC. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF PREMATURE CONDUCTION OF ONE OF TWO REQUIRED SIGNALS TO THE FIRE-2 LOGIC CIRCUITS.

REFERENCES: VS70-510109 ZONES 54, 63

REPORT DATE 02/13/87  C-224
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

ITEM: HYBRID DRIVER CONTROLLER (TYPE 1)
FAILURE MODE: LOSS OF OUTPUT
LEAD ANALYST: G. BEAIRD SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA-2
3) HYBRID DRIVER CONTROLLER, TYPE 1
4) 
5) 
6) 
7) 
8) 
9) 05-6BA

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LOCATION: FWD LCA-2 82V76A17-AR
PART NUMBER: MC477-0261-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
THE HDC CONNECTS MAIN BUS DC POWER TO "WOW2" CIRCUITS WITHIN BRAKE/SKID CONTROL BOX A. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF CAPABILITY TO SEND "NLG NO-WOW2" SIGNAL TO BRAKE/SKID CONTROL BOX A.

REFERENCES: VS70-510109 ZONE 102

REPORT DATE 02/13/87
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C  FLIGHT: 3/3
MDAC ID: 31162  ABDORT: 3/3

ITEM: HYBRID DRIVER CONTROLLER (TYPE 1)
FAILURE MODE: INADVERTENT OUTPUT

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA-2
3) HYBRID DRIVER CONTROLLER, TYPE 1
4) 
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8) 
9) 05-6BA

CRITICALITIES

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: FWD LCA-2 82V76A17-AR
PART NUMBER: MC477-0261-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
The HDC connects main bus DC power to "WOW2" circuits within Brake/Skid control boxes. Prematurely conducts power to another HDC (which is inhibited), which has no effect on it.

REFERENCES: VS70-510109 ZONE 102

REPORT DATE 02/13/87  C-226
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EPD&C
MDAC ID: 31163

HIGHEST CRITICALITY
HDW/FUNC

FLIGHT: 3/1R
ABORT: 3/1R

ITEM: HYBRID DRIVER CONTROLLER (TYPE II)
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA - 2 & 3
3) HYBRID DRIVER CONTROLLER (4), TYPE II
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8)
9) 05-6BA

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LOCATION: FWD LCA - 2 & 3 82V76A17-AR(2) 83V76A18-AR(2)
PART NUMBER: MC477-0262-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
WHEN THE "ARM & DOWN" SIGNALS ARE RECEIVED, THE HDC (AFTER A 1 SECOND DELAY) CONNECTS INPUT POWER TO THE FIRE-2 CIRCUIT OF THE LEFT/RIGHT EMERGENCY UPLOCK RELEASE ON PIC'S 1 & 2. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF ELECTRICAL POWER TO SEND FIRE-2 COMMAND TO LEFT/RIGHT PIC'S 1 & 2.

REFERENCES: VS70-510109 ZONES 14,20,87,94

REPORT DATE 02/13/87 C-227
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EPD&C
MDAC ID: 31164

HIGHEST CRITICALITY
HDW/FUNC
FLIGHT: 3/1R
ABORT: 3/1R

ITEM:
HYBRID DRIVER CONTROLLER (TYPE II)
FAILURE MODE:
INADVERTENT OUTPUT

LEAD ANALYST:
G. BEAIRD
SUBSYS LEAD:
SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA - 2 & 3
3) HYBRID DRIVER CONTROLLER (4), TYPE II
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6)
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8)
9) 05-6BA

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REDUNDANCY SCREENS:
B [ F ]
C [ P ]

LOCATION:
FWD LCA - 2 & 3
82V76A17-AR(2)
83V76A18-AR(2)

PART NUMBER:
MC477-0262-0002

CAUSES:
PICE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
WHEN THE "ARM & DOWN" SIGNALS ARE RECEIVED, THE HDC (AFTER A 1 SECOND DELAY) CONNECTS INPUT POWER TO THE FIRE-2 CIRCUIT OF THE LEFT/RIGHT EMERGENCY UPLOCK RELEASE ON PIC'S 1 & 2. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF PREMATURE COMPLETION OF PIC FIRING SEQUENCE.

REFERENCES:
VS70-510109 ZONES 14,20,87,94

REPORT DATE 02/13/87 C-228
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86
SUBSYSTEM: EPD&C
MDAC ID: 31165

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: HYBRID DRIVER CONTROLLER (TYPE III)
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA - 2 & 3
3) HYBRID DRIVER CONTROLLER (4), TYPE III
4) 
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LOCATION: FWD LCA - 2 & 3 82V76A17-AR(2) 83V76A18-AR(2)
PART NUMBER: MC477-0263-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
WHEN LEFT/RIGHT UPLocked SIGNALS ARE RECEIVED, THE HDC CONNECTS INPUT POWER TO "ARM" CIRCUIT OF LEFT/RIGHT MAIN GEAR UPLock RELEASE PIC'S 1 & 2. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF ELECTRICAL POWER TO SEND ARM COMMAND TO LEFT/RIGHT PIC'S 1 & 2.

REFERENCES: VS70-510109 ZONES 12,19,85,93

REPORT DATE 02/13/87 C-229
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C FLIGHT: 3/1R
MDAC ID: 31166 ABORT: 3/1R

ITEM: HYBRID DRIVER CONTROLLER (TYPE III)
FAILURE MODE: INADVERTENT OUTPUT

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA - 2 & 3
3) HYBRID DRIVER CONTROLLER (4), TYPE III
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9) 05-6BA

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LOCATION: FWD LCA - 2 & 3  82V76A17-AR(2)  83V76A18-AR(2)
PART NUMBER: MC477-0263-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
WHEN LEFT/RIGHT UPLOCKED SIGNALS ARE RECEIVED, THE HDC CONNECTS INPUT POWER TO "ARM" CIRCUIT OF LEFT/RIGHT MAIN GEAR UPLOCK RELEASE PIC'S 1 & 2. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF PREMATURE COMPLETION OF PIC ARM SEQUENCE.

REFERENCES: VS70-510109  ZONES 12,19,85,93

REPORT DATE 02/13/87  C-230
INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/21/86  
SUBSYSTEM: EPD&C  
MDAC ID: 31167  

ITEM: HYBRID DRIVER CONTROLLER (TYPE 1)  
FAILURE MODE: LOSS OF OUTPUT, INADVERTENT OUTPUT  

LEAD ANALYST: G. BEAIRD  
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:  
1) LANDING GEAR CONTROL  
2) FWD LCA - 2 & 3  
3) HYBRID DRIVER CONTROLLER (2), TYPE 1  
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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: FWD LCA - 2 & 3 82V76A17-AR 83V76A18-AR  
PART NUMBER: MC477-0261-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:  
HDC'S POWER LEFT/RIGHT MAIN GEAR EVENT INDICATORS (DS3,DS2), NONCRITICAL MONITORING FUNCTION.

REFERENCES: VS70-510109 ZONES 14,87

REPORT DATE 02/13/87  C-231
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 1/03/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C  FLIGHT: 2/1R
MDAC ID: 31168  ABOORT: 2/1R

ITEM: LATCHING RELAY (6), LDG GR 'ARM' CONTROL CIRCUITS
FAILURE MODE: FAILS OPEN

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD PCA-1,2,3
3) LATCHING RELAY (6), 4PDT
4) 5) 6) 7) 8) 9) 05-6BA

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LOCATION: FWD PCA-1,2,3  82V76A23-K7,K15  81V76A22-K6,K7
83V76A24-K8,K11
PART NUMBER: MC455-0128-0001

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL
SHOCK, VIBRATION, CHEMICAL DEGRADED MATERIALS

EFFECTS/RATIONALE:
THE RELAY 'ARMS' AND CONNECTS MONITORS FOR THE LDG GR CONTROL
VALVES, PYRO UPLOCK RELEASE CIRCUITS AND NLG EXT PYRO ASSIST
CKTS. THE ASSOCIATED LDG GR 'DOWN' RELAYS, WHEN COMMANDED,
COMPLETES THE SERIES CIRCUIT AND ALLOWS FOR PROTECTION AGAINST
PREMATURES. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF SECOND
FAILURE; NLG MAY FAIL TO EXTEND IN THE REQUIRED AMOUNT OF TIME.

REFERENCES: VS70-510109 ZONES 33,38,41,57,62,68

REPORT DATE 02/13/87 C-232
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 1/03/87
SUBSYSTEM: EPD&C
MDAC ID: 31169

HIGHEST CRITICALITY
HDW/FUNC
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: LATCHING RELAY (6), LDG GR 'ARM' CONTROL CIRCUITS
FAILURE MODE: FAILS CLOSED, SHORTED CONTACTS

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD PCA-1,2,3
3) LATCHING RELAY (6), 4PDT

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LOCATION: FWD PCA-1,2,3 82V76A23-K7,K15 81V76A22-K6,K7
3V76A24-K8,K11
PART NUMBER: MC455-0128-0001

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
THE RELAY 'ARMS' AND CONNECTS MONITORS FOR THE LDG GR CONTROL VALVES, PYRO UPLock RELEASE CIRCUITS AND NLG EXT PYRO ASSIST CKTS. THE ASSOCIATED LDG GR 'DOWN' RELAYS, WHEN COMMANDED, COMPLETES THE SERIES CIRCUIT AND ALLOWS FOR PROTECTION AGAINST PREMATURES. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF 'DOWN' RELAY REDUNDANCY.

REFERENCES: VS70-510109 ZONES 33,38,41,57,62,68

REPORT DATE 02/13/87 C-233
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 1/03/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C  FLIGHT: 2/1R
MDAC ID: 31170  ABORT: 2/1R

ITEM: LATCHING RELAY (6), LDG GR 'DOWN' CONTROL CIRCUITS
FAILURE MODE: FAILS OPEN

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD PCA-1,2,3
3) LATCHING RELAY (6), 4PDT
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LOCATION: FWD PCA-1,2,3  81V76A22-K8  82V76A23-K6,K8
83V76A24-K7,K9,K10
PART NUMBER: MC455-0128-0001

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
THE 'LDG GR DOWN' RELAYS WITH THE 'ARM' RELAYS ACTUATES THE CIRCUITS FOR THE LDG GR CONTROL VALVES, PYRO UNLOCK RELEASE CRTS, AND NLG EXT PYRO ASSIST CKTS. PROTECTION AGAINST PREMATURITIES AND REDUNDANCY PROVIDED WITHIN LDG GR CIRCUITS. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF SECOND FAILURE; NLG MAY FAIL TO EXTEND IN THE REQUIRED AMOUNT OF TIME.

REFERENCES: VS70-510109 ZONES 32,36,40,56,62,69

REPORT DATE 02/13/87  C-234
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 1/03/87
SUBSYSTEM: EPD&C
MDAC ID: 31171

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/1R
ABORT: 3/1R

ITEM:
FAILURE MODE: LATCHING RELAY (6), LDG GR 'DOWN' CONTROL CIRCUITS FAILS CLOSED

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD PCA-1, 2, 3
3) LATCHING RELAY (6), 4 PDT

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LOCATION: FWD PCA-1, 2, 3 81V76A22-K8 82V76A23-K6, K8
83V76A24-K7, K9, K10
PART NUMBER: MC455-0128-0001

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
THE 'LDG GR DOWN' RELAYS WITH THE 'ARM' RELAYS ACTUATES THE CIRCUITS FOR THE LDG GR CONTROL VALVES, PYRO UPLock RELEASE CRTS, AND NLG EXT PYRO ASSIST CRTS. PROTECTION AGAINST PREMATURES AND REDUNDANCY PROVIDED WITHIN LDG GR CIRCUITS. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF 'ARM' RELAY REDUNDANCY.

REFERENCES: VS70-510109 ZONES 32, 36, 40, 56, 62, 69

REPORT DATE 02/13/87 C-235
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 1/05/87
SUBSYSTEM: EPD&C
MDAC ID: 31172

ITEM: GENERAL PURPOSE RELAY (2)
FAILURE MODE: FAILS OPEN, FAILS CLOSED

LEAD ANALYST: G. BEAIRD SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD MCA 2 & 3
3) GENERAL PURPOSE RELAY (2)
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FWD MCA 2 & 3 82V76A112-K32 83V76A113-K28

PART NUMBER: MC455-0129-0001

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
PROVIDES THE MEANS TO SWITCH THE PROX. SENSOR BOXES TO A GSE SOURCE DURING GROUND OPERATIONS TO RAISE AND LOWER THE MAIN GEAR. GROUND FUNCTION ONLY.

REFERENCES: VS70-510109 ZONES 11,78

REPORT DATE 02/13/87 C-236
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 1/05/87

HIGHEST CRITICALITY
HDW/FUNC

FLIGHT: 3/1R

ABORT: 3/1R

SUBSYSTEM: EPD&C

MDAC ID: 31173

ID: 31173

ABORT: HDW/FUNC 3/1R 3/IR

ITEM: REMOTE POWER CONTROLLER (2), 3 AMPS

FAILURE MODE: LOSS OF OUTPUT, OPENS

LEAD ANALYST: G. BEAIRD

SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:

1) LANDING GEAR CONTROL
2) FWD PCA 2 & 3
3) RPC (2), REDUNDANT SHUTOFF VALVE
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LOCATION: FWD PCA-2 & 3 82V76A23-RPC42 82V76A24-RPC43

PART NUMBER: MC450-0017-2030

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
CONNECTS MAIN DC BUSS POWER TO THE LDG REDUNDANT SHUTOFF VALVE.
REDUNDANT POWER AND CONTROL PROVIDED BY SECOND MAIN DC BUSS AND RPC. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF ELECTRICAL POWER TO RPC TO POWER SHUTOFF VALVE.

REFERENCES: VS70-510109 ZONES 57,61

REPORT DATE 02/13/87 C-237
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 1/05/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C  FLIGHT: 3/1R
MDAC ID: 31174  ABO: 3/1R

ITEM: REMOTE POWER CONTROLLER (2), 3 AMPS
FAILURE MODE: INADVERTENT OUTPUT

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD PCA 2 & 3
3) RPC (2), REDUNDANT SHUTOFF VALVE

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LOCATION: FWD PCA-2 & 3 82V76A23-RPC42 82V76A24-RPC43
PART NUMBER: MC450-0017-2030

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
CONNECTS MAIN DC BUSS POWER TO THE LDG REDUNDANT SHUTOFF VALVE. REDUNDANT POWER AND CONTROL PROVIDED BY SECOND MAIN DC BUSS AND RPC. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF INADVERTENT RPC OUTPUT.

REFERENCES: VS70-510109  ZONES 57,61

REPORT DATE 02/13/87  C-238
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 1/05/87
SUBSYSTEM: EPD&C
MDAC ID: 31175

HIGHEST CRITICALITY
HDW/FUNC
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: PYRO INITIATOR CONTROLLER (6)
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA 2 & 3
3) PIC (6), NLG, LMG & RMG EMERGENCY UPLK RELEASE 1 & 2
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LOCATION: FLCA 2 & 3 82V76A17-PIC(3) 83V76A18-PIC(3)
PART NUMBER: MC450-0018-0005

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
AFTER RECEIVING THE 'ARM', 'FIRE-1', AND 'FIRE-2' STIMULI (LDG GR DOWN COMMANDS), THE PIC'S ELECTRICAL OUTPUT FIRES THE SQ1 & SQ2 EXPLOSIVE INITIATORS FOR NLG, LMG, & RMG BACKUP UPLK RELEASE 1 & 2. POSSIBLE LOSS OF CAPABILITY TO COMPLETE FIRING CIRCUIT TO NLG, LMG, & RMG EMERGENCY UPLock RELEASES.

REFERENCES: VS70-510109 ZONES 14,21,52,65,87,94

REPORT DATE 02/13/87 C-239
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 1/05/87
SUBSYSTEM: EPD&C
MDAC ID: 31176

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: PYRO INITIATOR CONTROLLER (6)
FAILURE MODE: INADVERTENT OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA 2 & 3
3) PIC (6), NLG, LMG & RMG EMERGENCY UPLK RELEASE 1 & 2
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9) 05-6BA

CRITICALITIES

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LOCATION: FLCA 2 & 3 82V76A17-PIC(3) 83V76A18-PIC(3)
PART NUMBER: MC450-0018-0005

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
AFTER RECEIVING THE 'ARM', 'FIRE-1', AND 'FIRE-2' STIMULI (LDG GR DOWN COMMANDS), THE PIC'S ELECTRICAL OUTPUT FIRES THE SQ1 & SQ2 EXPLOSIVE INITIATORS FOR NLG, LMG, & RMG BACKUP UPLK RELEASE 1 & 2. POSSIBLE LOSS OF CREW/VEHICLE IF ALL PIC REDUNDANCY IS LOST.

REFERENCES: VS70-510109 ZONES 14,21,52,65,87,94
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 1/05/87
SUBSYSTEM: EPD&C
MDAC ID: 31177

ITEM: PYRO INITIATOR CONTROLLER (2)
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA 2 & 3
3) PIC (2), NLG EXTENSION POWERED ASSIST 1 & 2

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LOCATION: FLCA 2 & 3 82V76A17-PIC 83V76A18-PIC
PART NUMBER: MC450-0018-0005

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
AFTER RECEIVING LANDING GEAR DOWN COMMANDS AND THE NLG DOES NOT COME DOWN (NO GEAR RELEASE INHIBIT IS RECEIVED), THE SQ1 & SQ2 EXPLOSIVE INITIATORS WILL BE FIRED TO BRING THE NLG DOWN. HARDWARE CRIT. 2 FOR TIME CRITICAL NLG DOWN ON APPROACH & LANDING.

REFERENCES: VS70-510109 ZONES 126,132

REPORT DATE 02/13/87 C-241
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 1/05/87
SUBSYSTEM: EPD&C
MDAC ID: 31178

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: PYRO INITIATOR CONTROLLER (2)
FAILURE MODE: INADVERTENT OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD LCA 2 & 3
3) PIC (2), NLG EXTENSION POWERED ASSIST 1 & 2
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9) 05-6BA

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LOCATION: FLCA 2 & 3 82V76A17-PIC 83V76A18-PIC
PART NUMBER: MC450-0018-0005

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
AFTER RECEIVING LANDING GEAR DOWN COMMANDS AND THE NLG DOES NOT COME DOWN (NO GEAR RELEASE INHIBIT IS RECEIVED), THE SQ1 & SQ2 EXPLOSIVE INITIATORS WILL BE FIRED TO BRING THE NLG DOWN. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF PIC REDUNDANCY.

REFERENCES: VS70-510109 ZONES 126,132

REPORT DATE 02/13/87 C-242
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 1/07/87
SUBSYSTEM: EPD&C
MDAC ID: 31179

ITEM: ANNUNCIATOR LIGHT (4)
FAILURE MODE: FAILS OPEN, FAILS TO INDICATE

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) PANELS F6A5 & F8A5
3) ANNUNCIATOR LIGHT (4), LDG GR 'ARM' & LDG GR 'DOWN'

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: PANELS F6A5 & F8A5 34V73A6A5(2) 34V73A8A5(2)
PART NUMBER: UNKNOWN

CAUSES: MECHANICAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
VISUAL MONITORING OF LANDING GEAR 'ARM' AND 'DOWN' PUSH BUTTON CIRCUITS. NONCRITICAL MONITORING FUNCTION.

REFERENCES: VS70-510109 ZONE 46

REPORT DATE 02/13/87 C-243
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 1/07/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C  FLIGHT: 3/3
MDAC ID: 31180  ABORT: 3/3

ITEM: ANNUNCIATOR CONTROL ASSEMBLY (2)
FAILURE MODE: LOSS OF OUTPUT (ON CHANNELS 31, 33, 36, 40)

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) AREA 30 FLIGHT DECK
3) ANNUNCIATOR CONTROL ASSEMBLIES 2 & 3

LANDING GEAR CONTROL AREA 30 FLIGHT DECK ANNUNCIATOR CONTROL ASSEMBLIES 2 & 3

05-6BA

CRITICALITIES

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: 30V73A18 30V73A17
PART NUMBER: MC434-0283-0002

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
PROVIDES POWER TO LANDING GEAR 'ARM' AND 'DOWN' ANNUNCIATOR LIGHTS. NONCRITICAL OPERATION.

REFERENCES: VS70-510109  ZONE 44

REPORT DATE 02/13/87  C-244
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 1/07/87
SUBSYSTEM: EPD&C
MDAC ID: 31181

ITEM: MAIN GEAR BRAKE UPLOCK RELEASE CIRCUITS 1 & 2
FAILURE MODE: LOSS OF POWER, OPENS

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FLCA 2 & 3
3) LEFT & RIGHT MAIN GEAR BRAKE UPLOCK RELEASE CIRCUITS 1 & 2
4) ...
5) ...
6) ...
7) ...
8) ...
9) 05-6BA

CRITICALITIES

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LOCATION: FLCA 2 & 3 82V76A17 83V76A18
PART NUMBER: NA

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
CIRCUIT SUPPLIES CONTROL POWER TO LEFT/RIGHT MAIN LANDING GEAR BACK UPLOCK RELEASE SUBSYSTEM. THIS CIRCUIT IS A BACKUP TO THE PRIMARY HYDRAULIC SYSTEM. MDAC ID'S 31120, 31128, 31129, 31156, 31157, 31163 THROUGH 31166 COVER ALL THE COMPONENTS IN THIS CIRCUIT. COMPONENT LIST: PIC'S (4), HDC TYPE 1 (4), HDC TYPE 2 (4), HDC TYPE 3 (4), RESISTORS (8), DIODES (4).

REFERENCES: VS70-510109 ZONES 14,21,87,94

REPORT DATE 02/13/87  C-245
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 1/07/87
SUBSYSTEM: EPD&C
MDAC ID: 31182

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: NOSE LANDING GEAR BRAKE UPLOCK RELEASE CIRCUIT
NO'S 1 & 2
FAILURE MODE: LOSS OF POWER, OPENS

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FLCA 2 & 3
3) NOSE LANDING GEAR BRAKE UPLOCK RELEASE CIRCUIT NO'S 1 & 2
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LOCATION: FLCA 2 & 3 82V76A17 83V76A18
PART NUMBER: NA

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
CIRCUIT SUPPLIES CONTROL POWER TO NOSE LANDING GEAR BRAKE UPLOCK RELEASE SUBSYSTEM. THIS CIRCUIT IS A BACKUP TO THE PRIMARY HYDRAULIC SYSTEM. MDAC ID'S 31120, 31121, 31128 THROUGH 31129, 31154 THROUGH 31160, AND 31175 THROUGH 31176 COVER ALL THE COMPONENTS IN THIS CIRCUIT. COMPONENT LIST: PIC'S (2), HDC TYPE 1 (2), HDC TYPE 2 (2), HDC TYPE 3 (2), RESISTORS (4), DIODES (2).

REFERENCES: VS70-510109 ZONES 54,63

REPORT DATE 02/13/87 C-246
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 1/12/87
SUBSYSTEM: EPD&C
MDAC ID: 31183

HIGHEST CRITICALITY
FLIGHT: 2/1R
ABORT: 2/1R

ITEM: DIODE, 12 AMP
FAILURE MODE: ELEMENT OPENS, HIGH RESISTANCE

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD PCA 1
3) BLOCKING DIODE, 12 AMP, ARM & DOWN RELAY CIRCUIT
4) 5) 6) 7) 8) 9) 05-6BA

CRITICALITIES

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LOCATION: FWD PCA 1 81V76A22-CR12
PART NUMBER: JANTXV1N5551

CAUSES: MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
ISOLATES K6 & K7 ARM RELAYS FROM THE K8 DOWN RELAY; ALSO IN
CIRCUIT SUPPLYING POWER TO THE LDG GEAR CONTROL VALVE AND THE LDG
GEAR DUMP CONTROL VALVE. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE
OF LOSS OF POWER TO OPERATE THESE VALVES.

REFERENCES: VS70-510109: ZONE 68 HYD/WSB SUBSYSTEM: MDAC ID'S
472,473,491,492

REPORT DATE 02/13/87  C-247
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 1/12/87

SUBSYSTEM: EPD&C
MDAC ID: 31184

HIGHEST CRITICALITY: HDW/FUNC

FLIGHT: 3/3
ABORT: 3/3

ITEM: DIODE, 12 AMP
FAILURE MODE: SHORTS, LOW RESISTANCE

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD PCA 1
3) BLOCKING DIODE, 12 AMP, ARM & DOWN RELAY CIRCUIT

LOCATION: FWD PCA 1 81V76A22-CR12
PART NUMBER: JANTXV1N5551

CAUSES: MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
ISOLATES K6 & K7 ARM RELAYS FROM THE K8 DOWN RELAY; ALSO IN
CIRCUIT SUPPLYING POWER TO THE LDG GEAR CONTROL VALVE AND THE LDG
GEAR DUMP CONTROL VALVE. POSSIBLE RELAY DAMAGE IF DIODE FAILS
SHORTED, BUT NO EFFECT ON MISSION/CREW/VEHICLE.

REFERENCES: VS70-510109: ZONE 68 HYD/WSB SUBSYSTEM: MDAC ID'S
472, 473, 491, 492

REPORT DATE 02/13/87 C-248
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 1/14/87
SUBSYSTEM: EPD&C
MDAC ID: 31185

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: DIODE, 12 AMP
FAILURE MODE: ELEMENT OPENS, SHORTS

LEAD ANALYST: G. BEAIRD SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) LANDING GEAR CONTROL
2) FWD PCA 1
3) TRANSIENT SUPPRESSION DIODE, 12 AMP
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9) 05-6BA

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FWD PCA 1 81V76A22-CR42
PART NUMBER: JANTXV1N5551

CAUSES: MECHANICAL SHOCK, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
Provides transient suppression to solenoid coils of LDG gear control valve and LDG gear dump control valve from GSE tests. Not used in flight.

REFERENCES: VS70-510109 ZONE 68

REPORT DATE 02/13/87 C-249
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86
SUBSYSTEM: EPD&C
MDAC ID: 31200

ITEM: ISOLATION RESISTOR, 5.1K, 1/4W
FAILURE MODE: ELEMENT OPENS, SHORTS

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) FWD PCA 1
3) ISOLATION RESISTOR (1), 5.1K, 1/4W
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FWD PCA NO. 1 81V76A22-A1R80
PART NUMBER: RLR07C5101GR

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK

EFFECTS/RATIONALE:
LIMITS CURRENT BETWEEN MDM AND ANTI-SKID BUSS C/A, NONCRITICAL OPERATION.

REFERENCES: VS70-520109 ZONE 31

REPORT DATE 02/13/87 C-250
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86
SUBSYSTEM: EPD&C
MDAC ID: 31201

ITEM: GENERAL PURPOSE FUSE (8), 3 AMP
FAILURE MODE: OPENS, PREMATURELY OPENS

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) FWD PCA 1 & 2
3) GENERAL PURPOSE FUSES (8), BRAKE SUB-BUS, 3 AMP
4) 05-6BB

CRITICALITIES

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LOCATION: FWD PCA 1 & 2 81V76A22-F15,F16,F17,F21 82V76A23-F9,F10,F11,F12
PART NUMBER: ME451-0009-1003

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK, CHEMICAL DEGRADED MATERIALS

EFFECTS/RATIONALE:
PROVIDES CIRCUIT PROTECTION BETWEEN BRAKE SUB-BUSES AND BRAKE/SKID CONTROL BOXES. POSSIBLE LOSS OF VEHICLE BECAUSE OF LOSS OF ELECTRICAL POWER.

REFERENCES: VS70-520109 ZONES 9,19

REPORT DATE 02/13/87 C-251
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86
SUBSYSTEM: EPD&C
MDAC ID: 31202

HIGHEST CRITICALITY: HDW/FUNC
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: FUSE (5 AMP), 2
FAILURE MODE: OPENS, PREMATURELY OPENS

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) FWD PCA 1 & 2
3) FUSE (2, 5 AMP), BRAKE SUB-BUS/ANTI-SKID POWER
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9) 05-6BB

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Location: FWD PCA 1 & 2 81V76A22-F28 82V76A23-F8

Part Number: ME451-0009-1021

Causes: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK, CHEMICAL DEGRADED

Effects/Rationale:
PROVIDES CURRENT PROTECTION TO BRAKE AND ANTI-SKID SUB-BUSSES.
POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF ELECTRICAL POWER.

References: VS70-520109 ZONES 30,31

Report Date 02/13/87 C-252
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86

SUBSYSTEM: EPD&C

MDAC ID: 31203

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: ANNUNCIATOR

FAILURE MODE: FAILS OPEN, FAILS TO INDICATE

LEAD ANALYST: G. BEAIRD SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) PANEL F3
3) ANNUNCIATOR, ANTI-SKID FAIL LIGHT
4) 5) 6) 7) 8) 9) 05-6BB

CRITICALITIES

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: PANEL F3 34V73A3-XDS4

PART NUMBER: MC434-0075-0012

CAUSES: MECHANICAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
VISUAL MONITORING OF ANTI-SKID FAILURE, NONCRITICAL OPERATION.

REFERENCES: VS70-520109 ZONE 27

REPORT DATE 02/13/87 C-253
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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**HIGHEST CRITICALITY**

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**ITEM:** FUSE, 1 AMP

**FAILURE MODE:** OPENS, PREMATURELY OPENS

**LEAD ANALYST:** G. BEAIRD  **SUBSYS LEAD:** SCHMECKPEPER

**BREAKDOWN HIERARCHY:**
1) BRAKE & ANTI-SKID
2) PANEL L2A1
3) FUSE, 1 AMP, BRAKE/SKI CONTROL CRT.
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5)...
6)...
7)...
8)...
9) 05-6BB

**CRITICALITIES**

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**REDUNDANCY SCREENS:** A [ ] B [ ] C [ ]

**LOCATION:** PANEL L2A1 31V73A2A1-F7

**PART NUMBER:** ME451-0018-0100

**CAUSES:** MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK, CHEMICAL DEGRADED MATERIALS

**EFFECTS/RATIONALE:** PROVIDES CIRCUIT PROTECTION FOR WIRING IN ANTI-SKID FAIL CIRCUIT. NONCRITICAL OPERATION.

**REFERENCES:** VS70-520109 ZONE 30

REPORT DATE 02/13/87  C-254
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86
SUBSYSTEM: EPD&C
MDAC ID: 31205

HIGHEST CRITICALITY
HDW/FUNC
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: GENERAL PURPOSE FUSE (8), 2 AMP
FAILURE MODE: OPENS, PREMATURELY OPENS

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) FWD PCA 1 & 2
3) GENERAL PURPOSE FUSES (8), ANTI-SKID BUSES, 2 AMP

CRITICALITIES

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LOCATION: FWD PCA 1 & 2 81V76A22-F18,F19,F20,F22 82V76A23-F13,F14,F15,F16
PART NUMBER: ME451-0009-1002

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK, CHEMICAL DEGRADED MATERIALS

EFFECTS/RATIONALE:
PROVIDES CIRCUIT PROTECTION BETWEEN ANTI-SKID BUSES AND BRAKE/SKID BOXES. POSSIBLE LOSS OF VEHICLE BECAUSE OF LOSS OF ELECTRICAL POWER.

REFERENCES: VS70-520109 ZONES 9,19

REPORT DATE 02/13/87 C-255
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C  FLIGHT: 3/3
MDAC ID: 31206  ABORT: 3/3

ITEM: ISOLATION RESISTOR (3), 5.1K, 1/4 WATT
FAILURE MODE: ELEMENT OPENS, SHORTS

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) FWD PCA 1,2 & 3
3) RESISTOR (3), BRAKE-SKID POWER/SWITCH SCAN
4) 
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9) 05-6BB

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REDUNDANCY SCREENS:  A [ ]  B [ ]  C [ ]

LOCATION:  FWD PCA 1,2 & 3  81V76A22-A1R64  82V76A23-A1R1
83V76A24-A1R1
PART NUMBER:  RLR07C5101GR

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK

EFFECTS/RATIONALE:
RESTRICTS CURRENT BETWEEN CONTROL CIRCUITS AND MDM MONITORING
CIRCUITS. NONCRITICAL FUNCTION.

REFERENCES: VS70-520109 ZONES 10,14,17

REPORT DATE 02/13/87 C-256
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86
SUBSYSTEM: EPD&C
MDAC ID: 31207

HIGHEST CRITICALITY
HDW/FUNC FLIGHT: 3/3
ABORT: 3/3

ITEM: ISOLATION RESISTOR (4), 2.2K, 1/2W
FAILURE MODE: ELEMENT OPENS, SHORTS

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) FWD PCA-1,2,3
3) ISOLATION RESISTORS (4), 2.2K, 1/2W
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9) 05-6BB

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REDUNDANCY SCREENS:  A [ ]  B [ ]  C [ ]

LOCATION: FWD PCA - 1,2,3 81V76A22-A1R5 82V76A23-A1R22
83V76A24-A1R18,A1R19
PART NUMBER: RLR20C2201GR

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK

EFFECTS/RATIONALE:
ISOLATES AND LIMITS CURRENT BETWEEN THE RPC OUTPUT AND THE MDM MONITORING CIRCUIT FOR DETERMINING AN RPC'S OPERATING STATUS, NONCRITICAL FUNCTION.

REFERENCES: VS70-520109 ZONES 11,14,17

REPORT DATE 02/13/87  C-257
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86
SUBSYSTEM: EPD&C
MDAC ID: 31208

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: CURRENT LIMITING RESISTOR (4), 1.21K, 2W
FAILURE MODE: SHORTS (LOW RESISTANCE)

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) PANELS 014, 015, 016
3) CURRENT LIMITING RESISTOR (4), 1.21K, 2W
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9) 05-6BB

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: PANELS 014, 015, 016 33V73A14-A1R1, 33V73A16-A1R1, 33V73A15-A1R1, 33V73A16-A1R2
PART NUMBER: RWR80S1211FR

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK

EFFECTS/RATIONALE:
LIMITS CURRENT TO THE RPC CONTROL CIRCUITS FOR POWER "ON" TO THE BRAKE AND ANTI-SKID SYSTEM. NONCRITICAL OPERATION, RPC'S ARE OVERCURRENT PROTECTED.

REFERENCES: VS70-520109 ZONES 11,13,15,17

REPORT DATE 02/13/87 C-258
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86
SUBSYSTEM: EPD&C
MDAC ID: 31209

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: RESISTOR (4), 1.8K, 1/4W
FAILURE MODE: ELEMENT OPENS, SHORTS

LEAD ANALYST: G. BEAIRD   SUBSYS LEAD: SCHMECKPPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) FWD PCA-1,2,3
3) BLEED-OFF RESISTORS (4), 1.8K, 1/4W

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REDUNDANCY SCREENS: A [ ]   B [ ]   C [ ]

LOCATION: FWD PCA-1,2,3 81V76A22-A1R42 82V76A23-A1R57
83V76A24-A1R49,A1R50
PART NUMBER: RLR07C1801GR

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK

EFFECTS/RATIONALE:
PROVIDES A BLEED-OFF LINE TO THE RETURN BUS, NONCRITICAL FAILURE.

REFERENCES: VS70-520109 ZONES 11,14,17

REPORT DATE 02/13/87   C-259
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86
SUBSYSTEM: EPD&C
MDAC ID: 31210

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: CURRENT LIMITING RESISTOR (4), 1.21K, 2W
FAILURE MODE: ELEMENT OPENS, HIGH RESISTANCE

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) PANELS 014,015,016
3) CURRENT LIMITING RESISTOR (4), 1.21K, 2W
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9) 05-6BB

CRITICALITIES

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LOCATION: PANELS 014,015,016 33V73A14-A1R1 33V73A15-A1R1
33V73A16-A1R1 33V73A16-A1R2
PART NUMBER: RWR80S1211FR

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK

EFFECTS/RATIONALE:
LIMITS CURRENT TO THE RPC CONTROL CIRCUITS FOR POWER "ON" TO THE
BRAKE AND ANTI-SKID SYSTEM. POSSIBLE LOSS OF CREW/VEHICLE
BECAUSE OF LOSS OF ELECTRICAL POWER.

REFERENCES: VS70-520109 ZONES 11,13,15,17

REPORT DATE 02/13/87 C-260
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: EPD&C  FLIGHT: 3/1R
MDAC ID: 31211  ABORT: 3/1R

ITEM: BLOCKING DIODE (4), 12 AMP
FAILURE MODE: ELEMENT OPENS, HIGH RESISTANCE

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) FWD PCA 1 & 2
3) BLOCKING DIODES (4), POWER "ON" BRAKE CIRCUIT
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9) 05-6BB

CRITICALITIES

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LOCATION: FWD PCA 1 & 2  81V76A22-CR7,CR8  82V76A23-CR18,CR19
PART NUMBER: JANTX1N1204RA

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK

EFFECTS/RATIONALE:
PROVIDES BUS ISOLATION IN THE EVENT OF AN RPC FAILING CLOSED.
POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF SKID CONTROL FUNCTION.

REFERENCES: VS70-520109 ZONES 11,16

REPORT DATE 02/13/87  C-261
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86
SUBSYSTEM: EPD&C
MDAC ID: 31212

HIGHEST CRITICALITY
HDW/FUNC: FLIGHT: 3/3
ABORT: 3/3

ITEM: BLOCKING DIODE (4), 12 AMP
FAILURE MODE: SHORTS (LOW RESISTANCE)

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) FWD PCA 1 & 2
3) BLOCKING DIODES (4), POWER "ON" BRAKE CIRCUIT
4) 5) 6) 7) 8) 9) 05-6BB

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FWD PCA 1 & 2 81V76A22-CR7,CR8 82V76A23-CR18,CR19
PART NUMBER: JANTX1N1204RA

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK

EFFECTS/RATIONALE:
Provides bus isolation in the event of an RPC failing closed. No effect on crew/vehicle because of RPC overcurrent protection.

REFERENCES: VS70-520109 ZONES 11,16

REPORT DATE 02/13/87 C-262
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C  FLIGHT: 3/1R
MDAC ID: 31213  ABORT: 3/1R

ITEM: GENERAL PURPOSE RELAY, NONLATCHING (2)
FAILURE MODE: FAILS OPEN (RELAYS NORMALLY OPEN)

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) FWD PCA 1 & 2
3) G.P. RELAYS (2), BRAKE SUB-BUS/WOW CKT POWER
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LOCATION: FWD PCA-1 & 2 81V76A22-K9 82V76A23-K11
PART NUMBER: MC455-0129-0001

CAUSES: MECHANICAL SHOCK, VIBRATION, PIECE-PART STRUCTURAL
FAILURE, CONTAMINATION

EFFECTS/RATIONALE:
TRANSFERS BRAKE SUB-BUS POWER TO THE WOW CIRCUITS WITHIN THE
BRAKE/SKID CONTROL UNITS. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE
LOSS OF ANTI-SKID CAPABILITY, PILOT WOULD HAVE TO USE MANUAL
BRAKING.

REFERENCES: VS70-520109 ZONES 7,21 SHUTTLE SYSTEM HANDBOOK
DRAWING 13.2

REPORT DATE 02/13/87  C-263
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C  FLIGHT: 3/1R
MDAC ID: 31214  ABORT: 3/1R

ITEM: GENERAL PURPOSE RELAY, NONLATCHING (2)
FAILURE MODE: FAILS CLOSED

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) FWD PCA 1 & 2
3) G.P. RELAYS (2), BRAKE SUB-BUS/WOW CKT POWER

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LOCATION: FWD PCA-1 & 2 81V76A22-K9 82V76A23-K11
PART NUMBER: MC455-0129-0001

CAUSES: MECHANICAL SHOCK, VIBRATION, PIECE-PART STRUCTURAL FAILURE, CONTAMINATION

EFFECTS/RATIONALE:
TRANSFERS BRAKE SUB-BUS POWER TO THE WOW CIRCUITS WITHIN THE BRAKE/SKID CONTROL UNITS. IF A RELAY(S) FAILS TO OPEN AT LG WOW WITH THE ANTI-SKID SWITCH ON, THE ANTI-SKID FAIL LIGHT WILL COME ON. THE PILOT WILL SWITCH ANTI-SKID "OFF" AND APPLY MANUAL BRAKING. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF ANTI-SKID FUNCTION.

REFERENCES: VS70-520109 ZONES 7,21 SHUTTLE SYSTEM HANDBOOK
DRAWING 13.2

REPORT DATE 02/13/87 C-264
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86
SUBSYSTEM: EPD&C
MDAC ID: 31215

ITEM: BLOCKING DIODES (9), 3 AMP ELEMENT OPENS, HIGH RESISTANCE, SHORTS

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) FWD LCA NO 1 & 2
3) BLOCKING DIODES (9), ANTI-SKID FAIL LIGHT/CONTROL Ckt.
4) 5) 6) 7) 8) 9) 05-6BB

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FWD LCA 1 & 2 82V76A17-CR(5) 81V76A16-CR(4)
PART NUMBER: JANTXV1N5551

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK

EFFECTS/RATIONALE:
BLOCKS SIGNAL FEEDBACK ON VARIOUS SIGNALS IN ANTI-SKID FAIL LIGHT/CONTROL CIRCUIT. NONCRITICAL FUNCTION.

REFERENCES: VS70-520109 ZONE 28

REPORT DATE 02/13/87 C-265
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86
SUBSYSTEM: EPD&C
MDAC ID: 31216

HIGHEST CRITICALITY
HDW/FUNC

FLIGHT: 3/1R
ABORT: 3/1R

ITEM: HYBRID DRIVER CONTROLLER (3), TYPE 1
FAILURE MODE: LOSS OF OUTPUT, OPENS

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) FWD LCA 1 & 2
3) HYBRID DRIVER CONTROLLERS (3), TYPE 1
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LOCATION: FWD LCA 1 & 2 81V76A16-AR(2) 82V76A17-AR(1)
PART NUMBER: MC477-0261-0002

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
WITH ABSENCE OF WOW, THE HDC'S CONNECT MAIN BUS POWER TO RELAYS WHICH TRANSFER BRAKE POWER IN THE BRAKE/SKID CONTROL UNIT. ON LMG/RMG TOUCHDOWN, THE OPENING OF THE HDC'S ENERGIZES THE ANTI-SKID CONTROL CIRCUITS. LOSS OF CONTROL POWER TO ONE "NO-WOW" RELAY COIL, POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF ELECTRICAL POWER.

REFERENCES: VS70-520109 ZONES 5,22

REPORT DATE 02/13/87 C-266
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86
SUBSYSTEM: EPD&C
MDAC ID: 31217

HIGHEST CRITICALITY
FLIGHT: 3/3
ABORT: 3/3

ITEM: HYBRID DRIVER CONTROLLER (3), TYPE 1
FAILURE MODE: INADVERTENT OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) FWD LCA
3) HYBRID DRIVER CONTROLLERS (3), TYPE 1
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FWD LCA 1 & 2 81V76A16-AR(2) 82V76A17-AR(1)
PART NUMBER: MC477-0261-0002

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
WITH ABSENCE OF WOW, THE HDC'S CONNECT MAIN BUS POWER TO RELAYS WHICH TRANSFER BRAKE POWER IN THE BRAKE/SKID CONTROL UNIT. ON LMG/RMG TOUCHDOWN, THE OPENING OF THE HDC'S ENERGIZES THE ANTI-SKID CONTROL CIRCUITS. TWO HDC FAILURES REQUIRED BEFORE PREMATURELY CLOSING A RELAY CONTACT, NO EFFECT ON MISSION/CREW/VEHICLE.

REFERENCES: VS70-520109 ZONES 5,22

REPORT DATE 02/13/87 C-267
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C  FLIGHT: 3/1R
MDAC ID: 31218  ABOERT: 3/1R

ITEM: HYBRID DRIVER CONTROLLER (TYPE 3)
FAILURE MODE: LOSS OF OUTPUT, OPENS

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) FWD LCA 2
3) HYBRID DRIVER CONTROLLER, TYPE 3
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LOCATION: FWD LCA 2  82V76A17-AR(1)
PART NUMBER: MG477-0263-0002

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
WITH ABSENCE OF WOW, THE HDC CONNECTS MAIN BUS POWER TO RELAY (K11) WHICH TRANSFERS BRAKE POWER IN THE BRAKE/SKID CONTROL UNIT B. ON LMG/RMG TOUCHDOWN, THE OPENING OF THE HDC'S ENERGIZES THE ANTI-SKID CONTROL CIRCUITS. LOSS OF CONTROL POWER TO K11 RELAY COIL, POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF ELECTRICAL POWER.

REFERENCES: VS70-520109  ZONE 22

REPORT DATE 02/13/87  C-268
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86
SUBSYSTEM: EPD&C
MDAC ID: 31219

HIGHEST CRITICALITY
FLIGHT: 3/3
ABORT: 3/3

ITEM: HYBRID DRIVER CONTROLLER (TYPE 3)
FAILURE MODE: INADVERTENT OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) FWD LCA 2
3) HYBRID DRIVER CONTROLLER, TYPE 3
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FWD LCA 2 82V76A17-AR(1)
PART NUMBER: MC477-0263-0002

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
WITH ABSENCE OF WOW, THE HDC CONNECTS MAIN BUS POWER TO RELAY (K11) WHICH TRANSFERS BRAKE POWER IN THE BRAKE/SKID CONTROL UNIT. ON LMG/RMG TOUCHDOWN, THE OPENING OF THE HDC'S ENERGIZES THE ANTI-SKID CONTROL CIRCUITS. TWO HDC FAILURES REQUIRED BEFORE PREMATURELY CLOSING A RELAY CONTACT, NO EFFECT ON MISSION/CREW/VEHICLE.

REFERENCES: VS70-520109 ZONE 22

REPORT DATE 02/13/87 C-269
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86       HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C       FLIGHT: 3/1R
MDAC ID: 31220       ABORT: 3/1R

ITEM: TOGGLE SWITCH, DPST
FAILURE MODE: FAILS OPEN (ONE POLE AFFECTED)

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) PANEL L2A1
3) TOGGLE SWITCH (1), DPST, ANTI-SKID CONTROL CKT
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LOCATION: PANEL L2A1 31V73A2A1-S5
PART NUMBER: ME452-0102-7201

CAUSES: MECHANICAL SHOCK, VIBRATION, PIECE-PART STRUCTURAL FAILURE, CONTAMINATION

EFFECTS/RATIONALE:
MANUALLY SWITCHES "ON-OFF" ANTI-SKID CONTROL CIRCUIT. EACH POLE CONTROLS POWER TO ONE ANTI-SKID BUS. ONE POLE POSITION WHEN IN "OFF" POSITION CONTROLS ANTI-SKID-FAIL-LIGHT "ON" INDICATION. LOSS OF CAPABILITY TO ENERGIZE ONE SKID BUS AND LOSS OF REDUNDANT SKID CONTROL CIRCUITS TO FOUR WHEELS. WITH LOSS OF ANTI-SKID FUNCTION, SHUTTLE MIGHT BE SAFELY LANDED WITH MANUAL BRAKING.

REFERENCES: VS70-520109: ZONE 31, MDAC 30101, AND 13.2 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87 C-270
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86   HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C   FLIGHT: 3/3
MDAC ID: 31221   ABORT: 3/3

ITEM: TOGGLE SWITCH, DPST
FAILURE MODE: FAILS CLOSED, SHORTED CONTACTS

LEAD ANALYST: G. BEAIRD   SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) PANEL L2A1
3) TOGGLE SWITCH (1), DPST, ANTI-SKID CONTROL CKT
   4)
   5)
   6)
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   8)
   9) 05-6BB

CRITICALITIES

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: PANEL L2A1  31V73A2A1-S5
PART NUMBER: ME452-0102-7201

CAUSES: MECHANICAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
MANUALLY SWITCHES "ON-OFF" ANTI-SKID CONTROL CIRCUIT. EACH POLE CONTROLS POWER TO ONE ANTI-SKID BUS. ONE POLE POSITION WHEN IN "OFF" POSITION CONTROLS ANTI-SKID-FAIL-LIGHT "ON" INDICATION. CLOSES - NO EFFECT - NORMAL OPERATING POSITION.

REFERENCES: VS70-520109: ZONE 31, MDAC 30101, AND 13.2 SSSH, JSC 12770 VOL. 10D

REPORT DATE 02/13/87  C-271
TOGGLE SWITCH

FAILURE MODE: Fails Open

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) PANELS 014, 015
3) TOGGLE SWITCH (2), MAIN BUS (A, B), "ON" CONTROL CKT
4) ...

CRITICALITIES

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LOCATION: PANELS 014, 015 33V73A14-S1 33V73A15-S1
PART NUMBER: ME452-0102-7101

CAUSES: MECHANICAL SHOCK, VIBRATION, PIECE-PART STRUCTURAL FAILURE, CONTAMINATION

EFFECTS/RATIONALE:
PROVIDES MANUAL SWITCHING FOR REDUNDANT CONTROL AND DC POWER TO BRAKING CIRCUITS. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF CONTROL TO MAIN DC CONNECTING/DISCONNECTING RPC'S.

REFERENCES: VS70-520109 ZONES 11,16
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86
HSITEST CRITICALITY  HDW/FUNC
SUBSYSTEM: EP&D&C  FLIGHT: 3/3
MDAC ID: 31223  ABORT: 3/3

ITEM: TOGGLE SWITCH
FAILURE MODE: FAILS CLOSED, SHORTED CONTACTS

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) PANELS 014,015
3) TOGGLE SWITCH (2), MAIN BUS (A,B), "ON" CONTROL CKT
4) 5) 6) 7) 8) 9) 05-6BB

CRITICALITIES

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REDUNDANCY SCREENS:  A [ ]  B [ ]  C [ ]

LOCATION: PANELS 014,015  33V73A14-S1  33V73A15-S1
PART NUMBER: ME452-0102-7101

CAUSES: MECHANICAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
PROVIDES MANUAL SWITCHING FOR REDUNDANT CONTROL AND DC POWER TO BRAKING CIRCUITS. FAILS CLOSED HAS NO EFFECT, NORMAL OPERATING CONDITION.

REFERENCES: VS70-520109 ZONES 11,16

REPORT DATE 02/13/87  C-273
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86
SUBSYSTEM: EPD&C
MDAC ID: 31224

HIGHEST CRITICALITY
HDW/FUNC
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: TOGGLE SWITCH, DPST
FAILURE MODE: FAILS OPEN

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) PANELS 014,015
3) TOGGLE SWITCH, MAIN BUS (C), "ON" CONTROL CKT
4) 
5) 
6) 
7) 
8) 
9) 05-6BB

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LOCATION: PANEL 016 33V73A16-S1
PART NUMBER: ME452-0102-7201

CAUSES: MECHANICAL SHOCK, VIBRATION, PIECE-PART STRUCTURAL FAILURE, CONTAMINATION

EFFECTS/RATIONALE:
PROVIES MANUAL SWITCHING FOR REDUNDANT CONTROL AND DC POWER TO BRAKING CIRCUIT. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF CONTROL TO MAIN C CONNECTING/DISCONNECTING RPC'S.

REFERENCES: VS70-520109 ZONE 14

REPORT DATE 02/13/87 C-274
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C  FLIGHT: 3/3
MDAC ID: 31225  ABORT: 3/3

ITEM: TOGGLE SWITCH, DPST
FAILURE MODE: FAILS CLOSED

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) PANELS 014,015
3) TOGGLE SWITCH, MAIN BUS (C), "ON" CONTROL CKT

LOCATION: PANEL 016  33V73A16-S1
PART NUMBER: ME452-0102-7201

CAUSES: MECHANICAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
PROVIDES MANUAL SWITCHING FOR REDUNDANT CONTROL AND DC POWER TO BRAKING CIRCUIT. FAILS CLOSED HAS NO EFFECT, NORMAL OPERATING CONDITION.

REFERENCES: VS70-520109 ZONE 14

REPORT DATE 02/13/87  C-275
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EP&D&C  FLIGHT: 3/1R
MDAC ID: 31226  ABORT: 3/1R

ITEM: REMOTE POWER CONTROLLER (4), 10 AMP
FAILURE MODE: LOSS OF OUTPUT, OPENS

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) FWD PCA-1,2,3
3) RPC'S (4), 10 AMP
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LOCATION:  FWD PCA-1,2,3  81V76A22-RPC-5  82V76A23-RPC-4
           83V76A24-RPC-4, RPC-5
PART NUMBER:  MC450-0017-2100

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE: CONNECTS OR DISCONNECTS MAIN DC BUS POWER TO THE ANTI-SKID AND BRAKE CONTROL UNITS. PROVIDES CIRCUIT PROTECTION AGAINST OVERLOADS. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF ELECTRICAL POWER.

REFERENCES: VS70-520109  ZONES 11,13,15,17

REPORT DATE 02/13/87  C-276
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/14/86

SUBSYSTEM: EPD&C
MDAC ID: 31227

HIGHEST CRITICALITY

FLIGHT: 3/3
ABORT: 3/3

ITEM: REMOTE POWER CONTROLLER (4), 10 AMP

FAILURE MODE: INADVERTENT OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) FWD PCA-1,2,3
3) RPC'S (4), 10 AMP
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8) 
9) 05-6BB

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FWD PCA-1,2,3 81V76A22-RPC-5 82V76A23-RPC-4 83V76A24-RPC-4, RPC-5
PART NUMBER: MC450-0017-2100

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
CONNECTS OR DISCONNECTS MAIN DC BUS POWER TO THE ANTI-SKID AND BRAKE CONTROL UNITS. PROVIDES CIRCUIT PROTECTION AGAINST OVERLOADS. RPC'S ARE OVERCURRENT PROTECTED IN THE EVENT TWO MAIN BUSSES ARE POWERING THE BRAKE SUB-BUS AT THE SAME INSTANT.

REFERENCES: VS70-520109 ZONES 11,13,15,17

REPORT DATE 02/13/87 C-277
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/18/86
SUBSYSTEM: EPD&C
MDAC ID: 31228

HIGHEST CRITICITY
HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: TOGGLE SWITCH (3)
FAILURE MODE: FAILS CLOSED, SHORTED CONTACTS

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) PANEL R4
3) TOGGLE SWITCH (3), CONTROL BUS (AB1, BCL, CA1) HYD BRAKE HEATER
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9) 05-6BB

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: PANEL R4 32V73A4-S28,S29,S30
PART NUMBER: UNKNOWN

CAUSES: MECHANICAL SHOCK, VIBRATION, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
PROVIDES MANUAL SWITCHING FOR REDUNDANT DC POWER TO THE BREAK HYDRAULIC LINE HEATERS. FAILURE HAS NO EFFECT BECAUSE SWITCH IS IN NORMALLY CLOSED POSITION.

REFERENCES: VS70-958102; 58GC, ZONE 7H; 58GA, ZONES 7H, 19H

REPORT DATE 02/13/87 C-278
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM:  EPD&C  FLIGHT:  3/1R
MDAC ID:  31229  ABORT:  3/1R

ITEM:  TOGGLE SWITCH (3)
FAILURE MODE:  FAILS OPEN

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) PANEL R4
3) TOGGLE SWITCH (3), CONTROL BUS (AB1,BC1,CA1) HYD BRAKE HEATER
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LOCATION:  PANEL R4  32V73A4-S28, S29, S30
PART NUMBER:  UNKNOWN

CAUSES:  MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
PROVIDES MANUAL SWITCH FOR REDUNDANT DC POWER TO THE BREAK HYDRAULIC LINE HEATERS. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF ELECTRICAL POWER TO BRAKE HEATERS.

REFERENCES:  VS70-958102; 58GC, ZONE 7H; 58GA, ZONES 7H,19H

REPORT DATE 02/13/87  C-279
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/19/86
SUBSYSTEM: EPD&C
MDAC ID: 31230

HIGHEST CRITICALITY
HDW/FUNC
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: CURRENT LIMITING RESISTOR (3), 1.21K, 2W
FAILURE MODE: ELEMENT OPENS, HIGH RESISTANCE

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) PANEL R4
3) RESISTORS (3), 1.21K, 2W
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8) 05-6BB

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LOCATION: PANEL R4
PART NUMBER: 32V73A4-A6R1,A6R2,A6R3

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK

EFFECTS/RATIONALE:
LIMITS CURRENT TO THE RPC CONTROL CIRCUITS FOR POWER "ON" TO THE BRAKE HYDRAULIC LINE HEATERS. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF ELECTRICAL POWER TO BRAKE HEATERS.

REFERENCES: VS70-958102; 58GC, ZONE 7H; 58GA, ZONES 7H,19H

REPORT DATE 02/13/87 C-280
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/19/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C FLIGHT: 3/3
MDAC ID: 31231 ABORT: 3/3

ITEM: CURRENT LIMITING RESISTOR (3), 1.21K, 2W
FAILURE MODE: SHORTS, LOW RESISTANCE

LEAD ANALYST: G. BEAIRD SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) PANEL R4
3) RESISTORS (3), 1.21K, 2W

LOCATION: PANEL R4 32V73A4-A6R1,A6R2,A6R3
PART NUMBER: UNKNOWN

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK

EFFECTS/RATIONALE:
LIMITS CURRENT TO THE RPC CONTROL CIRCUITS FOR POWER "ON" TO THE BRAKE/HYDRAULIC LINE HEATERS. FAILURE HAS NO EFFECT ON SUBSYSTEM.

REFERENCES: VS70-958102; 58GC, ZONE 7H; 58GA, ZONES 7H,19H

REPORT DATE 02/13/87 C-281
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/19/86
SUBSYSTEM: EPD&C
MDAC ID: 31232

ITEM: REMOTE POWER CONTROLLER (3), 10 AMP
FAILURE MODE: LOSS OF OUTPUT, OPENS

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) PANEL R4
3) MID PCA 1,2,3
4) RPC (3), HEATER CONTROL CIRCUIT
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9) 05-6BB

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LOCATION: MID PCA 1,2,3 RPC-37,39,24
PART NUMBER: UNKNOWN

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
CONNECTS OR DISCONNECTS MAIN DC BUS POWER TO THE HYDRAULIC BRAKE HEATER COILS. POSSIBLE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF ELECTRICAL POWER TO HEATER COILS.

REFERENCES: VS70-958102; 58GC, ZONE 7E; 58GA, ZONES 7E,19E

REPORT DATE 02/13/87 C-282
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/19/86  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPD&C  FLIGHT: 3/3
MDAC ID: 31233  ABORT: 3/3

ITEM: REMOTE POWER CONTROLLER (3), 10 AMP
FAILURE MODE: INADVERTENT OUTPUT

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) PANEL R4
3) MID PCA 1,2,3
4) RPC (3), HEATER CONTROL CIRCUIT
5)...
8)...
9) 05-6BB

CRITICALITIES

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LOCATION: MID PCA 1,2,3 RPC-37,39,24
PART NUMBER: UNKNOWN

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
CONNECTS OR DISCONNECTS MAIN DC BUS POWER TO THE HYDRAULIC BRAKE HEATER COILS. RPC'S ARE OVERCURRENT PROTECTED, INADVERTENT OUTPUT WOULD HAVE NO EFFECT ON HEATER COILS.

REFERENCES: VS70-958102; 58GC, ZONE 7E; 58GA, ZONES 7E,19E

REPORT DATE 02/13/87  C-283
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/19/86  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: EPD&C  FLIGHT: 3/3
MDAC ID: 31234  ABORT: 3/3

ITEM: ISOLATION RESISTOR (3), 5.1K, 1/4W
FAILURE MODE: ELEMENT OPENS, SHORTS

LEAD ANALYST: G. BEAIRD  SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) PANEL R4
3) MID PCA 1,2,3
4) ISOLATION RESISTOR (3), 5.1K, 1/4W

CRITICALITIES

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: MID PCA 1,2,3  40V76A25-A1R28, 40V76A26-A1R27, 40V76A27-A1R29
PART NUMBER: UNKNOWN

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
RESTRICTS CURRENT BETWEEN HEATER CONTROL CIRCUITS AND MDM MONITORING CIRCUITS. NONCRITICAL FUNCTION.

REFERENCES: VS70-958102; 58GC, ZONE 6E; 58GA, ZONES 18E,6E

REPORT DATE 02/13/87 C-284
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/19/86
SUBSYSTEM: EPD&C
MDAC ID: 31235

HIGHEST CRITICALITY
FLIGHT: 3/3
ABORT: 3/3

ITEM: ANNUNCIATOR CONTROL ASSEMBLY
FAILURE MODE: LOSS OF OUTPUT (CHANNEL 12)

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) FWD LCA NO 2
3) ANNUNCIATOR CONTROL ASSEMBLY NO. 2
4)
5)
6)
7)
8)
9) 05-6BB

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLIGHT DECK AREA 30 30V73A17-NO. 2
PART NUMBER: MC434-0283-0002

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
PROVIDES POWER TO ANTI-SKID FAIL ANNUNCIATOR LIGHT, NONCRITICAL OPERATION.

REFERENCES: VS70-520109, ZONE 27

REPORT DATE 02/13/87 C-285
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/19/86
SUBSYSTEM: EPD&C
MDAC ID: 31237

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 3/3

ITEM: SIGNAL CONDITIONER
FAILURE MODE: INADVERTENT OUTPUT, LOSS OF OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) FWD BAY 1, AREA 81W8
3) BRAKE/SKID BOX A SIGNAL CONDITIONER
4) 
5) 
6) 
7) 
8) 
9) 05-6BB

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LOCATION: FWD BAY 1 AREA 81W8 81V75A16
PART NUMBER: V070-753251

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
PROVIDES VOLTAGE REDUCTION AND MDM-OF1 MONITORING TO BRAKE/SKID CONTROL BOX A. MONITORING FUNCTION HAS NO EFFECT ON CREW/VEHICLE.

REFERENCES: VS70-520109 ZONES 36,185

REPORT DATE 02/13/87 C-286
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/19/86
SUBSYSTEM: EPD&C
MDAC ID: 31239

HIGHEST CRITICALITY
HDW/FUNC

ITEM: SIGNAL CONDITIONER
FAILURE MODE: INADVERTENT OUTPUT, LOSS OF OUTPUT

LEAD ANALYST: G. BEAIRD
SUBSYS LEAD: SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) BRAKE & ANTI-SKID
2) FWD BAY 2, AREA 82W9
3) BRAKE/SKID BOX B SIGNAL CONDITIONER

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LOCATION: FWD BAY 2 AREA 82W9 82V75A17
PART NUMBER: V070-753252

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL SHOCK, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
PROVIDES VOLTAGE REDUCTION AND MDM-OF2 MONITORING TO BRAKE/SKID CONTROL BOX B. MONITORING FUNCTION HAS NO EFFECT ON CREW/VEHICLE.

REFERENCES: VS70-520109 ZONES 41,190

REPORT DATE 02/13/87 C-287
# APPENDIX D
## POTENTIAL CRITICAL ITEMS

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<tr>
<td>30126</td>
<td>RUDDER/BRAKE PEDAL ASSEMBLY</td>
<td>BINDING/JAMMING</td>
</tr>
<tr>
<td>30129</td>
<td>HYD PRESS REG (SYS 1) FAILS CLOSED</td>
<td></td>
</tr>
<tr>
<td>30130</td>
<td>INLET FILTER, HYD MODULE ASSY (SYS 1)</td>
<td>FILTER CLOGGED</td>
</tr>
<tr>
<td>30131</td>
<td>BY - PASS VALVE, HYD MODULE ASSY (SYS 2 &amp; 3)</td>
<td>FAILS TO OPEN (SYSTEM 1)</td>
</tr>
<tr>
<td>31101</td>
<td>PROXIMITY SENSOR BOX (2)</td>
<td>INADVERTENT OUTPUT</td>
</tr>
<tr>
<td>31107</td>
<td>BLOCKING DIODE (2) 12 AMP, 400V</td>
<td>ELEMENT OPENS, HIGH RESISTANCE</td>
</tr>
<tr>
<td>31109</td>
<td>BLOCKING DIODE (2) 12 AMP</td>
<td>ELEMENT OPENS, HIGH RESISTANCE</td>
</tr>
<tr>
<td>31113</td>
<td>PUSHBUTTON SWITCH (2), LANDING GEAR DOWN</td>
<td>FAILS OPEN (SWITCHES NORMALLY OPEN)</td>
</tr>
<tr>
<td>31117</td>
<td>PUSHBUTTON SWITCH, LDG GR ARM, 4PDT, ILLUMINATED</td>
<td>FAILS OPEN (SWITCHES NORMALLY OPEN)</td>
</tr>
<tr>
<td>31125</td>
<td>GENERAL PURPOSE FUSE (5 AMP) OPENS, PREMATURELY OPENS</td>
<td>1 AMP</td>
</tr>
<tr>
<td>31126</td>
<td>GENERAL PURPOSE FUSE, (8), 1 AMP</td>
<td>OPENS, PREMATURELY OPENS</td>
</tr>
<tr>
<td>31127</td>
<td>GENERAL PURPOSE FUSE (1 AMP) OPENS, PREMATURELY OPENS</td>
<td>5 AMP</td>
</tr>
<tr>
<td>31128</td>
<td>RESISTOR (12), 10.2 OHMS, 2W</td>
<td>ELEMENT OPENS, HIGH RESISTANCE</td>
</tr>
<tr>
<td>31137</td>
<td>GENERAL PURPOSE FUSE (2), 5 AMP</td>
<td>OPENS, PREMATURELY OPENS</td>
</tr>
<tr>
<td>31144</td>
<td>HYBRID DRIVER CONTROLLER (TYPE 1)</td>
<td>INADVERTENT OUTPUT</td>
</tr>
<tr>
<td>MDAC-ID</td>
<td>ITEM</td>
<td>FAILURE MODE</td>
</tr>
<tr>
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<tr>
<td>31149</td>
<td>HYBRID DRIVER CONTROLLER (TYPE 1)</td>
<td>INADVERTENT OUTPUT</td>
</tr>
<tr>
<td>31150</td>
<td>HYBRID DRIVER CONTROLLER (TYPE 1)</td>
<td>LOSS OF OUTPUT</td>
</tr>
<tr>
<td>31151</td>
<td>HYBRID DRIVER CONTROLLER (TYPE 1)</td>
<td>INADVERTENT OUTPUT</td>
</tr>
<tr>
<td>31152</td>
<td>HYBRID DRIVER CONTROLLER (TYPE II)</td>
<td>LOSS OF OUTPUT</td>
</tr>
<tr>
<td>31153</td>
<td>HYBRID DRIVER CONTROLLER (TYPE II)</td>
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</tr>
<tr>
<td>31154</td>
<td>HYBRID DRIVER CONTROLLER (TYPE II)</td>
<td>LOSS OF OUTPUT</td>
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<tr>
<td>31155</td>
<td>HYBRID DRIVER CONTROLLER (TYPE 3)</td>
<td>INADVERTENT OUTPUT</td>
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<tr>
<td>31156</td>
<td>HYBRID DRIVER CONTROLLER (TYPE 3)</td>
<td>LOSS OF OUTPUT</td>
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<tr>
<td>31157</td>
<td>HYBRID DRIVER CONTROLLER (TYPE 1)</td>
<td>INADVERTENT OUTPUT</td>
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<tr>
<td>31159</td>
<td>HYBRID DRIVER CONTROLLER (TYPE 1)</td>
<td>LOSS OF OUTPUT</td>
</tr>
<tr>
<td>31160</td>
<td>HYBRID DRIVER CONTROLLER (TYPE II)</td>
<td>INADVERTENT OUTPUT</td>
</tr>
<tr>
<td>31161</td>
<td>HYBRID DRIVER CONTROLLER (TYPE II)</td>
<td>LOSS OF OUTPUT</td>
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<tr>
<td>31163</td>
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<tr>
<td>31164</td>
<td>HYBRID DRIVER CONTROLLER (TYPE II)</td>
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<tr>
<td>31165</td>
<td>HYBRID DRIVER CONTROLLER (TYPE III)</td>
<td>LOSS OF OUTPUT</td>
</tr>
<tr>
<td>31166</td>
<td>HYBRID DRIVER CONTROLLER (TYPE III)</td>
<td>INADVERTENT OUTPUT</td>
</tr>
<tr>
<td>31168</td>
<td>LATCHING RELAY (6), LDG GR 'ARM' CONTROL CIRCUITS</td>
<td>Fails Open</td>
</tr>
<tr>
<td>31170</td>
<td>LATCHING RELAY (6), LDG GR 'DOWN' CONTROL CIRCUITS</td>
<td>Fails Open</td>
</tr>
<tr>
<td>31177</td>
<td>PYRO INITIATOR CONTROLLER (2)</td>
<td>LOSS OF OUTPUT</td>
</tr>
<tr>
<td>31181</td>
<td>MAIN GEAR BRAKE UPLOCK RELEASE CIRCUITS 1 &amp; 2</td>
<td>LOSS OF POWER, OPENS</td>
</tr>
<tr>
<td>31182</td>
<td>NOSE LANDING GEAR BRAKE UPLock RELEASE CIRCUIT NO'S 1 &amp; 2</td>
<td>LOSS OF POWER, OPENS</td>
</tr>
<tr>
<td>31183</td>
<td>DIODE, 12 AMP</td>
<td>ELEMENT OPENS, HIGH RESISTANCE</td>
</tr>
<tr>
<td>31201</td>
<td>GENERAL PURPOSE FUSE (8), 3 AMP</td>
<td>OPENS, PREMATURELY OPENS</td>
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<td>31205</td>
<td>GENERAL PURPOSE FUSE (8), 2 AMP</td>
<td>OPENS, PREMATURELY OPENS</td>
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<td>31210</td>
<td>CURRENT LIMITING RESISTOR (4), 1.21K, 2W</td>
<td>ELEMENT OPENS, HIGH RESISTANCE</td>
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<tr>
<td>MDAC-ID</td>
<td>ITEM</td>
<td>FAILURE MODE</td>
</tr>
<tr>
<td>---------</td>
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<tr>
<td>31214</td>
<td>GENERAL PURPOSE RELAY, NONLATCHING (2)</td>
<td>FAILS CLOSED</td>
</tr>
<tr>
<td>31213</td>
<td>GENERAL PURPOSE RELAY, NONLATCHING (2)</td>
<td>FAILS OPEN (RELAYS NORMALLY OPEN)</td>
</tr>
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