INDEPENDENT ORBITER ASSESSMENT

ANALYSIS
OF THE
ACTIVE
THERMAL CONTROL
SUBSYSTEM

1 DECEMBER 1987
INDEPENDENT ORBITER ASSESSMENT
ANALYSIS OF THE ACTIVE THERMAL CONTROL SUBSYSTEM

1 December 1987

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Project Manager
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## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 EXECUTIVE SUMMARY</td>
<td>1</td>
</tr>
<tr>
<td>2.0 INTRODUCTION</td>
<td>4</td>
</tr>
<tr>
<td>2.1 Purpose</td>
<td>4</td>
</tr>
<tr>
<td>2.2 Scope</td>
<td>4</td>
</tr>
<tr>
<td>2.3 Analysis Approach</td>
<td>4</td>
</tr>
<tr>
<td>2.4 Active Thermal Control Subsystem Ground Rules and Assumptions</td>
<td>5</td>
</tr>
<tr>
<td>3.0 ACTIVE THERMAL CONTROL SUBSYSTEM DESCRIPTION</td>
<td>6</td>
</tr>
<tr>
<td>3.1 Design and Function</td>
<td>6</td>
</tr>
<tr>
<td>3.2 Interfaces and Locations</td>
<td>10</td>
</tr>
<tr>
<td>3.3 Hierarchy</td>
<td>10</td>
</tr>
<tr>
<td>4.0 ANALYSIS RESULTS</td>
<td>31</td>
</tr>
<tr>
<td>4.1 Freon Coolant Loop</td>
<td>31</td>
</tr>
<tr>
<td>4.2 Radiator and Flow Control Assembly</td>
<td>32</td>
</tr>
<tr>
<td>4.3 Flash Evaporator System</td>
<td>32</td>
</tr>
<tr>
<td>4.4 Ammonia Boiler System</td>
<td>32</td>
</tr>
<tr>
<td>5.0 REFERENCES</td>
<td></td>
</tr>
<tr>
<td>APPENDIX A ACRONYMS</td>
<td>A-1</td>
</tr>
<tr>
<td>APPENDIX B DEFINITIONS, GROUND RULES, AND ASSUMPTIONS</td>
<td>B-1</td>
</tr>
<tr>
<td>B.1 Definitions</td>
<td>B-2</td>
</tr>
<tr>
<td>B.2 Project Level Ground Rules and Assumptions</td>
<td>B-4</td>
</tr>
<tr>
<td>B.3 Subsystem Specific Ground Rules and Assumptions</td>
<td>B-6</td>
</tr>
<tr>
<td>APPENDIX C DETAILED ANALYSIS</td>
<td>C-1</td>
</tr>
<tr>
<td>APPENDIX D POTENTIAL CRITICAL ITEMS</td>
<td>D-1</td>
</tr>
</tbody>
</table>
List of Figures

Figure 1 - ACTIVE THERMAL CONTROL SUBSYSTEM OVERVIEW ANALYSIS SUMMARY 3
Figure 2 - ACTIVE THERMAL CONTROL SUBSYSTEM DIAGRAM 7
Figure 3 - ACTIVE THERMAL CONTROL SUBSYSTEM COMPONENT LOCATION 11
Figure 4 - ACTIVE THERMAL CONTROL SUBSYSTEM ANALYSIS HIERARCHY 12
Figure 5 - FREON COOLANT LOOP MECHANICAL 13
Figure 6 - FREON PUMP PACKAGE 14
Figure 7 - HEAT EXCHANGERS 15
Figure 8 - FLOW PROPORTIONING VALVE MODULE 16
Figure 9 - COLD PLATES 17
Figure 10 - FCL EPD&C 18
Figure 11 - FREON PUMP EPD&C 19
Figure 12 - FLOW PROPORTIONING VALVE MODULE EPD&C 20
Figure 13 - RFCA MECHANICAL 21
Figure 14 - RADIATOR BYPASS VALVE EPD&C 22
Figure 15 - RADIATOR FLOW VALVE CONTROL EPD&C 23
Figure 16 - FES MECHANICAL 24
Figure 17 - FES HI-LOAD EVAPORATOR 25
Figure 18 - FES TOPPING EVAPORATOR 26
Figure 19 - FES FEEDLINE/SUPPLY SYSTEM 27
Figure 20 - FES EPD&C 28
Figure 21 - AMMONIA BOILER SYSTEM MECHANICAL 29
Figure 22 - ABS EPD&C 30

List of Tables

Table I - SUMMARY OF ATCS FAILURE MODES AND CRITICALITIES 31
Table II - SUMMARY OF ATCS POTENTIAL CRITICAL ITEMS 31
Independent Orbiter Assessment
Analysis of the Active Thermal Control 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, PCN-2, 6 April 1987. 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 Active Thermal Control Subsystem (ATCS).

The major purpose of the ATCS is to remove the heat, generated during normal Shuttle operations from the Orbiter systems and subsystems. The four major components of the ATCS contributing to the heat removal are:

0 Freon Coolant Loops
0 Radiator and Flow Control Assembly
0 Flash Evaporator System
0 Ammonia Boiler System

The IOA analysis followed this major breakdown structure, with the additional enhancement of examining each category from both the mechanical and electrical perspectives.

In order to perform the analysis, the IOA process utilized available ATCS 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 each of the four major subdivisions of the ATCS. A summary of the number of failure modes, by criticality, is also presented below with Hardware (HW) criticality first and Functional (F) criticality second.
Figure 1 presents a summary of the failure criticalities for each of the four major subdivisions of the ATCS. A summary of the number of failure modes, by criticality, is also presented below with Hardware (HW) criticality first and Functional (F) criticality second.

<table>
<thead>
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<th>Summary of ATCS Failure Modes By Criticality (HW/F)</th>
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<tbody>
<tr>
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</tr>
<tr>
<td>Number :</td>
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</tbody>
</table>

For each failure mode identified, the criticality and redundancy screens were examined to identify critical items. A summary of Potential Critical Items (PCIs) is presented as follows:

<table>
<thead>
<tr>
<th>Summary of ATCS Potential Critical Items (HW/F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criticality :</td>
</tr>
<tr>
<td>Number :</td>
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Of the 310 failure modes analyzed, 101 were determined to be PCIs.
ACTIVE THERMAL CONTROL SUBSYSTEM
OVERVIEW ANALYSIS SUMMARY

ATCS ANALYSIS SUMMARY

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<td>11</td>
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<tr>
<td>3/3</td>
<td>15</td>
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</table>

CRIT. - CRITICALITY
FM - FAILURE MODE
PCI - POTENTIAL CRITICAL ITEM

Figure 1 - ACTIVE THERMAL CONTROL SUBSYSTEM
OVERVIEW ANALYSIS SUMMARY
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 ATCS Ground Rules and Assumptions

The ATCS ground rules and assumptions used in the IOA are defined in Appendix B. The subsystem specific ground rules were defined to provide necessary additions and clarifications to the ground rules and assumptions contained in NSTS 22206.
3.0 SUBSYSTEM DESCRIPTION

3.1 Design and Function

The Active Thermal Control Subsystem (ATCS) is made up of four major systems consisting of the Freon Coolant Loop (FCL), Radiator and Flow Control Assembly (RFCA), Flash Evaporator System (FES), and Ammonia Boiler System (ABS). The ATCS is shown schematically in Figure 2.

Freon Coolant Loops

The Orbiter ATCS continuously circulates Freon 21 through two independent Freon Coolant Loops (FCL). Each loop consists of two redundant pumps, one accumulator, flow control valves, and several heat exchangers.

The FCL transfers heat from many orbiter systems while dumping the excess to either Ground Support Equipment (GSE) or the environment, depending upon mission phase. The main components that require cooling by the FCL are the three fuel cell stacks, equipment mounted to midbody coldplates, payload water coolant loop, and aft avionics/rate gyro assembly coldplates. Furthermore, the FCL is designed to provide heat to the hydraulic fluid and cabin oxygen.

During the prelaunch phase, heat is transferred from the FCL through the GSE heat exchanger. After lift-off, the General Purpose Computer (GPC) sends a command to initiate cooling of the FCL by the FES which continues until the payload bay doors are opened on-orbit. While the shuttle is on-orbit, heat removal from the FCLs is performed primarily by the radiators. The FES is available, however, to supplement the radiators as required.

Prior to de-orbit prep, the radiators are cold soaked. This cold-soaking allows the radiators to act as heat sinks when the payload bay doors are closed during entry. The primary heat extraction mechanism during entry is the FES, however. Additionally, the ABS will act as a supplement to the cold-soaked radiators when it is activated and the FES deactivated by GPC command at an altitude of 120K ft.

Radiator and Flow Control Assembly

The radiator is used as the primary method of rejecting heat from the Orbiter while on-orbit and as the secondary method during ascent and entry. Eight panels make up the radiator, four on each payload by door. To increase heat rejection, the two forward panels on each door can be deployed. Once deployed, the forward panels are capable of radiating heat from both sides. The basic heat rejection capability from the panels is 61,000 BTU/hr, but is dependent on the Orbiter attitude.
The Flow Control Assembly (FCA) is located downstream of the radiator panels. The main components of the FCA are the bypass valve, flow control valve, mode control valve and several controllers. The main purpose of the FCA is to control flow by either bypassing the radiator panels completely, as during a cold soak, or, by allowing a certain percentage of warm freon to bypass the panels.

Flash Evaporator System

There are two flash evaporators: a high load evaporator which is sized to reject 95,000 BTU/hr; and a topping evaporator, sized to reject 35,500 BTU/hr. Both evaporators are used to reject these heat loads from the freon coolant loops during ascent at altitudes above 140,000 and during entry at altitudes above 120,000 ft. Additionally, the topping evaporator can be used as necessary to supplement the radiators during on-orbit operations.

The basic concept behind the operation of the flash evaporators is to flash water at its triple point pressure. To facilitate this flashing, the evaporators are cylindrical with a finned inner core. The hot Freon 21 from the cooling loops flows around the finned core and water is sprayed onto the core from the nozzles in each evaporator. The water is vaporized and this process removes approximately 1,000 BTU per pound of water. In addition to the finned core, Freon 21 also flows through an anti-carryover device (ACOD) inside the evaporator to reduce the amount of water droplets in the exit duct.

The water used for the flash evaporator operation comes from the supply water subsystem via two feedlines. A series of heaters maintain the desired temperature in both feedlines. An accumulator in each feedline maintains the required operating pressure. Each feedline separates in the vicinity of the evaporators so that each evaporator has an inlet valve/nozzle combination from each feedline. This yields redundant water supply paths for each evaporator.

Following vaporization in the flash evaporators, the water vapor is vented overboard via heated exit ducts terminating in sonic nozzles. The topping evaporator has dual exit ducts terminating in sonic nozzles and configured to provide non-propulsive venting. The high load evaporator has only one exit duct and gives a propulsive venting effect when used. There are concerns about the use of the high load evaporator when the vernier jets are being used to control the vehicle. For these reasons, and also to prevent possible payload contamination from the high load evaporator venting, the high load evaporator is not used while on-orbit.

The flash evaporator operation is controlled by three controllers (primary A, primary B, and secondary). The primary controllers operate in conjunction with a given feedline (A or B) and are capable of controlling both the topping and high load evaporators simultaneously. When using the secondary controller with the
high load evaporator, it is necessary to select either the A or the B feedline. The secondary controller will use both feedlines simultaneously when controlling the topping evaporator.

The controllers operate by opening the evaporator valve/nozzle at a frequency determined by the temperature of the Freon 21 loop at the appropriate evaporator exit. The primary controllers will set this pulsing at a frequency so that the topping evaporator is activated at an exit temperature of 62 degrees F; and is inhibited when the exit temperature reaches a lower limit of 43 degrees F. Included in the primary controller circuitry is over- and under-temperature shutdown logic to protect the evaporators.

Ammonia Boiler System

The ammonia boiler system cools the freon coolant loop below 120,000 feet and until the GSE is connected by evaporating liquid anhydrous ammonia. The system configuration allows two independent redundant paths to supply ammonia to the boiler. The main components of the ABS are the shell and tube heat exchanger (1), controllers (2), several control valves (6), and storage tanks (2). Ammonia tank control valves are operated by the controllers to deplete one tank before switching to the alternate tank. Since one tank will typically provide all the required cooling, the order of tank initiation is switched from flight to flight. However, due to current entry configuration of the radiators/FES, operation the ABS is not required and is maintained as contingency backup.
3.2 Interfaces and Locations

The location of the ATCS components on the Orbiter are shown in Figure 3.

The ATCS interfaces with the Air Revitalization System (ARS) at the H2O/Freon interchanger. At the interchanger, heat collected by the ARS is transferred to freon. The heat is then transferred to Ground Support Equipment (GSE) or into space. The Electrical Power System (EPS) and pressurization systems have heat removed by the ATCS. The hydraulic system is warmed at the hydraulic heat exchanger by hot freon.

The Active Thermal Control System interfaces with the Electrical Power Distribution & Control (EPD&C) system, the Display and Control (D&C) system, the instrumentation system, and GPC software. The EPD&C system provides the electric power and the control assemblies for motors and valves. The D&C system provides the capability for the crew to monitor, configure or manually control the systems where necessary. The instrumentation system processes the performance parameters required for system monitoring and control. The GPC software provides automatic control.

3.3 Hierarchy

Figure 4 illustrates the hierarchy of the ATCS hardware and the corresponding subcomponents. Figures 5 through 22 comprise the detailed system representation.
Figure 4 - ACTIVE THERMAL CONTROL SUBSYSTEM ANALYSIS HIERARCHY
Figure 5 - FREON COOLANT LOOP MECHANICAL
Figure 6 - FREON PUMP PACKAGE
Figure 7 - Heat Exchangers

- Heat Exchangers
  - ARS Interchanger Heat Exchanger
  - 02 Restrictor
  - Payload Heat Exchanger
    - GSE Heat Exchanger
      - Hydraulic Heat Exchanger
    - Primary Service Lines
  - Secondary Service Lines
  - Fuel Cell Heat Exchanger
* ONLY USED DURING GROUND SERVICING.
** GPC COMMANDS PUMP MOTOR B "ON" IF MAIN BUS A OUTPUT IS LESS THAN 20V.

Figure 11 - FREON PUMPS EPD&C
Figure 13 - RFCA MECHANICAL
Figure 14 - RADIATOR BYPASS VALVE EPD & C
Figure 15 - RADIATOR FLOW VALVE CONTROL EP&D&C

RADIATOR FLOW CONTROL VALVE EP&D & C

PANEL L1A2

RESISTOR A8R1

SWITCH 25

DIODE A4CR1

SWITCH 26

CIRCUIT BREAKER 14

PANEL L4
Figure 16 - FES MECHANICAL
Figure 17 - FES HI-LOAD EVAPORATOR
Figure 18 - FES TOPPING EVAPORATOR
Figure 19 - FES FEEDLINE/SUPPLY SYSTEM
Figure 20 - FES EPD&C
Figure 21 - AMMONIA BOILER SYSTEM MECHANICAL
4.0 ANALYSIS RESULTS

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

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<td>0</td>
<td>15</td>
<td>28</td>
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TOTAL  | 4   | 89   | 4   | 45   | 79   | 89  | 310   |

Of the 310 failure modes analyzed, 101 failures were determined to be Potential Critical Items (PCIs). A summary of the potential critical items is presented in Table II. Appendix D presents a cross reference between each Potential Critical Item (PCI) and a specific worksheet in Appendix C.

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<tr>
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4.1 Freon Coolant Loop

The Freon Coolant (FCL) analysis identified 108 failure modes. The FCL analysis breakdown is illustrated in Figures 5 through 12. Most of the failure modes were identified as criticality 2/1R or 3/3. 59 PCIs were identified and are listed in Appendix D.
4.2 Radiator and Flow Control Assembly

The Radiator and Flow Control Assembly (RFCA) analysis identified 40 failure modes. The RFCA analysis breakdown is illustrated in Figures 13 through 15. Most of the failure modes were identified as either criticality 3/2R or 3/3. 7 PCIs were identified and are listed in Appendix D.

4.3 Flash Evaporator System

The Flash Evaporator System (FES) analysis identified 134 failure modes. The FES analysis breakdown is illustrated in Figures 16 through 20. Most of the failure modes were identified as either criticality 3/1R or 3/2R. 22 PCIs were identified and are listed in Appendix D.

4.4 Ammonia Boiler System

The Ammonia Boiler System (ABS) analysis identified 28 failure modes. The ABS analysis breakdown is illustrated in Figures 21 and 22. Most of the failure modes were identified as either criticality 2/1R or 3/3. 13 PCIs were identified and 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:

1. RI-VS70-960102, Integrated Systems Schematics
4. Shuttle Operational Data Book, JSC 08934
5. STS Operational Flight Rules, JSC 12820
7. Instructions for Preparation of Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL), NSTS 22206
APPENDIX A
ACRONYMS
APPENDIX A
ACRONYMS

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<th>Description</th>
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</tr>
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</tr>
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<td>ACOD</td>
<td>Anti-Carryover Device</td>
</tr>
<tr>
<td>ALC</td>
<td>Aft Load Controller</td>
</tr>
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<td>ALCA</td>
<td>Aft Load Control Assembly</td>
</tr>
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<td>AOA</td>
<td>Abort-Once-Around</td>
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<tr>
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ACRONYMS

JSC - Johnson Space Center
LCA - Load Controller Assembly
MC - Memory Configuration
MDAC - McDonnell Douglas Astronautics Company
MDM - Multiplexer/Demultiplexer
MM - Major Mode
NA - Not Applicable
NASA - National Aeronautics and Space Administration
NC - Normally Closed
NH3 - Ammonia
NO - Normally Open
NSTS - National Space Transportation System
O2 - Oxygen
OPS - Operations Sequence
P - Pass
P/L - Payload
PASS - Primary Avionics Software System
PCA - Power Control Assembly
PCI - Potential Critical Item
PCN - Page Change Notice
PNL - Panel
R - Redundancy
RAD - Radiator
RCS - Reaction Control System
RFCA - Radiator and Flow Control Assembly
RGA - Rate Gyro Assembly
RI - Rockwell International
RTLS - Return-to-Launch Site
SM - Systems Management
SOP - Secondary Oxygen Pack
SSSH - Space Shuttle Systems Handbook
STS - Space Transportation System
TAL - Transatlantic Abort Landing
TEMP - Temperature
VAC - Volts, ac
VRCS - Vernier Reaction Control System
WP - Working Paper
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
B.1 Definitions

Definitions contained in NSTS 22206, Instructions For Preparation of FMEA/CIL, PCN-2, 6 April 1987, 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 on-orbit 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)

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

DE-ORBIT 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
B.2  IOA Project Level Ground Rules and Assumptions

The philosophy embodied in NSTS 22206, Instructions for Preparation of FMEA/CIL, PCN-2, 6 April 1987, 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 existential 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 ATCS-Specific Ground Rules and Assumptions

The IOA analysis was performed to the component or assembly level of the ATCS subsystem. The analysis considered the worst case effects of the hardware or functional failure on the subsystem, mission, and crew and vehicle safety.

1. For redundancy definitions; the high load evaporator is not redundant to the topping evaporator during on-orbit operation.

   **RATIONALE:** During on-orbit operations, the topping evaporator is used: (1) to eliminate the excess heat load which cannot be handled by the radiators alone; and, (2) to provide an alternate means of performing a water dump. The topping evaporator operation also results in "balanced venting" with no propulsive effects. The high load evaporator would operate erratically at the heat levels of the topping. The high load results in propulsive venting and concern for vehicle control if used with the VRCS. Payload contamination concerns also limit the use of the high load evaporator on orbit. Due to evaporator these negative effects, the high load cannot be considered as redundant to the topping evaporator.

2. Orbiter attitudes and payload cooling requirements necessitate the use of the topping evaporator for the entire mission.

   **RATIONALE:** Worst case. Some attitudes require only the radiators. Requiring the use of the FES for the entire mission results in a worst case scenario.

3. The two exit duct/sonic nozzle systems for the topping evaporator are not redundant to each other.

   **RATIONALE:** The topping evaporator is sized to reject a given heat load with both nozzles operational. Loss of one duct/nozzle would reduce the operational heat load. Additionally, the configuration is such that the venting is nonpropulsive when both duct/nozzles are used. Using only one duct/nozzle would result in a propulsive venting with subsequent impacts on the attitude hold and RCS jet systems.
4. During ascent and entry, the high load evaporator is redundant to the freon coolant loops.

RATIONALE: Definition of redundancy. Loss of both the high load evaporator and one freon loop can lead to the loss of crew/vehicle. Defining redundancy as above allows the end result to be reflected in the criticalities.

5. Loss of the topping evaporator on-orbit, is a loss of mission.

RATIONALE: The loss of the topping evaporator will mean attitude changes and power level reductions. These changes result in changes to the mission profile and mission length. Taken together, this means a loss of mission.

6. During on-orbit operations, the FES and the fuel cell drain vent line provide an unlike redundancy to the water dump capability.

RATIONALE: Conservative approach. If a leak in one of the feedlines occurs, then the steps to isolate the leak can also isolate the water dump system from the water tanks. When this occurs, the FES must function as an unlike redundancy item to dump excess water from the storage tanks. If leaks occur in both feedlines, they must be isolated leaving no "primary" method of dumping water.

7. In analysis cases where the meaning of hardware item redundancy seems ambiguous, redundancy is understood to mean that there is one or more systems that are redundant to the system in which the hardware item occurs.

RATIONALE: This is the most conservative assumption for purposes of determining criticality.

8. Loss of redundancy means loss of all capability to perform function.

RATIONALE: Maintain uniform usage within project.

9. Caps and fittings for quick disconnects are considered one component.

RATIONALE: This is the most conservative assumption.

10. Leaks (GN2, hydraulic fluid, water) are sufficiently prolonged
in time to allow recognition and response.

RATIONALE: This assumption allows for non-trivial case analysis.

11. Contamination of all freon coolant loops during turnaround servicing is not considered a "single credible event" in evaluating Redundancy Screen C.

RATIONALE: This is considered a ground operations problem although the significant number of inflight system anomalies attributed to contamination suggests that it should be analyzed independently as a potential cause of critical failure modes. Without this assumption, all system failure modes that list contamination as a cause would fail screen C.
APPENDIX C
DETAILED ANALYSIS

This section contains the IOA analysis worksheets employed during the analysis of the Active Thermal Control Subsystem. The information on these worksheets is intentionally similar to the FMEA's written by Rockwell and the NASA. Each of these sheets identifies the item being analyzed, and 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. PCN-2, 6 April 1987. 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
3 = Non loss of life or vehicle or mission

Functional Criticalities:
1R = Redundant identical hardware components or redundant functional paths all of which, if failed, could cause loss of life or vehicle.
2R = Redundant identical hardware components or redundant functional paths 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
4 = Do Not Know

Redundancy Screens B and C:
P = Passed Screen
F = Failed Screen
NA = Not Applicable

Preceding the actual analysis worksheets are summary tables containing a complete listing of all identified failure modes and the associated criticalities.
### TABLE C.1 FREON COOLANT LOOP ANALYSIS WORKSHEETS

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ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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SUBSYSTEM: ATCS
MDAC ID: 1000

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

ITEM: INLET SELF-SEALING COUPLING
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) FREON PUMP ASSEMBLY
4) INLET SELF-SEALING COUPLING
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CRITICALITIES

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LOCATION: MIDBODY, AREA 40
PART NUMBER: 40V63TP201, TP203

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL STRESS

EFFECTS/RATIONALE:
IF DEPLETION OF FREON FROM ONE COOLANT LOOP OCCURS, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE IN THE REDUNDANT LOOP RESULTS IN LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER. EFFECTS OF FREON LEAKING INTO THE MIDBODY ARE UNKNOWN; HOWEVER, IT IS EXPECTED TO HAVE NO IMPACT ON ORBITER PERFORMANCE.

REFERENCES:

REPORT DATE 11/24/87
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/17/87  
SUBSYSTEM: ATCS  
MDAC ID: 1001  

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

ITEM: ORIFICE (INLET COUPLING)  
FAILURE MODE: RESTRICTED FLOW

LEAD ANALYST: W.E. PARKMAN  
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:  
1) ACTIVE THERMAL CONTROL SYSTEM  
2) FREON COOLANT LOOP  
3) INLET SELF-SEALING COUPLING  
4) ORIFICE

CRITICALITIES

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REDUNDANCY SCREENS:  
A [ 2 ]  
B [ P ]  
C [ P ]

LOCATION: MIDBODY-AREA 40  
PART NUMBER: 40V63TP201, TP203

CAUSES: PIECE-PART STRUCTURAL FAILURE, CONTAMINATION, VIBRATION, MECHANICAL SHOCK, THERMAL STRESS

EFFECTS/RATIONALE:  
RESTRICTED FLOW FROM WITHIN THE ORIFICE REDUCES THE COOLING CAPABILITY PROVIDED BY ONE OF THE FREON COOLANT LOOPS. FOR LOSS OF ONE LOOP, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. IF BOTH FREON COOLANT LOOPS FAIL, CREW AND VEHICLE WOULD BE LOST, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87 C-12
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/26/87
SUBSYSTEM: ATCS
MDAC ID: 1002

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

ITEM: PUMP INLET PRESSURE SENSOR
FAILURE MODE: ERRONEOUS OUTPUT, FAILS OFF-SCALE (HIGH/LOW)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) FREON PUMP ASSEMBLY
4) PRESSURE SENSOR
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63-MT4, MT12

CAUSES: THERMAL SHOCK, VIBRATION, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK

EFFECTS/RATIONALE:
TELEMETRY CONTAINS UNRELIABLE PRESSURE DATA ON FLUID ENTERING THE FREON PUMP ASSEMBLY. REDUNDANT DOWNSTREAM SENSORS PROVIDE DATA WHICH COMPENSATES FOR THE FAILED SENSOR.

REFERENCES:

REPORT DATE 11/24/87 C-13
INDEPENDENT ORBITER ASSESSMENT ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/26/87
SUBSYSTEM: ATCS
MDAC ID: 1003

ITEM: INLET FILTER (ACCUMULATOR)
FAILURE MODE: RESTRICTED FLOW

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) FREON PUMP ASSEMBLY
4) INLET FILTER
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LOCATION: MIDBODY-AREA 40

PART NUMBER:

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
LOSS OF ONE FREON COOLANT LOOP RESULTS FROM AN INABILITY TO MAINTAIN ADEQUATE FLOW THROUGH THE FILTER. ENTRY IS THEN REQUIRED AT THE NEXT PRIMARY LANDING SITE. IF BOTH FREON COOLANT LOOPS FAIL, CREW AND VEHICLE WOULD BE LOST, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87  C-14
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/26/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 2/1R
MDAC ID: 1004  ABORT: 2/1R

ITEM: INLET FILTER (ACCUMULATOR)
FAILURE MODE: STRUCTURAL FAILURE (RUPTURE)

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) FREON PUMP ASSEMBLY
4) INLET FILTER
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LOCATION: MIDBODY-AREA 40
PART NUMBER:

CAUSES: PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
FILTER ELEMENTS MAY COMBINE WITH THE FILTERS PRECEDING THE FREON PUMPS AND THUS REDUCE THE FLOW RATE IN ONE COOLANT LOOP. THIS, IN TURN COULD LEAD TO LOSS OF MISSION. A FAILURE IN THE REDUNDANT COOLANT LOOP ELIMINATES ORBITER COOLING AND RESULTS IN LOSS OF CREW AND VEHICLE.

REFERENCES:

REPORT DATE 11/24/87  C-15
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/26/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 2/1R
MDAC ID: 1005  ABORT: 2/1R

ITEM: ACCUMULATOR
FAILURE MODE: INTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) FREON PUMP ASSEMBLY
4) ACCUMULATOR
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LOCATION: MIDBODY-AREA 40
PART NUMBER:

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION, MECHANICAL SHOCK, THERMAL STRESS

EFFECTS/RATIONALE:
ACCUMULATOR IS UNABLE TO PROVIDE ADEQUATE HEAD PRESSURE TO FREON PUMPS IN ONE COOLANT LOOP, WHICH COULD RESULT IN LOSS OF MISSION. IF A SECOND FAILURE OCCURS IN THE REDUNDANT FREON COOLANT LOOP, 1) CREW AND VEHICLE MAY BE LOST, 2) NITROGEN IN THE FREON COOLANT LOOP COULD LEAD TO WINDMILLING OF THE FREON PUMPS.

REFERENCES:

REPORT DATE 11/24/87  C-16
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/26/87
SUBSYSTEM: ATCS
MDAC ID: 1006

ITEM: SELF-SEALING DISCONNECT
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) FREON PUMP ASSEMBLY
4) ACCUMULATOR
5) SELF-SEALING DISCONNECT CAPPED
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63TP209

CAUSES: PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
EXTERNAL LEAKAGE OF THE DISCONNECT IS CONTAINED BY THE REDUNDANT CAP. IF ALL REDUNDANCY TO CONTAIN NITROGEN FAILS, ONE FREON COOLANT LOOP WILL BE LOST. THE LATTER DUE TO INABILITY TO PROVIDE ADEQUATE FREON PRESSURE TO THE PUMPS.

REFERENCES:

REPORT DATE 11/24/87 C-17
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/26/87
SUBSYSTEM: ATCS
MDAC ID: 1007

HIGHEST CRITICALITY

HDW/FUNC

FLIGHT: 3/3
ABORT: 3/3

ITEM: QUANTITY SENSOR
FAILURE MODE: ERRONEOUS OUTPUT, FAILS OFF-SCALE (HIGH/LOW)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) FREON PUMP ASSEMBLY
4) ACCUMULATOR
5) QUANTITY TRANSDUCER

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REDUNDANCY SCREENS:  A [ ]  B [ ]  C [ ]

LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63-PP1, PP2

CAUSES: VIBRATION, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL STRESS

EFFECTS/RATIONALE:
ONE FREON LOOP CANNOT BE MONITORED USING THE QUANTITY SENSOR. HOWEVER, REDUNDANT DOWNSTREAM SENSORS PROVIDE DATA WHICH COMPENSATES FOR THE FAILED SENSOR.

REFERENCES:

REPORT DATE 11/24/87  C-18
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/17/87
SUBSYSTEM: ATCS
MDAC ID: 1008

ITEM: INLET FILTER (FREON PUMP)
FAILURE MODE: RESTRICTED FLOW

LEAD ANALYST: W.E. PARKMAN
LEAD SUBYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) FREON PUMP ASSEMBLY
4) INLET FILTER

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LOCATION: MIDBODY-AREA 40
PART NUMBER:

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
BLOCKED FLOW AT THE INLET FILTER restricts FREON FROM ONE OF TWO REDUNDANT PUMPS IN THE COOLANT LOOP. WITH LOSS OF BOTH FREON PUMPS IN ONE COOLANT LOOP, THE MISSION IS LOST.

REFERENCES:

REPORT DATE 11/24/87 C-19
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/17/87
SUBSYSTEM: ATCS
MDAC ID: 1009

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: INLET FILTER (FREON PUMP)
FAILURE MODE: STRUCTURAL FAILURE (RUPTURE)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) FREON PUMP ASSEMBLY
4) INLET FILTER
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LOCATION: MIDBODY-AREA 40

PART NUMBER:

CAUSES: PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
PIECES OF THE RUPTURED FILTER MAY DAMAGE THE ASSOCIATED FREON PUMP AND THUS, LEAD TO FAILURE OF THAT PUMP. WITH LOSS OF ALL REDUNDANCY TO PROVIDE FLOW WITHIN A FREON COOLANT LOOP, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE.

REFERENCES: REPORT DATE 11/24/87 C-20
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/26/87

SUBSYSTEM: ATCS
MDAC ID: 1010

HIGHEST CRITICALITY
HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: FREON PUMP
FAILURE MODE: PHYSICAL BINDING/JAMMING

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) FREON PUMP ASSEMBLY
4) CENTRIFUGAL PUMP
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63PP1

CAUSES: MECHANICAL SHOCK, THERMAL STRESS, PIECE-PART STRUCTURAL FAILURE, CONTAMINATION

EFFECTS/RATIONALE:
ONE OF TWO REDUNDANT FREON PUMPS IS UNABLE TO PROVIDE FLOW IN THE ASSOCIATED COOLANT LOOP. ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE, WHEN A LOSS OF BOTH FREON PUMPS IN ONE COOLANT LOOP OCCURS.

REFERENCES:

REPORT DATE 11/24/87  C-21
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/26/87
SUBSYSTEM: ATCS
MDAC ID: 1011

ITEM: FREON PUMP
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) FREON PUMP ASSEMBLY
4) CENTRIFUGAL PUMP
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LOCATION: MIDBODY
PART NUMBER: 40V63-PP1, PP2

CAUSES: PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
WHEN DEPLETION OF FREON FROM ONE COOLANT LOOP OCCURS, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE TO THE REDUNDANT LOOP RESULTS IN LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER. EFFECTS OF FREON LEAKING INTO THE MIDBODY ARE UNKNOWN; HOWEVER, IT IS EXPECTED TO HAVE NO IMPACT ON ORBITER PERFORMANCE.

REFERENCES:

REPORT DATE 11/24/87 C-22
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/26/87
SUBSYSTEM: ATCS
MDAC ID: 1012

ITEM: 3-PHASE MOTOR
FAILURE MODE: FAILS TO START

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) FREON PUMP ASSEMBLY
4) CENTRIFUGAL PUMP
5) 3-PHASE MOTOR
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63-PP1, PP2

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK

EFFECTS/RATIONALE:
THE REDUNDANT PUMP IS UNABLE TO PROVIDE FLOW IN ONE FREON COOLANT LOOP. WITH LOSS OF BOTH PUMPS IN SAID FREON COOLANT LOOP, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE.

REFERENCES:

REPORT DATE 11/24/87 C-23
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/26/87
SUBSYSTEM: ATCS
MDAC ID: 1013

ITEM: 3-PHASE MOTOR
FAILURE MODE: LOSS OF 1 PHASE

LEAD ANALYST: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) FREON PUMP ASSEMBLY
4) CENTRIFUGAL PUMP
5) 3-PHASE MOTOR

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63-PP1, PP2

CAUSES: VIBRATION, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, MECHANICAL SHOCK

EFFECTS/RATIONALE:
PUMP CAN BE STARTED AND OPERATED IN A DEGRADED MODE ON TWO-PHASE POWER. FLOW IN THE FREON COOLANT LOOP WILL BE PROVIDED BY THE REDUNDANT PUMP SHOULD LOSS OF ALL REDUNDANCY TO POWER THE PUMP MOTOR OCCUR.

REFERENCES:

REPORT DATE 11/24/87 C-24
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/12/87
SUBSYSTEM: ATCS
MDAC ID: 1014

ITEM: OUTLET FILTER
FAILURE MODE: STRUCTURAL FAILURE (RUPTURE)

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) FREON PUMP ASSEMBLY
4) OUTLET FILTER
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REMARKS

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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63-PP1, PP2

CAUSES: PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
PIECES OF FILTER MAY CLOG DOWNSTREAM COMPONENTS, CAUSING LOSS OF FLOW THROUGH THE FREON COOLANT LOOP. ENTRY IS THEN REQUIRED AT THE NEXT PRIMARY LANDING SITE SHOULD SAID COOLANT LOOP FAIL. SHOULD ALL REDUNDANCY TO COOL THE ORBITER FAIL, CREW AND VEHICLE WILL BE LOST.

REFERENCES:

REPORT DATE 11/24/87 C-25
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/26/87
SUBSYSTEM: ATCS
MDAC ID: 1015

ITEM: OUTLET FILTER
FAILURE MODE: RESTRICTED FLOW

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) FREON PUMP ASSEMBLY
4) OUTLET FILTER
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63-PP1, PP2

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
A BLOCKED FILTER WILL RESTRICT FREON FROM EXITING ONE REDUNDANT PUMP IN THE ASSOCIATED COOLANT LOOP. LOSS OF BOTH FREON PUMPS IN ONE COOLANT LOOP RESULTS IN A LOST MISSION.

REFERENCES:

REPORT DATE 11/24/87 C-26
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/26/87

SUBSYSTEM: ATCS
MDAC ID: 1016

ITEM: CHECK VALVE
FAILURE MODE: FAILS TO CLOSE

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) FREON PUMP ASSEMBLY
4) CHECK VALVE
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63PP1

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
WINDMILLING OF PUMP MAY ALLOW FREON TO CYCLE INSIDE THE PUMP ASSEMBLY, WHICH ELIMINATES FLOW THROUGH THE REMAINING COOLANT LOOP. FOR LOSS OF ONE FREON COOLANT LOOP, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. SHOULD BOTH FREON COOLANT LOOPS FAIL, CREW AND VEHICLE WOULD BE LOST, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87 C-27
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/26/87
SUBSYSTEM: ATCS
MDAC ID: 1017

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

ITEM: OUTLET SELF-SEALING COUPLING
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) FREON PUMP ASSEMBLY
4) OUTLET SELF-SEALING COUPLING
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63TP205, TP207

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK

EFFECTS/RATIONALE:
FOR DEPLETION OF FREON FROM ONE COOLANT LOOP, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE TO THE REDUNDANT LOOP RESULTS IN LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER. EFFECTS OF FREON LEAKING INTO THE MIDBODY ARE UNKNOWN; HOWEVER, IT IS EXPECTED TO HAVE NO IMPACT ON THE ORBITER PERFORMANCE.

REFERENCES:

REPORT DATE 11/24/87 C-28
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/17/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 2/1R
MDAC ID: 1018  ABORT: 2/1R

ITEM: ORIFICE (OUTLET COUPLING)  FAILURE MODE: RESTRICTED FLOW

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) FREON PUMP ASSEMBLY
4) OUTLET SELF-SEALING COUPLING
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LOCATION: MIDBODY-AREA 40
PART NUMBER:

CAUSES: PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
RESTRICTED FLOW WITHIN THE ORIFICE REDUCES THE COOLING CAPABILITY OF ONE FREON COOLANT LOOP. WHERE THE LOSS OF ONE FREON COOLANT LOOP OCCURS, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. SHOULD BOTH FREON COOLANT LOOPS FAIL, CREW AND VEHICLE WOULD BE LOST, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87  C-29
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1019

ITEM: FUEL CELL HEAT EXCHANGER
FAILURE MODE: INTERNAL LEAKAGE (F21 TO FC40)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) FUEL CELL HEAT EXCHANGER
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63HX11

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS

EFFECTS/RATIONALE:
INTERNAL LEAKAGE WITHIN FUEL CELL HEAT EXCHANGER RESULTS IN THE MIXING OF FREON AND FC40. MIXING OF THESE FLUIDS RESULTS IN ONE COOLANT LOOP AND FUEL CELL LOOP TO BE LOST, THUS REQUIRING ENTRY AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE THAT ELIMINATES THE REDUNDANT FREON COOLANT LOOP RESULTS IN LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87 C-30
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1020

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

ITEM: FUEL CELL HEAT EXCHANGER
FAILURE MODE: INTERNAL LEAKAGE (F21 TO F21)

LEAD ANALYST: W. E. PARKMAN
SUBSYS LEAD: W. E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) FUEL CELL HEAT EXCHANGER
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63HX11

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
WHEN A FREON-TO-FREON LOOP LEAK OCCURS, TWO COOLANT LOOPS BEGIN TO FUNCTION AS ONE. AN INTERLOOP LEAK REQUIRES ENTERING AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE ASSOCIATED WITH THE LOOPS OCCUR, THERE WILL BE A LOSS OF CREW AND VEHICLE.

REFERENCES:

REPORT DATE 11/24/87 C-31
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1021

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

ITEM: FUEL CELL HEAT EXCHANGERS
FAILURE MODE: INTERNAL LEAKAGE (FC40 TO FC40)

LEAD ANALYST: M.R. HIOTT
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) FUEL CELL HEAT EXCHANGER
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LOCATION: MIDBODY
PART NUMBER: 40V63HX11

CAUSES: MECHANICAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
1/4 INCH WELD AT HEAT EXCHANGER CAN CAUSE LOSS OF 2 FUEL CELLS.

REFERENCES:

REPORT DATE 11/24/87 C-32
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1022

ITEM: FUEL CELL HEAT EXCHANGER
FAILURE MODE: EXTERNAL LEAKAGE (FREON)

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1)  ACTIVE THERMAL CONTROL SYSTEM
2)  FREON COOLANT LOOP
3)  HEAT EXCHANGER
4)  FUEL CELL HEAT EXCHANGER
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63HX11

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS

EFFECTS/RATIONALE:
SHOULD THERE BE A DEPLETION OF FREON FROM ONE COOLANT LOOP, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE IN THE REDUNDANT LOOP WOULD RESULT IN LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER. EFFECTS OF FREON LEAKING INTO THE MIDBODY ARE UNKNOWN; HOWEVER, IT IS EXPECTED TO HAVE NO IMPACT ON ORBITER PERFORMANCE.

REFERENCES:

REPORT DATE 11/24/87  C-33
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 2/1R
MDAC ID: 1023  ABORT: 2/1R

ITEM: FUEL CELL HEAT EXCHANGER
FAILURE MODE: EXTERNAL LEAKAGE (FC40)

LEAD ANALYST: M.R. HIOTT  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) FUEL CELL HEAT EXCHANGER
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LOCATION: MIDBODY
PART NUMBER: 40V63HX11

CAUSES: MECHANICAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
LOSS OF COOLANT TO FCP MAY CAUSE 1) OVERHEATING, 2) POSSIBLE REACTANT CROSSOVER, WHICH MAY LEAD TO EXPLOSION.

REFERENCES:

REPORT DATE 11/24/87  C-34
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1024

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LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
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2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) FUEL CELL HEAT EXCHANGER
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63HX11

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
RESTRICTED FLOW WITHIN THE HEAT EXCHANGER CAUSES A REDUCTION IN THE COOLING CAPABILITY FROM ONE FREON COOLANT LOOP. ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE, SHOULD A LOSS OF ONE FREON LOOP OCCUR, FAILURE OF BOTH FREON LOOPS RESULTS IN LOSS OF CREW AND VEHICLE SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87 C-35
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87

SUBSYSTEM: ATCS
MDAC ID: 1025

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

ITEM: HYDRAULIC HEAT EXCHANGER
FAILURE MODE: INTERNAL LEAKAGE (FREON 21 TO HYDRAULIC FLUID)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) HYDRAULIC HEAT EXCHANGER
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LOCATION: AFT FUSELAGE
PART NUMBER: 56V63HX2

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS

EFFECTS/RATIONALE:
INTERNAL LEAKAGE WITHIN THE HEAT EXCHANGER LEADS TO MIXING OF FREON AND HYDRAULIC FLUID WHICH RESULTS IN LOSS OF ONE FREON COOLANT LOOP AND ONE HYDRAULIC LOOP. ELIMINATION OF THE REDUNDANT FREON COOLANT LOOP RESULTS IN LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87 C-36
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 2/1R
MDAC ID: 1026  ABORT: 2/1R

ITEM: HYDRAULIC HEAT EXCHANGERS
FAILURE MODE: INTERNAL LEAKAGE (FREON TO FREON)

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) HYDRAULIC HEAT EXCHANGER

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LOCATION: AFT FUSELAGE
PART NUMBER: 56V63HX2

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS

EFFECTS/RATIONALE:
DURING A FREON-TO-FREON LOOP LEAK, TWO COOLANT LOOPS CONTINUE TO FUNCTION AS ONE, WITH ENTRY BEING REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE (I.E.-EXTERNAL LEAKAGE) IN THE FREON LOOPS LEADS TO LOSS OF CREW AND VEHICLE.

REFERENCES:

REPORT DATE 11/24/87  C-37
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 2/1R
MDAC ID: 1027  ABORT: 2/1R

ITEM: HYDRAULIC HEAT EXCHANGERS
FAILURE MODE: INTERNAL LEAKAGE (HYDRAULIC TO HYDRAULIC)

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) HYDRAULIC HEAT EXCHANGER
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LOCATION: AFT FUSELAGE
PART NUMBER: 56V63HX2

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
DURING CIRCULATION PUMP OPERATIONS, HYDRAULIC QUANTITY SENSORS MUST BE MONITORED TO ASSURE CONSISTENT VOLUMES OF THE TWO SYSTEMS REMAIN CONSTANT. FOR MAIN PUMP OPERATIONS, FLUID WITHIN THESE SYSTEMS SHOULD NOT FLOW THROUGH THE HYDRAULIC HEAT EXCHANGER. EXTERNAL LEAKAGE IN THE HYDRAULIC SYSTEM DEGRADES PERFORMANCE OF THE ORBITER AERO SURFACES, WHICH COULD RESULT IN LOSS OF VEHICLE.

REFERENCES:

REPORT DATE 11/24/87  C-38
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1028

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

ITEM: HYDRAULIC HEAT EXCHANGER
FAILURE MODE: EXTERNAL LEAKAGE (FREON 21)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) HYDRAULIC HEAT EXCHANGER
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LOCATION: AFT FUSELAGE
PART NUMBER: 56V63HX2

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS

EFFECTS/RATIONALE:
ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE SHOULD DEPLETION OF FREON FROM ONE COOLANT LOOP OCCUR. FAILURE IN THE REDUNDANT LOOP WOULD ALSO RESULT IN LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER. EFFECTS OF FREON LEAKING INTO THE AFT FUSELAGE ARE UNKNOWN; HOWEVER, IT IS EXPECTED TO HAVE NO IMPACT ON ORBITER PERFORMANCE.

REFERENCES:

REPORT DATE 11/24/87 C-39
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1029

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

ITEM: HYDRAULIC HEAT EXCHANGER
FAILURE MODE: EXTERNAL LEAKAGE (HYDRAULIC FLUID)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) HYDRAULIC HEAT EXCHANGER
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LOCATION: AFT FUSELAGE
PART NUMBER: 56V63HX2

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS

EFFECTS/RATIONALE:
SHOULD A HYDRAULIC SYSTEM FAIL, THE MISSION MUST BE TERMINATED, SINCE TWO SYSTEMS ARE REQUIRED TO SUPPORT THE END-OF-MISSION. FAILURE IN ONE OF THE REMAINING SYSTEMS LEADS TO LOSS OF CREW AND VEHICLE. FOR THE ABORT CASE WITH AN SSME-OUT AND AN ENGINE STUCK IN THE BUCKET, CREW AND VEHICLE MAY BE LOST IN RTLS DUE TO DEGRADED PERFORMANCE.

REFERENCES:

REPORT DATE 11/24/87 C-40
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1030

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

ITEM: HYDRAULIC HEAT EXCHANGER
FAILURE MODE: RESTRICTED FLOW (FREON 21)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) HYDRAULIC HEAT EXCHANGER
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LOCATION: AFT FUSELAGE
PART NUMBER: 56V63HX2

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
RESTRICTED FLOW WITHIN THE COMPONENT REDUCES THE COOLING
CAPABILITY FOR ONE FREON COOLANT LOOP. LOSS OF SAID LOOP
REQUIRES ENTRY AT THE PRIMARY LANDING SITE. IF BOTH FREON
COOLANT LOOPS FAIL, CREW AND VEHICLE ARE LOST, SINCE HEAT CANNOT
BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87 C-41
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1031

ITEM: HYDRAULIC HEAT EXCHANGER
FAILURE MODE: RESTRICTED FLOW (HYDRAULIC FLUID)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) GSE HEAT EXCHANGER
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LOCATION: AFT FUSELAGE
PART NUMBER: 56V63HX1

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
THERE IS A LOSS OF CAPABILITY TO HEAT HYDRAULIC FLUID IN ONE SYSTEM USING THE HYDRAULIC HEAT EXCHANGER. HOWEVER, THIS HYDRAULIC SYSTEM CAN BE HEATED BY OPERATING MAIN PUMP OR BARBECUING.

REFERENCES:
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1032

ITEM: GSE HEAT EXCHANGER
FAILURE MODE: INTERNAL LEAKAGE (FREON 21 TO GSE LINES)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
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LOCATION: AFT FUSELAGE
PART NUMBER: 56V63HX1

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS

EFFECTS/RATIONALE:
DURING PRELAUNCH AND LANDING/SAFING, THE FREON COOLANT LOOP (FCL) LEAKS TO THE GSE LOOP. FOR ON-ORBIT OPERATIONS, FREON FROM THE FCL BLEEDS TO 55 PSIG THROUGH THE GSE SERVICE LINE RELIEF VALVE. THE FCL IS THEREFORE INOPERABLE DUE TO UNDERPRESSURIZATION AND REQUIRES AN ENTRY AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE TO THE REDUNDANT LOOP RESULTS IN LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87 C-43
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 2/1R
MDAC ID: 1033  ABORT: 2/1R

ITEM: GSE HEAT EXCHANGER
FAILURE MODE: INTERNAL LEAKAGE (FREON 21 TO FREON 21)

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) GSE HEAT EXCHANGER
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LOCATION: AFT FUSELAGE
PART NUMBER: 56V63HX1

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS

EFFECTS/RATIONALE:
FOR A FREON-TO-FREON LEAK, THE TWO COOLANT LOOPS WILL CONTINUE TO FUNCTION AS ONE. DUE TO SAID INTERLOOP LEAK, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND, FREON LOOP FAILURE (I.E.- EXTERNAL LEAKAGE) LEADS TO LOSS OF CREW AND VEHICLE, SINCE HEAT MAY NOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87  C-44
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 2/1R
MDAC ID: 1034  ABORT: 2/1R

ITEM: GSE HEAT EXCHANGERS
FAILURE MODE: EXTERNAL LEAKAGE (FREON 21)

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) GSE HEAT EXCHANGER
5) FREON COOLANT LOOP
6) HEAT EXCHANGER
7) GSE HEAT EXCHANGER
8) FREON COOLANT LOOP
9) ACTIVE THERMAL CONTROL SYSTEM

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LOCATION: AFT FUSELAGE
PART NUMBER: 56V63HX1

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS

EFFECTS/RATIONALE:
WHEN DEPLETION OF FREON FROM ONE COOLANT LOOP OCCURS, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE IN THIS REDUNDANT LOOP WOULD LEAD TO LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER. EFFECTS OF FREON LEAKING INTO THE MIDBODY ARE UNKNOWN; HOWEVER, IT IS EXPECTED TO HAVE NO IMPACT ON ORBITER PERFORMANCE.

REFERENCES:

REPORT DATE 11/24/87  C-45
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1035

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

ITEM: GSE HEAT EXCHANGER
FAILURE MODE: EXTERNAL LEAKAGE (GSE FREON)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) GSE HEAT EXCHANGER
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LOCATION: AFT FUSELAGE
PART NUMBER: 56V63HX1

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS

EFFECTS/RATIONALE:
DURING GROUND OPERATIONS, HEAT TRANSFERRED TO THE GSE LOOP FROM THE FREON COOLANT LOOP IS REDUCED; HOWEVER, ON-ORBIT OPERATIONS ARE NOT AFFECTED BY EXTERNAL LEAKAGE OF GSE FREON.

REFERENCES:

REPORT DATE 11/24/87 C-46
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1036
HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 2/1R
ABORT: 2/1R

ITEM: GSE HEAT EXCHANGER
FAILURE MODE: RESTRICTED FLOW (FREON 21)

LEAD ANALYST: W. E. PARKMAN
SUBSYS LEAD: W. E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) GSE HEAT EXCHANGER
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LOCATION: AFT FUSELAGE
PART NUMBER: 56V63HX1

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
RESTRICTION OF FREON FLOW FROM WITHIN THE GSE HEAT EXCHANGER REDUCES THE HEAT TRANSFERRED FROM ONE COOLANT LOOP. WHEN THE LOSS OF ONE FREON COOLANT LOOP OCCURS, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. IF BOTH FREON COOLANT LOOPS FAIL, CREW AND VEHICLE WILL BE LOST, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87 C-47
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1037

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

ITEM: O2 RESTRICTOR
FAILURE MODE: EXTERNAL LEAKAGE (02)

LEAD ANALYST: M.J. SAIIDI SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) O2 RESTRICTOR
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LOCATION: MIDBODY-AREA 40
PART NUMBER:

CAUSES:

THE EXTERNAL LEAKAGE OF THE O2 RESTRICTOR IS COVERED IN THE ARPCS-150 LINES AND FITTINGS ANALYSIS. THIS FAILURE WILL RESULT IN LOSS OF O2 REDUNDANCY AND THUS POSES A FIRE HAZARD. TOTAL LOSS OF FUNCTION DEPRIVES CREW OF OXYGEN.

REFERENCES:

REPORT DATE 11/24/87 C-48
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1038

ITEM: 02 RESTRICTOR
FAILURE MODE: EXTERNAL LEAKAGE (FREON 21)

LEAD ANALYST: M.J. SAIIDI
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) 02 RESTRICTOR
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LOCATION: MIDBODY-AREA 40
PART NUMBER:

CAUSES: MECHANICAL SHOCK, PIECE-PART FAILURE

EFFECTS/RATIONALE:
WHEN DEPLETION OF FREON FROM ONE COOLANT LOOP OCCURS, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE IN THE REDUNDANT LOOP RESULTS IN LOSS OF CREW AND VEHICLE. THE EFFECTS OF FREON LEAKING INTO THE MIDBODY ARE UNKNOWN; HOWEVER, IT IS EXPECTED TO HAVE NO IMPACT ON ORBITER PERFORMANCE.

REFERENCES:

REPORT DATE 11/24/87 C-49
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1039

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

ITEM: ARS INTERCHANGER HEAT EXCHANGER
FAILURE MODE: INTERNAL LEAKAGE (FREON TO WATER)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) ARS INTERCHANGER HEAT EXCHANGER

CRITICALITIES
FLIGHT PHASE HDW/FUNC ABORT HDW/FUNC
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LIFTOFF: 2/1R TAL: 2/1R
ONORBIT: 2/1R AOA: 2/1R
DEORBIT: 2/1R ATO: 2/1R
LANDING/SAFING: 3/3


LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V61HX3

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS

EFFECTS/RATIONALE:
INTERNAL LEAKAGE WITHIN THE ARS HEAT EXCHANGER RESULTS IN THE MIXING OF THE DISSIMILAR FLUIDS. UPON THE MIXING OF FREON AND WATER, ONE FREON COOLANT LOOP AND ONE ARS WATER LOOP WILL BE LOST. LOSS OF ONE FREON COOLANT LOOP AND ARS WATER LOOP RESULTS IN LOSS OF MISSION. A SECOND FAILURE IN THE REDUNDANT ARS OR FREON LOOPS RESULTS IN LOSS OF CREW AND VEHICLE.

REFERENCES:

REPORT DATE 11/24/87 C-50
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1040

ITEM: ARS INTERCHANGER HEAT EXCHANGER
FAILURE MODE: INTERNAL LEAKAGE (FREON TO FREON)

LEAD ANALYST: W. E. PARKMAN  SUBSYS LEAD: W. E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) ARS INTERCHANGER HEAT EXCHANGER
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V61HX3

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS

EFFECTS/RATIONALE:
DURING A FREON-TO-FREON LEAK, TWO COOLANT LOOPS WILL CONTINUE TO FUNCTION AS ONE, WITH ENTRY REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE, SUCH AS AN EXTERNAL LEAK, LEADS TO LOSS OF CREW AND VEHICLE, SINCE HEAT MAY NOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87  C-51
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1041

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

ITEM: ARS INTERCHANGER HEAT EXCHANGER
FAILURE MODE: INTERNAL LEAKAGE (WATER TO WATER)

LEAD ANALYST: M. SAIIDI
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) ARS INTERCHANGER HEAT EXCHANGER
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V61HX3

CAUSES: CORROSION, MECHANICAL SHOCK, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
DUE TO WATER LEAKAGE FROM ONE LOOP TO ANOTHER, THERE IS LOSS OF WATER LOOP REDUNDANCY ALONG WITH REDUCED COOLING CAPABILITY THROUGHOUT ARS. SUBSEQUENT FAILURE OF THIS LOOP MAY RESULT IN A POTENTIAL FOR LOSS OF LIFE/VEHICLE. THIS FAILURE MODE IS ALSO COVERED IN ARPCS-205 ANALYSIS.

REFERENCES:

REPORT DATE 11/24/87 C-52
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1042

ITEM: ARS INTERCHANGER HEAT EXCHANGER
FAILURE MODE: EXTERNAL LEAKAGE (FREON 21)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) ARS INTERCHANGER HEAT EXCHANGER

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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V61HX3

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
DEPLETION OF FREON FROM A COOLANT LOOP REQUIRES THAT ENTRY BE MADE AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE TO THE REDUNDANT LOOP WOULD RESULT IN LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER. EFFECTS OF FREON LEAKING INTO THE MIDBODY ARE UNKNOWN; HOWEVER, IT IS EXPECTED TO HAVE NO IMPACT ON ORBITER PERFORMANCE.

REFERENCES:

REPORT DATE 11/24/87 C-53
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 2/1R
MDAC ID: 1043  ABORT: 2/1R

ITEM: ARS INTERCHANGER HEAT EXCHANGER
FAILURE MODE: EXTERNAL LEAKAGE (WATER)

LEAD ANALYST: M. SAIIDI  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) ARS INTERCHANGER HEAT EXCHANGER
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LOCATION: MIDBODY
PART NUMBER: 40V61HX3

CAUSES: CORROSION, MECHANICAL SHOCK, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
THE EFFECT OF EXTERNAL WATER LEAKAGE ON THE HEAT EXCHANGER
RESULTS IN THE LOSS OF THE AFFECTED WATER COOLANT LOOP. TOTAL
LOSS OF REDUNDANCY (NO WATER COOLANT LOOP) RESULTS IN POSSIBLE
LOSS OF CREW/VEHICLE. THIS FAILURE MODE IS ALSO COVERED IN
ARPCS-208 ANALYSIS.

REFERENCES:

REPORT DATE 11/24/87  C-54
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS
ABORT: 2/1R
MDAC ID: 1044
FLIGHT: 2/1R

ITEM: ARS INTERCHANGER HEAT EXCHANGER
FAILURE MODE: RESTRICTED FLOW (FREON 21)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) ARS INTERCHANGER HEAT EXCHANGER
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V61HX3

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
RESTRICTION OF FLOW WITHIN THE ARS INTERCHANGER REDUCES THE COOLING CAPABILITY FOR ONE FREON COOLANT LOOP. THEREFORE, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. IF BOTH FREON COOLANT LOOPS FAIL CREW AND VEHICLE WOULD BE LOST, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87  C-55
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1045

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

ITEM: ARS INTERCHANGER HEAT EXCHANGER
FAILURE MODE: RESTRICTED FLOW (WATER)

LEAD ANALYST: M.J. SAIIDI  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) ARS INTERCHANGER HEAT EXCHANGER
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V61HX3

CAUSES: CONTAMINATION, CORROSION

EFFECTS/RATIONALE:
RESTRICTION OF WATER FLOW ON THE INTERCHANGER RESULTS IN LOSS OF
AFFECTED WATER COOLANT LOOP. TOTAL LOSS OF REDUNDANCY (NO WATER
COOLANT LOOP) RESULTS IN POSSIBLE LOSS OF CREW/VEHICLE. THIS
FAILURE MODE IS ALSO COVERED IN ARS-205 ANALYSIS.

REFERENCES:

REPORT DATE 11/24/87 C-56
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1046

ITEM: INLET TEMPERATURE SENSOR
FAILURE MODE: ERRONEOUS OUTPUT, FAILS OFF-SCALE (HIGH/LOW)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) ARS INTERCHANGER HEAT EXCHANGER
5) INLET TEMPERATURE TRANSDUCER

CRITICALITIES

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REPEATABILITY SCREENS: A [ ] B [ ] C [ ]

LOCATION: MIDBODY
PART NUMBER: 40V63A6

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL STRESS, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
THE FAILED SENSOR ELIMINATES TEMPERATURE DATA FOR FREON ENTERING THE ARS INTERCHANGER. REDUNDANT DOWNSTREAM SENSORS PROVIDE DATA WHICH COMPENSATES FOR THE FAILED SENSOR.

REFERENCES:

REPORT DATE 11/24/87 C-57
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87

SUBSYSTEM: ATCS
MDAC ID: 1047

ITEM: FLOW RATE SENSOR INTERCHANGER
FAILURE MODE: ERRONEOUS OUTPUT, FAILS OFF-SCALE (HIGH/LOW)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) ARS INTERCHANGER HEAT EXCHANGER
5) FLOW RATE TRANSDUCER
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REDUNDANCY SCREENS:  A [ ]  B [ ]  C [ ]

LOCATION: MIDBODY
PART NUMBER: 40V63A6-MT3, MT8

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL STRESS, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
ERRONEOUS OUTPUT RESULTS IN UNRELIABLE FLOW RATE DATA ON FREON ENTERING THE ARS. REDUNDANT DOWNSTREAM SENSORS PROVIDE DATA WHICH COMPENSATES FOR THE FAILED SENSOR.

REFERENCES:

REPORT DATE 11/24/87  C-58
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1048

ITEM: PAYLOAD HEAT EXCHANGER
FAILURE MODE: INTERNAL LEAKAGE (FREON 21 TO P/L EXCHANGER FLUID)

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) PAYLOAD HEAT EXCHANGER

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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63HX1

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURE FAILURE, THERMAL STRESS

EFFECTS/RATIONALE:
INTERNAL LEAKAGE BETWEEN A FREON COOLANT LOOP AND PAYLOAD COOLANT LOOP RESULTS IN DEGRADED PERFORMANCE OF THE ACTIVE THERMAL CONTROL SYSTEM. A DEGRADED FREON COOLANT LOOP LEADS TO A MINIMUM DURATION FLIGHT. A FAILURE IN THE REDUNDANT FREON LOOP LEADS TO LOSS OF CREW LIFE AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87  C-59
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1049

ITEM: PAYLOAD HEAT EXCHANGER
FAILURE MODE: INTERNAL LEAKAGE (FREON-TO-FREON)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) PAYLOAD HEAT EXCHANGER

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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63HX1

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURE FAILURE, THERMAL STRESS

EFFECTS/RATIONALE:
DURING A FREON-TO-FREON LEAK, TWO COOLANT LOOPS WILL CONTINUE TO FUNCTION AS ONE. DUE TO SAID INTERLOOP LEAK, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE (I.E.-EXTERNAL LEAKAGE) OF THE LOOP LEADS TO LOSS OF CREW LIFE AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87 C-60
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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ITEM: PAYLOAD HEAT EXCHANGER
FAILURE MODE: INTERNAL LEAKAGE (P/L FLUID TO P/L FLUID)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) PAYLOAD HEAT EXCHANGER

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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63HX1

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS

EFFECTS/RATIONALE:
INTERNAL LEAKAGE IN THE HEAT EXCHANGER PROVIDES INADEQUATE COOLING TO THE PAYLOAD ATCS AND WATER LOOP (OV-103 ONLY). IF THE PAYLOAD REQUIRES BOTH ACTIVE COOLING LOOPS, THEN THE MISSION OBJECTIVE WOULD BE LOST.

REFERENCES:

REPORT DATE 11/24/87   C-61
**INDEPENDENT ORBITER ASSESSMENT**

**ORBITER SUBSYSTEM ANALYSIS WORKSHEET**

**DATE:** 6/12/87

**SUBSYSTEM:** ATCS

**MDAC ID:** 1051

**ITEM:** PAYLOAD HEAT EXCHANGER

**FAILURE MODE:** EXTERNAL LEAKAGE (FREON 21)

**LEAD ANALYST:** W. E. PARKMAN  
**SUBSYS LEAD:** W. E. PARKMAN

**BREAKDOWN HIERARCHY:**
1) ACTIVE THERMAL CONTROL SYSTEM  
2) FREON COOLANT LOOP  
3) HEAT EXCHANGER  
4) PAYLOAD HEAT EXCHANGER

**CRITICALITIES**

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**LOCATION:** MIDBODY-AREA 40  
**PART NUMBER:** 40V63HX1

**CAUSES:** MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS

**EFFECTS/RATIONALE:**
WHEN DEPLETION OF FREON FROM ONE COOLANT LOOP OCCURS, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE TO THE REDUNDANT LOOP WOULD RESULT IN LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER. EFFECTS OF FREON LEAKING INTO THE MIDBODY ARE UNKNOWN; HOWEVER, IT IS EXPECTED TO HAVE NO IMPACT ON ORBITER PERFORMANCE.

**REFERENCES:**

REPORT DATE 11/24/87  C-62
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87   HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS   FLIGHT: 3/3
MDAC ID: 1052   ABORT: 3/3

ITEM: PAYLOAD HEAT EXCHANGER
FAILURE MODE: EXTERNAL LEAKAGE (P/L FLUID)

LEAD ANALYST: W.E. PARKMAN   SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) PAYLOAD HEAT EXCHANGER
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63HX1

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS

EFFECTS/RATIONALE:
EXTERNAL LEAKAGE CAUSES THE EFFECTED HEAT EXCHANGER TO INADEQUATELY COOL. THE PAYLOAD COMPONENTS WHICH INTERFACE WITH THE PAYLOAD ACTIVE THERMAL CONTROL SYSTEMS. THIS, IN TURN, RESULTS IN LOSS OF MISSION OBJECTIVE FOR THE ASSOCIATED COMPONENTS THEREOF.

REFERENCES:

REPORT DATE 11/24/87   C-63
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87

SUBSYSTEM: ATCS
MDAC ID: 1053

ITEM: PAYLOAD HEAT EXCHANGER
FAILURE MODE: RESTRICTED FLOW (FREON 21)

LEAD ANALYST: W. E. PARKMAN
SUBSYS LEAD: W. E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) PAYLOAD HEAT EXCHANGER

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LOCATION: MIDBODY
PART NUMBER: 40V63HX1

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
RESTRICTED FLOW WITHIN THE PAYLOAD HEAT EXCHANGER REDUCES THE COOLING CAPABILITY OF ONE FREON COOLANT LOOP. IF LOSS OF ONE FREON LOOP OCCURS, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. IF BOTH FREON COOLANT LOOPS FAIL, CREW AND VEHICLE WOULD BE LOST, SINCE HEAT CANNOT BE REMOVED FROM THE ORBITER.

REFERENCES:
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1054

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

ITEM: FLOW RATE SENSOR PAYLOAD HX
FAILURE MODE: ERRONEOUS OUTPUT, FAILS OFF-SCALE (HIGH/LOW)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) HEAT EXCHANGER
4) PAYLOAD HEAT EXCHANGER
5) FLOW RATE TRANSDUCER

CRITICALITIES

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63-MT10-MT11

CAUSES: MECHANICAL SHOCK, VIBRATION, THERMAL STRESS, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
WHEN ERRONEOUS OUTPUT EFFECTS THE SENSOR, FLOW RATE DATA ON THE FREON ENTERING THE PAYLOAD HEAT EXCHANGER IS UNRELIABLE. HOWEVER, REDUNDANT DOWNSTREAM SENSORS PROVIDE DATA WHICH COMPENSATES FOR THE FAILED SENSOR.

REFERENCES:

REPORT DATE 11/24/87 C-65
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1055

HIGHEST CRITICALITY
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: SERVICING QUICK DISCONNECT CAP
FAILURE MODE: FAILS TO REMAIN CLOSED

LEAD ANALYST: W. E. PARKMAN

SUBSYS LEAD: W. E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) PLUMBING
4) SERVICING QUICK DISCONNECT
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LOCATION: GSE ECLSS/EPS SERVICING PANEL
PART NUMBER: 40V63MD142

CAUSES: CONTAMINATION, CORROSION, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
IF THE REDUNDANT CAP FOR THE DISCONNECT FAILS, DEPLETION OF FREON FROM ONE COOLANT LOOP RESULTS. LOSS OF ALL REDUNDANCY TO CONTAIN FLUID IN ONE FREON COOLANT LOOP, RESULTS IN ENTRY BEING REQUIRED AT THE NEXT PRIMARY LANDING SITE.

REFERENCES:

REPORT DATE 11/24/87 C-66
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/16/87
SUBSYSTEM: ATCS
MDAC ID: 1056

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

ITEM: FLOW PROPORTIONING VALVE
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) FLOW PROPORTIONING VALVE
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63-B1, B2

CAUSES: CONTAMINATION, CORROSION, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL STRESS

EFFECTS/RATIONALE:
DURING A DEPLETION OF FREON FROM ONE COOLANT LOOP, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE TO THE REDUNDANT LOOP RESULTS IN LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER. EFFECTS OF FREON LEAKING INTO THE MIDBODY ARE UNKNOWN; HOWEVER, IT IS TO HAVE NO IMPACT ON ORBITER PERFORMANCE.

REFERENCES:

REPORT DATE 11/24/87
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/16/87
SUBSYSTEM: ATCS
MDAC ID: 1057
HIGHEST CRITICALITY HDW/FUNC

ITEM: FLOW PROPORTIONING VALVE
FAILURE MODE: FAILS IN INTERMEDIATE POSITION, RESTRICTED FLOW

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) FLOW PROPORTIONING VALVE

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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63-B1, B2

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS

EFFECTS/RATIONALE:
RESTRICTED FLOW WITHIN THE FLOW PROPORTIONING VALVE REDUCES THE COOLING CAPABILITY FOR ONE FREON COOLANT LOOP. FOR LOSS OF ONE FREON LOOP, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. IF BOTH FREON COOLANT LOOPS FAIL, CREW AND VEHICLE WOULD BE LOST, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87 C-68
INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/16/87   HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS   FLIGHT: 3/2R
MDAC ID: 1058   ABORT: 3/2R

ITEM: FLOW PROPORTIONING VALVE   FAILURE MODE: FAILS IN THE PAYLOAD OR INTERCHANGER POSITION
LEAD ANALYST: W.E. PARKMAN   SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) FLOW PROPORTIONING VALVE
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63-B1, B2

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
THERE IS AN INABILITY TO MAINTAIN TEMPERATURES IN THE ARS WATER LOOP OR PAYLOAD ATCS WATER LOOP BY CONTROLLING FLOW THROUGH THE RESPECTIVE HEAT EXCHANGER. HOWEVER, TEMPERATURES MAY BE CONTROLLED IN THE ARS LOOPS BY VARYING COMPONENT LOADS. IF THE PAYLOAD REQUIRES THE FLOW CONTROL VALVES FOR BOTH LOOPS TO BE IN THE PAYLOAD POSITION, MISSION OBJECTIVE MAY BE LOST.

REFERENCES:

REPORT DATE 11/24/87  C-69
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/16/87
SUBSYSTEM: ATCS
MDAC ID: 1059

HIGHEST CRITICALITY

FLIGHT: 3/3
ABORT: 3/3

ITEM: ACTUATOR (FLOW PROPORTIONING VALVE)
FAILURE MODE: FAILS TO START

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) FLOW PROPORTIONING VALVE
4) ACTUATOR
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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63-B1, B2

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS

EFFECTS/RATIONALE:
THERE IS AN INABILITY TO MAINTAIN TEMPERATURES IN THE ARS WATER LOOP OR PAYLOAD ATCS WATER LOOP BY CONTROLLING FLOW THROUGH THE RESPECTIVE HEAT EXCHANGER. TEMPERATURES MAY BE CONTROLLED IN THE ARS LOOP BY VARYING COMPONENT LOADS. IF THE PAYLOAD REQUIRES THE FLOW CONTROL VALVES TO BE IN THE PAYLOAD POSITION, MISSION OBJECTIVE MAY BE LOST.

REFERENCES:

REPORT DATE 11/24/87 C-70
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/16/87
SUBSYSTEM: ATCS
MDAC ID: 1060

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

ITEM: MIDBODY COLDPLATES
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) MID-BODY COLDPLATES
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63HX2, HX3, HX4, HX5, HX6

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL STRESS

EFFECTS/RATIONALE:
DURING THE DEPLETION OF FREON FROM ONE COOLANT LOOP, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE IN THE REDUNDANT LOOP RESULTS IN LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE REMOVED FROM THE ORBITER. EFFECTS OF FREON LEAKING INTO THE MIDBODY ARE UNKNOWN; HOWEVER, IT IS EXPECTED TO HAVE NO IMPACT ON ORBITER PERFORMANCE.

REFERENCES:

REPORT DATE 11/24/87 C-71
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/16/87
SUBSYSTEM: ATCS
MDAC ID: 1061

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

ITEM: MIDBODY COLDPLATES
FAILURE MODE: INTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) MIDBODY COLDPLATES
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LOCATION: MIDBODY
PART NUMBER: 40V63HX2, HX3, HX4, HX5, HX6

CAUSES: CORROSION, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL STRESS

EFFECTS/RATIONALE:
FOR A FREON-TO-FREON LEAK, TWO COOLANT LOOPS WILL CONTINUE TO FUNCTION AS ONE. DUE TO THE INTERLOOP LEAK, ENTRY IS REQUIRED THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE (I.E.-EXTERNAL LEAKAGE) OF THE LOOPS LEADS TO LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87 C-72
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/16/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 2/1R
MDAC ID: 1062  ABORT: 2/1R

ITEM: MIDBODY COLDPLATES
FAILURE MODE: RESTRICTED FLOW

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) MIDBODY COLDPLATES
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63HX2, HX3, HX4, HX5, HX6

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
RESTRICTED FLOW WITHIN THE COLDPLATES REDUCES THE COOLING
CAPABILITY TO THE COLDPLATES FROM ONE FREON COOLANT LOOP. THUS,
ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. HOWEVER, FOR
LOSS OF BOTH FREON COOLANT LOOPS, CREW AND VEHICLE WILL BE
LOST, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87  C-73
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/16/87
SUBSYSTEM: ATCS
MDAC ID: 1063

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

ITEM: ORIFICE (AFT AVIONICS COLDPLATES)
FAILURE MODE: RESTRICTED FLOW

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) AFT AVIONICS COLDPLATES
4) ORIFICE

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LOCATION: AFT FUSELAGE

PART NUMBER:

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
RESTRICTED FLOW PRECEDING THE COLDPLATES REDUCES THE COOLING CAPABILITY TO THE COLDPLATES FROM ONE FREON COOLANT LOOP. FOR LOSS OF ONE FREON LOOP, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. FOR LOSS OF BOTH FREON COOLANT LOOPS, CREW AND VEHICLE WOULD BE LOST, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87   C-74
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/16/87  
SUBSYSTEM: ATCS  
MDAC ID: 1064  
HIGHEST CRITICALITY HDW/FUNC  
FLIGHT: 3/3  
ABORT: 3/3

ITEM: AFT COLDPLATE NETWORK FLOWRATE SENSOR  
FAILURE MODE: ERRONEOUS OUTPUT, FAILS OFF-SCALE (HIGH/LOW)

LEAD ANALYST: W.E. PARKMAN  
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM  
2) FREON COOLANT LOOP  
3) AFT AVIONICS COLDPLATES  
4) FLOW RATE TRANSDUCER
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REDUNDANCY SCREENS:  A [ ]  B [ ]  C [ ]

LOCATION: AFT FUSELAGE  
PART NUMBER: 50V63MT13

CAUSES: MECHANICAL SHOCK, VIBRATION, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS

EFFECTS/RATIONALE:
A FAILED SENSOR RESULTS IN LOSS OF FLOWRATE DATA FOR FREON ENTERING THE AFT AVIONICS COLDPLATES. HOWEVER, REDUNDANT PARALLEL SENSORS PROVIDE DATA WHICH COMPENSATES FOR THE FAILED SENSOR.

REFERENCES:

REPORT DATE 11/24/87  
C-75
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/16/87
SUBSYSTEM: ATCS
MDAC ID: 1065

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

ITEM: AFT AVIONICS COLDPLATES
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) AFT AVIONICS COLDPLATES

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LOCATION: AFT FUSELAGE
PART NUMBER: 50V63HX4, HX5, HX6

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL STRESS

EFFECTS/RATIONALE:
IF DEPLETION OF FREON OCCURS FROM ONE COOLANT LOOP, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE TO THE REDUNDANT LOOP RESULTS IN LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87  C-76
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/16/87
SUBSYSTEM: ATCS
MDAC ID: 1066

ITEM: AFT AVIONICS COLDPLATES
FAILURE MODE: INTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) AFT AVIONICS COLDPLATES
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LOCATION: AFT FUSELAGE
PART NUMBER: 50V63HX4, HX5, HX6

CAUSES: CORROSION, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
DURING A FREON-TO-FREON LEAK, TWO LOOPS WILL CONTINUE TO FUNCTION AS ONE. DUE TO THIS INTERLOOP FREON LEAK, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE (i.e. - EXTERNAL LEAKAGE) ASSOCIATED WITH THE LOOPS LEADS TO LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87 C-77
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/16/87
SUBSYSTEM: ATCS
MDAC ID: 1067

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

ITEM: AFT AVIONICS COLDPLATES
FAILURE MODE: RESTRICTED FLOW

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) AFT AVIONICS COLDPLATES
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LOCATION: AFT FUSELAGE
PART NUMBER: 50V63HX4, HX5, HX6

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
RESTRICTED FLOW WITHIN THE COMPONENT REDUCES THE CAPABILITY TO COOL THE AFT AVIONICS COLDPLATES. THIS LOSS OF COLDPLATE COOLING REQUIRES ONLY AT THE NEXT PRIMARY LANDING SITE. FOR LOSS OF BOTH FREON COOLANT LOOPS, CREW AND VEHICLE WOULD BE LOST, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87 C-78
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/16/87                                      HIGHEST CRITICALITY                     HDW/FUNC
SUBSYSTEM: ATCS                                     FLIGHT: 3/3
MDAC ID: 1068                                       ABORT: 3/3

ITEM: ORIFICE (RGA COLDPLATES)                     FAILURE MODE: RESTRICTED FLOW

LEAD ANALYST: W.E. PARKMAN                         SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) RGA COLDPLATES
4) ORIFICE

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: MIDBODY

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
BLOCKAGE WITHIN THE SYSTEM INHIBITS ADEQUATE FLOW TO EFFECTIVELY COOL COLDPLATES ASSOCIATED WITH THIS SECTION OF THE FREON COOLANT LOOP.

REFERENCES:

REPORT DATE 11/24/87  C-79
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/16/87
SUBSYSTEM: ATCS
MDAC ID: 1069

HIGHEST CRITICALITY
HDW/FUNC

FLIGHT: 2/1R
ABORT: 2/1R

ITEM: RGA COLDPLATES
FAILURE MODE: INTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) RGA COLDPLATES
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63HX7, HX8, HX9, HX10

CAUSES: CORROSION, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
FOR A FREON-TO-FREON LEAK, TWO COOLANT LOOPS WILL CONTINUE TO FUNCTION AS ONE. DUE TO THE INTERLOOP FREON LEAK, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE (i.e. - EXTERNAL LEAKAGE) ASSOCIATED WITH THE LOOPS LEADS TO LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87   C-80
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/16/87
SUBSYSTEM: ATCS
MDAC ID: 1070

ITEM: RGA COLDPLATES
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) RGA COLDPLATES
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63HX7, HX8, HX9, HX10

CAUSES: CORROSION, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL STRESS

EFFECTS/RATIONALE:
FOR DEPLETION OF FREON FROM ONE COOLANT LOOP, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE TO THE REDUNDANT LOOP RESULTS IN LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87 C-81
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/16/87
SUBSYSTEM: ATCS
MDAC ID: 1071

ITEM: RGA COLDPLATES
FAILURE MODE: RESTRICTED FLOW

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) RGA COLDPLATES
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63HX7, HX8, HX9, HX10

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
BLOCKAGE WITHIN THE SYSTEM INHIBITS ADEQUATE FLOW TO EFFECTIVELY COOL COLDPLATES ASSOCIATED WITH THIS SECTION OF THE FREON COOLANT LOOP. LOSS OF COLDPLATE COOLING REQUIRES AN ENTRY AT THE NEXT PRIMARY LANDING SITE. FOR LOSS OF BOTH COLDPLATES COOLED BY BOTH FREON COOLANT LOOPS, CREW AND VEHICLE WOULD BE LOST.

REFERENCES:

REPORT DATE 11/24/87 C-82
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/31/87  
SUBSYSTEM: ATCS  
MDAC ID: 1072  

HIGHEST CRITICALITY  
FLIGHT: 2/IR  
ABORT: 2/IR

ITEM: FREON LOOP LINES AND FITTINGS  
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN  
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
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LOCATION:  
PART NUMBER:

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, VIBRATION

EFFECTS/RATIONALE:
DURING DEPLETION OF FREON FROM ONE COOLANT LOOP, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE TO THE REDUNDANT LOOP RESULTS IN LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87  C-83
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/26/87
SUBSYSTEM: ATCS
MDAC ID: 1073

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

ITEM: CIRCUIT BREAKERS (FREON PUMP)
FAILURE MODE: OPEN (ELECTRICAL)

LEAD ANALYST: W.E. PARKMAN SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FREON PUMPS A(B)
4) PANEL L4
5) CIRCUIT BREAKERS

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLIGHT DECK, AREA 30
PART NUMBER: 31V73A4 - CB19-27, CB39-41

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
SAID FREON PUMP CAN BE STARTED AND OPERATED IN A DEGRADED MODE ON THE TWO REMAINING PHASES. FOR LOSS OF ALL REDUNDANCY TO POWER THE PUMP MOTOR, FLOW IN THE FREON COOLANT LOOP WILL BE PROVIDED BY THE REDUNDANT PUMP.

REFERENCES:

REPORT DATE 11/24/87 C-84
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/26/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/2R
MDAC ID: 1074  ABORT: 3/2R

ITEM: SWITCH (FREON PUMPS)  FAILURE MODE: FAILS TO REMAIN IN PUMP "A" POSITION

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EP&D&C
3) FREON PUMPS A (B)
4) PANEL L4
5) PANEL L1A2 (SWITCH)

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LOCATION: FLIGHT DECK
PART NUMBER: 31V73A1A2 - S23, S24

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
THERE IS AN INABILITY TO SUPPLY POWER TO ONE FREON PUMP MOTOR. IF THE REDUNDANT PUMP FAILS, FREON CANNOT BE CIRCULATED. LOSS OF A FREON COOLANT LOOP, RESULTS IN THE REQUIRED ENTRY BEING AT NEXT PRIMARY LANDING SITE.

REFERENCES:

REPORT DATE 11/24/87  C-85
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/26/87
SUBSYSTEM: ATCS
MDAC ID: 1075

HIGHEST CRITICALITY
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: SWITCH (FREON PUMPS)
FAILURE MODE: FAILS TO REMAIN IN PUMP "B" POSITION

LEAD ANALYST: W. E. PARKMAN

SUBSYS LEAD: W. E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FREON PUMPS A (B)
4) PANEL L4
5) PANEL L1A2 (SWITCH)

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LOCATION: FLIGHT DECK
PART NUMBER: 31V73A1A2-S23, S24

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
FREON PUMP MOTOR CANNOT BE MANUALLY COMMANDED "ON". IF PUMPS A OR B CANNOT BE COMMANDED ON USING THE SWITCH OR GPC, ONE FREON COOLANT LOOP IS LOST. FOR LOSS OF SAID COOLANT LOOP, ENTRY IS REQUIRED AT NEXT PRIMARY LANDING SITE.

REFERENCES:
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/26/87
SUBSYSTEM: ATCS
MDAC ID: 1076

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

ITEM: SWITCH (FREON PUMPS)
FAILURE MODE: FAILS IN PUMP "OFF" POSITION

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FREON PUMPS A (B)
4) PANEL L4
5) PANEL L1A2 (SWITCH)
6)
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CRITICALITIES

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LOCATION: FLIGHT DECK
PART NUMBER: 31V73A1A2 - S23, S24

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
IF LOSS OF BOTH PUMPS IN ONE FREON COOLANT LOOP OCCURS, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE TO THE REDUNDANT LOOP RESULTS IN LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87 C-87
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/26/87

HIGHEST CRITICALITY

FLIGHT: 3/3
ABORT: 3/3

MDAC ID: 1077

ITEM: RESISTOR (FREON PUMPS)

FAILURE MODE: OPEN (ELECTRICAL)

LEAD ANALYST: W.E. PARKMAN

SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FREON PUMPS A (B)
4) PANEL L4
5) PANEL L1A2
6) RESISTOR

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8)
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLIGHT DECK

PART NUMBER: 31V73A1A2 - A2R19, A2R21, A2R23, A2R25

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
THE STATUS OF FREON PUMP SWITCH POSITION IS LOST. HOWEVER, SYSTEM SENSORS PROVIDE DATA WHICH COMPENSATES FOR THE FAILED RESISTOR.

REFERENCES: 
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/26/87
SUBSYSTEM: ATCS
MDAC ID: 1078

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

ITEM: RESISTOR (FREON PUMPS)
FAILURE MODE: SHORTED

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FREON PUMPS A (B)
4) PANEL L4
5) PANEL L1A2 (S23)
6) RESISTOR
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLIGHT DECK
PART NUMBER: 31V73A1A2

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
THE STATUS OF FREON PUMP SWITCH POSITION IS LOST. HOWEVER, SYSTEM SENSORS PROVIDE DATA WHICH COMPENSATES FOR THE FAILED RESISTOR.

REFERENCES:

REPORT DATE 11/24/87 C-89
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/26/87
SUBSYSTEM: ATCS
MDAC ID: 1079

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: MDM BLOCKING DIODE (FREON PUMPS)
FAILURE MODE: OPEN (ELECTRICAL)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FREON PUMP B
4) FCLA
5) DIODE (3A)

CRITICALITIES

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LOCATION:
PART NUMBER: 81V76A16-CR; 82V76A17-CR

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
GPC IS UNABLE TO CONTROL PUMP B FOR ONE FREON LOOP BASED ON MAIN BUS A VOLTAGE. IF BOTH PUMPS A AND B CANNOT BE STARTED, ONE FREON COOLANT LOOP IS LOST. FOR LOSS OF A COOLANT LOOP, ENTRY IS REQUIRED AT NEXT PRIMARY LANDING SITE.

REFERENCES:

REPORT DATE 11/24/87 C-90
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/26/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/2R
MDAC ID: 1080  ABORT: 3/2R

ITEM: MDM BLOCKING DIODE (FREON PUMPS)
FAILURE MODE: SHORTED

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FREON PUMP B
4) FCLA
5) DIODE (3A)
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LOCATION:
PART NUMBER: 81V76A16-CR; 82V76A17-CR

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
The GPC CIRCUIT COULD BE DAMAGED DUE TO REVERSE CURRENT APPLIED DURING GROUND TURNAROUND. GPC IS UNABLE TO CONTROL PUMP B FOR ONE FREON LOOP BASED ON MAIN BUS A VOLTAGE. IF BOTH PUMPS A AND B CANNOT BE STARTED, ONE FREON COOLANT LOOP IS LOST. FOR LOSS OF A COOLANT LOOP, ENTRY IS REQUIRED AT NEXT PRIMARY LANDING SITE.

REFERENCES:

REPORT DATE 11/24/87  C-91
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/26/87
SUBSYSTEM: ATCS
MDAC ID: 1081

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: HYBRID DRIVER (FREON PUMPS)
FAILURE MODE: OPEN (ELECTRICAL), FAILS "OFF"

LEAD ANALYST: W. E. PARKMAN
SUBSYS LEAD: W. E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FREON PUMP B
4) FCLA
5) HYBRID DRIVER-TYPE 1
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CRITICALITIES

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LOCATION:
PART NUMBER: 81V76A16-AR; 82V76A17-AR

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
GPC IS UNABLE TO CONTROL PUMP B FOR ONE FREON LOOP BASED ON MAIN BUS A VOLTAGE. IF BOTH PUMPS A AND B CANNOT BE STARTED, ONE FREON COOLANT LOOP IS LOST. FOR LOSS OF A COOLANT LOOP, ENTRY IS REQUIRED AT NEXT PRIMARY LANDING SITE.

REFERENCES:

REPORT DATE 11/24/87 C-92
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/26/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/2R
MDAC ID: 1082  ABORT: 3/2R

ITEM: HYBRID DRIVER (FREON PUMPS)
FAILURE MODE: SHORTED, FAILS "ON"

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FREON PUMP B
4) FCLA
5) HYBRID DRIVER-TYPE 1
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LOCATION:
PART NUMBER: 81V76A16-AR; 82V76A17-AR

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
GPC IS UNABLE TO CONTROL PUMP B BASED ON MAIN BUS A VOLTAGE. IF BOTH PUMPS A AND B CANNOT BE STARTED, ONE FREON COOLANT LOOP IS LOST. FOR LOSS OF A COOLANT LOOP, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE.

REFERENCES:

REPORT DATE 11/24/87  C-93
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/26/87
SUBSYSTEM: ATCS
MDAC ID: 1083

ITEM: RELAY SOLENOID (FREON PUMPS)
FAILURE MODE: FAILS TO REMAIN CLOSED

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FREON PUMP B
4) MMCA
5) RELAY SOLENOID

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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V76A117-K76; 40V76118-K2

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
GPC IS UNABLE TO CONTROL PUMP B FOR ONE FREON LOOP BASED ON MAIN BUS A VOLTAGE. IF BOTH PUMPS A AND B CANNOT BE STARTED, ONE FREON COOLANT LOOP IS LOST. FOR LOSS OF A COOLANT LOOP, ENTRY IS REQUIRED AT NEXT PRIMARY LANDING SITE.

REFERENCES:

REPORT DATE 11/24/87  C-94
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/26/87  HIGHEST CRITICALITY
SUBSYSTEM: ATCS  HDW/FUNC
MDAC ID: 1084  FLIGHT: 3/3

ITEM: RELAY SOLENOID (FREON PUMPS)
FAILURE MODE: FAILS TO REMAIN OPEN

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FREON PUMP B
4) MMCA
5) RELAY SOLENOID

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REDUNDANCY SCREENS:  A [ ]  B [ ]  C [ ]

LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V76A117-K76; 40V76118-K2

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
INADVERTANT VOLTAGE IS APPLIED TO FREON PUMP B. HOWEVER, POWER MAY BE REMOVED BY OPENING CIRCUIT BREAKERS.

REFERENCES:

REPORT DATE 11/24/87  C-95
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87
SUBSYSTEM: ATCS
MDAC ID: 1085

ITEM: CIRCUIT BREAKER (FREON FLOW PROPORTIONING)
FAILURE MODE: OPEN (ELECTRICAL)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FLOW PROPORTIONING MODULE
4) PANEL L4
5) CIRCUIT BREAKER

CRITICALITIES

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LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A4-C42, CB45

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
IF A CIRCUIT BREAKER FAILS WITH FLOW PROPORTIONING VALVE IN MID-TRAVEL, ONE FREON COOLANT LOOP WILL BE LOST DUE TO BLOCKAGE. FOR NO FLOW IN A FREON LOOP, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE IN THE REDUNDANT LOOP LEADS TO LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87 C-96
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT:  2/1R
MDAC ID: 1086  ABORT:  2/1R

ITEM: SWITCH (FLOW PROPORTIONING VALVE)
FAILURE MODE: FAILS WITH VALVE IN MID-TRAVEL POSITION

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FLOW PROPORTIONING MODULE
4) SWITCH
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LOCATION:  FLIGHT DECK-AREA 30
PART NUMBER:  31V73A1A2-S21, S22

CAUSES:  CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL
FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
IF A CIRCUIT BREAKER FAILS WITH FLOW PROPORTIONING VALVE IN MID-
TRAVEL, ONE FREON COOLANT LOOP WILL BE LOST DUE TO BLOCKAGE. FOR
NO FLOW IN A FREON LOOP, ENTRY IS REQUIRED AT THE NEXT PRIMARY
LANDING SITE. A SECOND FAILURE IN THE REDUNDANT LOOP LEADS
TO LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED
FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87  C-97
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87
SUBSYSTEM: ATCS
MDAC ID: 1087

HIGHEST CRITICALITY

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LEAD ANALYST: W.E. PARKMAN

SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FLOW PROPORTIONING MODULE
4) SWITCH
5)
6)
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9)

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LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-S21, S22

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
INABILITY TO MAINTAIN TEMPERATURES IN THE ARS WATER LOOP OR PAYLOAD ATCS WATER LOOP BY CONTROLLING FLOW THROUGH THE RESPECTIVE HEAT EXCHANGER. HOWEVER, TEMPERATURES MAY BE CONTROLLED BY VARYING COMPONENT LOADS IN THE ASSOCIATED LOOPS. IF THE PAYLOAD REQUIRES THE FLOW CONTROL VALVES FOR BOTH LOOPS TO BE IN THE PAYLOAD POSITION, MISSION OBJECTIVE MAY BE LOST.

REFERENCES:

REPORT DATE 11/24/87 C-98
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87
SUBSYSTEM: ATCS
MDAC ID: 1088

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

ITEM: SWITCH 21 (FLOW PROPORTIONING VALVE)
FAILURE MODE: FAILS TO SWITCH FROM "PAYLOAD HX" POSITION

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FLOW PROPORTIONING MODULE
4) SWITCH
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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-S21, S22

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
INABILITY TO MAINTAIN TEMPERATURES IN THE ARS WATER LOOP OR PAYLOAD ATCS WATER LOOP BY CONTROLLING FLOW THROUGH THE RESPECTIVE HEAT EXCHANGER. HOWEVER, TEMPERATURES MAY BE CONTROLLED BY VARYING COMPONENT LOADS IN THE ASSOCIATED LOOPS.

REFERENCES:

REPORT DATE 11/24/87  C-99
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87                        HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS                      FLIGHT:  2/1R
MDAC ID: 1089                        ABORT:  2/1R

ITEM: SIGNAL CONDITIONER (ATCS OF1)
FAILUR MODE: ERRONEOUS OUTPUT, LOSS OF OUTPUT

LEAD ANALYST: W.E. PARKMAN           SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FLOW PROPORTIONING MODULE
4) SIGNAL CONDITIONER
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63A12

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
ERRONEOUS OUTPUT FROM THE SIGNAL CONDITIONER COULD CAUSE VALVE TO FAIL IN INTERMEDIATE POSITION AND RESTRICT THE FLOW OF ONE FREON COOLANT LOOP. DUE TO VALVE BLOCKAGE. ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE IN THE REDUNDANT LOOP LEADS TO LOSS OF CREW AND VEHICLE.

REFERENCES:

REPORT DATE 11/24/87 C-100
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87
SUBSYSTEM: ATCS
MDAC ID: 1090

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BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FLOW PROPORTIONING MODULE
4) RESISTOR
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CRITICALITIES

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-A2R17, A2R20

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
POWER CANNOT BE SUPPLIED TO POSITION INDICATOR OR MDM FOR THE FLOW PROPORTIONING MODULE. THE DOWNSTREAM FREON SENSORS INDICATE VALVE POSITION.

REFERENCES:

REPORT DATE 11/24/87 C-101
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87
SUBSYSTEM: ATCS
MDAC ID: 1091

HIGHEST CRITICALITY
FLIGHT: 3/3
ABORT: 3/3

ITEM: RESISTOR (FLOW PROPORTIONING VALVE)
FAILURE MODE: SHORTED

LEAD ANALYST: W. E. PARKMAN
SUBSYS LEAD: W. E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FLOW PROPORTIONING MODULE
4) RESISTOR
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLIGHT DECK—AREA 30
PART NUMBER: 31V73A1A2−A2R17, A2R20

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
AN OVERCURRENT WOULD DAMAGE THE CIRCUIT, WHICH WOULD REMOVE POWER FROM POSITION INDICATOR OR MDM. THE DOWNSTREAM FREON SENSOR INDICATE VALVE POSITION.

REFERENCES:

REPORT DATE 11/24/87 C-102
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87
SUBSYSTEM: ATCS
MDAC ID: 1092

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

ITEM: BLOCKING DIODE (INTERCHANGER)
FAILURE MODE: OPEN (ELECTRICAL)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FLOW PROPORTIONING MODULE
4) BLOCKING DIODE (INTERCHANGER)
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CRITICALITIES

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-A2CR1. A2CR3

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
POWER CANNOT BE SUPPLIED TO FEEDBACK INDICATOR FOR THE FLOW PROPORTIONING MODULE IN THE INTERCHANGER POSITION. THE DOWNSTREAM FREON SENSORS INDICATE VALVE POSITION.

REFERENCES:

REPORT DATE 11/24/87 C-103
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/3
MDAC ID: 1093  ABORT: 3/3

ITEM: BLOCKING DIODE (INTERCHANGER)
FAILURE MODE: SHORTED

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EP&D&C
3) FLOW PROPORTIONING MODULE
4) BLOCKING DIODE (INTERCHANGER)
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CRITICALITIES

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-A2CR1, A2CR3

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
POWER CANNOT BE SUPPLIED TO FEEDBACK INDICATOR FOR THE FLOW PROPORTIONING MODULE IN THE INTERCHANGER POSITION. THE DOWNSTREAM FREON SENSORS INDICATE VALVE POSITION.

REFERENCES:

REPORT DATE 11/24/87  C-104
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/3
MDAC ID: 1094  ABORT: 3/3

ITEM: BLOCKING DIODE (PAYLOAD HX)
FAILURE MODE: OPEN (ELECTRICAL)

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FLOW PROPORTIONING MODULE
4) BLOCKING DIODE (PAYLOAD HX)
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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-A2CR2, A2CR4

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
POWER CANNOT BE SUPPLIED TO FEEDBACK INDICATOR FOR THE FLOW PROPORTIONING MODULE IN THE PAYLOAD HEAT EXCHANGER POSITION. THE DOWNSTREAM FREON SENSORS INDICATE VALVE POSITION.

REFERENCES:

REPORT DATE 11/24/87  C-105
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87
SUBSYSTEM: ATCS
MDAC ID: 1095

HDW/FUNC

HIGHEST CRITICALITY

FLIGHT: 3/3
ABORT: 3/3

ITEM: BLOCKING DIODE (PAYLOAD HX)
FAILURE MODE: SHORTED

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FLOW PROPORTIONING MODULE
4) BLOCKING DIODE (PAYLOAD HX)
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-A2CR2, A2CR4

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
POWER CANNOT BE SUPPLIED TO FEEDBACK INDICATOR FOR THE FLOW PROPORTIONING MODULE IN THE PAYLOAD HEAT EXCHANGER POSITION. THE DOWNSTREAM FREON SENSORS INDICATE VALVE POSITION.

REFERENCES:

REPORT DATE 11/24/87 C-106
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/3
MDAC ID: 1096  ABORT: 3/3

ITEM: INDICATOR (FLOW PROPORTIONING VALVE)
FAILURE MODE: FAILS TO SWITCH FROM "INTERCHANGER" POSITION

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FLOW PROPORTIONING MODULE
4) INDICATOR
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REDUNDANCY SCREENS:  A [ ]  B [ ]  C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-DS1, DS2

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL
FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:  DATA FROM MDM WILL INDICATE CORRECT POSITION OF THE FLOW
PROPORTIONING VALVE, REGARDLESS OF INDICATOR POSITION.

REFERENCES:

REPORT DATE 11/24/87  C-107
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87

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

ITEM: INDICATOR (FLOW PROPORTIONING VALVE)
FAILURE MODE: FAILS TO SWITCH FROM "PAYLOAD HX" POSITION

LEAD ANALYST: W.E. PARKMAN SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FLOW PROPORTIONING MODULE
4) INDICATOR

CRITICALITIES

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-DS1, DS2

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
DATA FROM MDM WILL INDICATE POSITION OF THE FLOW PROPORTIONING VALVE, REGARDLESS OF INDICATOR POSITION.

REFERENCES:

REPORT DATE 11/24/87 C-108
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87
SUBSYSTEM: ATCS
MDAC ID: 1098

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

ITEM: INDICATOR (FLOW PROPORTIONING VALVE)
FAILURE MODE: FAILS TO SWITCH FROM INTERMEDIATE POSITION

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) FLOW PROPORTIONING MODULE
4) INDICATOR
5) 
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-DS1, DS2

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
DATA FROM MDM WILL INDICATE STATUS OF THE PROPORTIONING VALVE, REGARDLESS OF INDICATOR POSITION.

REFERENCES:

REPORT DATE 11/24/87 C-109
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 1099

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

ITEM: CIRCUIT BREAKER (FREON SIGNAL CONDITIONER)
FAILURE MODE: FAILS TO OPEN

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) INSTRUMENTATION
4) PANEL L4
5) CIRCUIT BREAKER (FREON SIGNAL CONDITIONER)

CRITICALITIES

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A4-CB43, CB46

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
AN ELECTRICAL SURGE COULD REMOVE POWER FROM ONE OF THE ATCS OFI SIGNAL CONDITIONER SECTIONS. LOSS OF A REDUNDANT SIGNAL CONDITIONER SECTION LEADS TO LOSS OF MOST FREON COOLANT LOOP SENSORS. CONDITION OF FREON CAN BE MONITORED WITHOUT THE USE OF EITHER SECTION OF THE ATCS SIGNAL CONDITIONER.

REFERENCES:

REPORT DATE 11/24/87 C-110
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 1100

ITEM: CIRCUIT BREAKER (FREON SIGNAL CONDITIONER)
FAILURE MODE: FAILS TO REMAIN CLOSED

LEAD ANALYST: W. E. PARKMAN
SUBSYS LEAD: W. E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) INSTRUMENTATION
4) PANEL L4
5) CIRCUIT BREAKER (FREON SIGNAL CONDITIONER)
6)
7)
8)
9)

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A4-CB43, CB46

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
THERE IS AN INABILITY TO SUPPLY POWER FROM ONE OF THE ATCS OFI SIGNAL CONDITIONER SECTIONS. FAILURE OF REDUNDANT SIGNAL CONDITIONER SECTION LEADS TO LOSS OF NINE FREON COOLANT SENSORS. THE FREON COOLANT LOOP CAN BE MONITORED WITHOUT EITHER SECTION OF THE ATCS SIGNAL CONDITIONER.

REFERENCES:

REPORT DATE 11/24/87 C-111
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87  HIGHEST CRITICALITY FLIGHT: 3/3
SUBSYSTEM: ATCS  HDW/FUNC  ABORT: 3/3
MDAC ID: 1101

ITEM: SWITCH 10 (FREON SIGNAL CONDITIONER)
FAILURE MODE: FAILS TO SWITCH FROM "OFF" POSITION

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) INSTRUMENTATION
4) PANEL 017
5) SWITCH 10 (FREON SIGNAL CONDITIONER)
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CRITICALITIES

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 33V73A17-S10, S11

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
THERE IS A LOSS OF SENSOR DATA FOR: FCL 1 PAYLOAD HX FLOW RATE; FCL 1 PUMP INLET PRESSURE; FCL 1 INTERCHANGER INLET TEMP (NOT REDUNDANT); FCL 2 ACCUMULATOR QUANTITY; AND FCL 2 INTCHGR FLOW RATE. LOSS OF REDUNDANT SIGNAL CONDITIONER LEADS TO LOSS OF SEVERAL FREON COOLANT SENSORS. FREON COOLANT LOOP CAN BE MONITORED WITHOUT EITHER SECTION OF THE ATCS SIGNAL CONDITIONER.

REFERENCES:

REPORT DATE 11/24/87  C-112
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87

SUBSYSTEM: ATCS

MDAC ID: 1102

HIGHEST CRITICALITY HDW/FUNC

FLIGHT: 3/3
ABORT: 3/3

ITEM: SWITCH 10 (FREON SIGNAL CONDITIONER)

FAILURE MODE: FAILS TO SWITCH FROM "A" POSITION

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) INSTRUMENTATION
4) PANEL 017
5) SWITCH 10 (FREON SIGNAL CONDITIONER)
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLIGHT DECK-AREA 30

PART NUMBER: 33V73A17-S10, S11

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL
FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
ATCS SIGNAL CONDITIONER (SECTION 1) CAN ONLY BE POWERED BY AC2
PHASE B. IF ALL REDUNDANCY TO OPERATE ONE SECTION OF THE SIGNAL
CONDITIONER FAILS, THEN SECOND SECTION OF CONDITIONER WILL
PROVIDE FREON COOLANT MEASUREMENTS.

REFERENCES:

REPORT DATE 11/24/87 C-113
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 1103

ITEM: SWITCH 10 (FREON SIGNAL CONDITIONER)
FAILURE MODE: FAILS TO SWITCH FROM "B" POSITION

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) INSTRUMENTATION
4) PANEL 017
5) SWITCH 10 (FREON SIGNAL CONDITIONER)

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 33V73A17-S10, S11

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
ATCS SIGNAL CONDITIONER (SECTION 1) CAN ONLY BE POWERED BY AC2 PHASE B. IF ALL REDUNDANCY TO OPERATE ONE SECTION OF THE SIGNAL CONDITIONER FAILS, THEN SECOND SECTION OF CONDITIONER WILL PROVIDE FREON COOLANT MEASUREMENTS.

REFERENCES:

REPORT DATE 11/24/87 C-114
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/19/87
SUBSYSTEM: ATCS
MDAC ID: 1104

HIGHEST CRITICALITY
FLIGHT: 3/3
ABORT: 3/3

ITEM: SWITCH 4 (FREON)
FAILURE MODE: FAILS TO SWITCH FROM LOOP 1 (2)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) INSTRUMENTATION
4) PANEL 01
5) SWITCH 4 (FREON)
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION:
PART NUMBER: 33V73A1-S4

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
INABILITY TO SWITCH FROM LOOP 1 (2) FREON FLOW RATE AND FLASH EVAPORATOR OUTLET TEMPERATURE TRANSDECER SIGNALS TO LOOP 2 (1) SIGNALS. HOWEVER, SYSTEM SENSORS PROVIDE DATA WHICH COMPENSATES FOR THE FAILED SWITCH.

REFERENCES:

REPORT DATE 11/24/87  C-115
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 1105

HIGHEST CRITICALITY
HDW/FUNC

FLIGHT: 3/3
ABORT: 3/3

ITEM: FREON FLOW VOLTMETER
FAILURE MODE: OPEN (ELECTRICAL), SHORTS

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) INSTRUMENTATION
4) PANEL 01
5) FREON FLOW VOLTMETER
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 33V73A1

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL
FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
THERE IS A LOSS OF INDICATION FOR LOOP 1 AND 2 FREON FLOW RATES.
SYSTEM SENSORS PROVIDE DATA WHICH COMPENSATES FOR THE FAILED
VOLTMETER.

REFERENCES:

REPORT DATE 11/24/87 C-116
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/3
MDAC ID: 1106  ABORT: 3/3

ITEM: FREON EVAPORATOR OUTLET TEMPERATURE VOLTMETER
FAILURE MODE: OPEN (ELECTRICAL), SHORTED

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) INSTRUMENTATION
4) PANEL 01
5) FREON EVAPORATOR OUTLET TEMPERATURE VOLTMETER

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 33V73A1

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
THERE IS A LOSS OF INDICATION FOR LOOP 1 AND 2 FLASH EVAPORATOR SYSTEM OUTLET TEMPERATURES. SYSTEM SENSORS PROVIDE DATA WHICH COMPENSATES FOR THE FAILED VOLTMETER.

REFERENCES:

REPORT DATE 11/24/87  C-117
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 1107

HIGHEST CRITICALITY

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ITEM: FREON C&W LIGHT
FAILURE MODE: FAILS TO SWITCH "ON" OR "OFF"

LEAD ANALYST: W. E. PARKMAN
SUBSYS LEAD: W. E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP EPD&C
3) INSTRUMENTATION
4) C&W ELECTRONICS
5) PANEL F7A2
6) C&W LIGHT
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLIGHT DECK

PART NUMBER:

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
THERE IS A FAILURE TO INDICATE FREON LOOP 1 OR 2 OUT OF LIMIT CONDITIONS. IF ALL CAUTION AND WARNING INDICATORS FOR THE FREON SYSTEM ARE LOST, INDICATORS FROM INTERFACING SYSTEMS WILL COMPENSATE FOR THE FAILURES.

REFERENCES:

REPORT DATE 11/24/87 C-118
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87

SUBSYSTEM: ATCS
MDAC ID: 2000

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

ITEM: INLET SELF-SEALING COUPLING
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY
3) INLET SELF-SEALING COUPLING
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63TP229A, TP229B

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL STRESS

EFFECTS/RATIONALE:
IF DEPLETION OF FREON FROM ONE COOLANT LOOP OCCURS, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE TO THE REDUNDANT LOOP RESULTS IN LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87 C-119
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 2/1R
MDAC ID: 2001  ABORT: 2/1R

ITEM: OUTLET SELF-SEALING COUPLING
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN   SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY
3) OUTLET SELF-SEALING COUPLING
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63TP231

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, MECHANICAL SHOCK

EFFECTS/RATIONALE:
IF DEPLETION OF FREON FROM ONE COOLANT LOOP OCCURS, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE TO THE REDUNDANT LOOP RESULTS IN THE LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87 C-120
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 2002

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

ITEM: FLEX HOSES, MANIFOLDS, TUBES
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY
3) FLEX HOSES, MANIFOLDS, TUBES
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LOCATION: MIDBODY

PART NUMBER:

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
IF DEPLETION OF FREON FROM ONE COOLANT LOOP OCCURS, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE TO THE REDUNDANT LOOP RESULTS IN LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87 C-121
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 2003

ITEM: FLOW CONTROL VALVE
FAILURE MODE: FAILS TO OPEN

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY
3) FLOW CONTROL ASSEMBLY
4) FLOW CONTROL VALVE
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63-A20, A23

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION, VIBRATION

EFFECTS/RATIONALE:
INABILITY TO COOL FREON BY THE RADIATOR RESULTS IN LOSS OF MISSION OBJECTIVE, AND LEADS TO A MINIMUM DURATION FLIGHT. FOR A SECOND FAILURE IN THE REDUNDANT LOOP THAT ELIMINATES VEHICLE COOLING, THE ORBITER MUST ENTER AT THE NEXT PRIMARY LANDING SITE.

REFERENCES:

REPORT DATE 11/24/87 C-122
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87

SUBSYSTEM: ATCS

MDAC ID: 2004

HIGHEST CRITICALITY HDW/FUNC

FLIGHT: 3/2R

ABORT: 3/2R

ITEM: FLOW CONTROL VALVE

FAILURE MODE: FAILS TO CLOSE, INTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN

SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:

1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY
3) FLOW CONTROL ASSEMBLY
4) FLOW CONTROL VALVE

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LOCATION: MIDBODY-AREA 30

PART NUMBER: 40V63-A20, A23

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION, MECHANICAL SHOCK

EFFECTS/RATIONALE:

IF THE FLOW CONTROL VALVE FAILS IN THE FULL FLOW POSITION, THE BYPASS VALVE COULD BE USED TO CONTROL FREON TEMPERATURES. IN THE CASE WHERE BOTH VALVES FAIL, AN UNDER TEMP OF FREON COULD OCCUR WHICH CAUSES THE LOSS OF A COOLANT LOOP AND A MINIMUM DURATION FLIGHT.

REFERENCES:

REPORT DATE 11/24/87 C-123
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 2005

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

ITEM: FLOW CONTROL VALVE
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: W. E. PARKMAN
SUBSYS LEAD: W. E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY
3) FLOW CONTROL ASSEMBLY
4) FLOW CONTROL VALVE
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63-A20, A23

CAUSES: PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, MECHANICAL SHOCK.

EFFECTS/RATIONALE:
IF DEPLETION OF FREON FROM ONE COOLANT LOOP OCCURS, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE TO THE REDUNDANT LOOP RESULTS IN LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87 C-124
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 2006

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: STEPPING MOTOR (FLOW CONTROL VALVE)
FAILURE MODE: FAILS TO START

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY
3) FLOW CONTROL ASSEMBLY
4) FLOW CONTROL VALVE
5) STEPPING MOTOR

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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63-A20, A23

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION, THERMAL STRESS, MECHANICAL SHOCK

EFFECTS/RATIONALE:
INABILITY TO COOL FREON BY THE RADIATOR RESULTS IN LOSS OF MISSION OBJECTIVE, AND LEADS TO A MINIMUM DURATION FLIGHT. FOR A SECOND FAILURE IN THE REDUNDANT LOOP THAT ELIMINATES VEHICLE COOLING, THE ORBITER MUST ENTER AT THE NEXT PRIMARY LANDING SITE.

REFERENCES:

REPORT DATE 11/24/87 C-125
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 2007

HIGHEST CRITICALITY  HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: BYPASS VALVE
FAILURE MODE: FAILS IN BYPASS MODE

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY
3) FLOW CONTROL ASSEMBLY
4) BYPASS VALVE
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63-A19, A22

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION, MECHANICAL SHOCK

EFFECTS/RATIONALE:
INABILITY TO COOL FREON BY THE RADIATOR RESULTS IN LOSS OF MISSION OBJECTIVE, AND LEADS TO A MINIMUM DURATION FLIGHT. FOR A SECOND FAILURE IN THE REDUNDANT LOOP THAT ELIMINATES VEHICLE COOLING, THE ORBITER MUST ENTER AT THE NEXT PRIMARY LANDING SITE.

REFERENCES:

REPORT DATE 11/24/87  C-126
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87    HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/2R
MDAC ID: 2008   ABORT: 3/2R

ITEM: BYPASS VALVE
FAILURE MODE: FAILS IN RADIATOR FLOW

LEAD ANALYST: W.E. PARKMAN    SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY
3) FLOW CONTROL ASSEMBLY
4) BYPASS VALVE
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63-A19, A22

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION, MECHANICAL SHOCK

EFFECTS/RATIONALE:
IF THE BYPASS VALVE FAILS IN THE FULL FLOW POSITION, THE FLOW CONTROL VALVE CAN BE USED TO CONTROL FREON TEMPERATURES. IN THE CASE WHERE BOTH VALVES FAIL, AN UNDER TEMP OF FREON COULD OCCUR WHICH LEADS TO LOSS OF A COOLANT LOOP AND A MINIMUM DURATION FLIGHT.

REFERENCES:

REPORT DATE 11/24/87 C-127
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 2009
HIGHEST CRITICALITY FLIGHT: 2/1R
ABORT: 2/1R

ITEM: BYPASS VALVE
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY
3) FLOW CONTROL ASSEMBLY
4) BYPASS VALVE
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LOCATION: M IDBODY-AREA 40
PART NUMBER: 40V63-A19, A22

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
FOR DEPLETION OF FREON FROM ONE COOLANT LOOP, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE TO THE REDUNDANT LOOP RESULTS IN LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87 C-128
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 2010

ITEM: MOTOR (BYPASS VALVE)
FAILURE MODE: FAILS TO START

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY
3) FLOW CONTROL ASSEMBLY
4) BYPASS VALVE
5) MOTOR

CRITICALITIES

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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63-A19, A22

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION, MECHANICAL SHOCK, THERMAL STRESS

EFFECTS/RATIONALE:
IF THE VALVE FAILS IN THE BYPASS POSITION FREON CANNOT BE COOLED BY THE RADIATOR WHICH RESULTS IN LOSS OF MISSION OBJECTIVE, AND LEADS TO A MINIMUM DURATION FLIGHT. FOR A SECOND FAILURE IN THE REDUNDANT LOOP THAT ELIMINATES VEHICLE COOLING, ORBITER MUST ENTER AT THE NEXT PRIMARY LANDING SITE.

REFERENCES:

REPORT DATE 11/24/87 C-129
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 2011

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

ITEM: MODE CONTROL VALVE
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY
3) FLOW CONTROL ASSEMBLY
4) MODE CONTROL VALVE
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION, MECHANICAL SHOCK, THERMAL STRESS

EFFECTS/RATIONALE:
FOR DEPLETION OF FREON FROM ONE COOLANT LOOP, ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE TO THE REDUNDANT LOOP RESULTS IN LOSS OF CREW AND VEHICLE, SINCE HEAT CANNOT BE TRANSFERRED FROM THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87 C-130
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 2012

HIGHEST CRITICALITY
HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: RADIATOR FLOW CONTROLLER
FAILURE MODE: OPEN (ELECTRICAL), INTERNAL SHORT

LEAD ANALYST: W.E. PARKMAN SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY
3) FLOW CONTROL ASSEMBLY
4) MODE CONTROL VALVE

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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63-A21, A24, A25, A26

CAUSES: VIBRATION, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL STRESS

EFFECTS/RATIONALE:
ONE OF TWO REDUNDANT RADIATOR FLOW CONTROLLER IS LOST FOR ONE FREON COOLANT LOOP. IF THERE IS LOSS OF BOTH CONTROLLERS, FREON TEMPERATURE WITHIN ONE LOOP CANNOT BE AUTOMATICALLY ADJUSTED. IF THE PAYLOAD REQUIRES PARTICIPATION BY ALL CREW MEMBERS, THE MISSION OBJECTIVE IS LOST, SINCE ONE CREW MEMBER MUST MANUALLY CONTROL FLOW IN ONE FREON COOLANT LOOP.

REFERENCES:

REPORT DATE 11/24/87 C-131
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 2013

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

ITEM: INLET TEMPERATURE TRANSDUCER
FAILURE MODE: ERRONEOUS OUTPUT, FAILS OFF-SCALE (HIGH/LOW)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY
3) INLET TEMPERATURE TRANSDUCER
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63MT30, MT32

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, VIBRATION, THERMAL STRESS

EFFECTS/RATIONALE:
A FAILED TRANSDUCER RESULTS IN LOSS OF INSIGHT ON TEMPERATURE OF FREON ENTERING THE RADIATOR PANELS. REDUNDANT DOWNSTREAM TEMPERATURE SENSORS PROVIDE DATA WHICH COMPENSATES FOR THE FAILED SENSOR.

REFERENCES:

REPORT DATE 11/24/87 C-132
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 2014

ITEM: OUTLET TEMPERATURE TRANSDUCER
FAILURE MODE: ERRONEOUS OUTPUT, FAILS OFF-SCALE (HIGH/LOW)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY
3) OUTLET TEMPERATURE TRANSDUCER (PANELS)

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63-MT28, MT29, MT31, MT33

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
TEMPERATURE DATA FOR FREON EXITING RADIATOR PANELS IS UNRELIABLE. HOWEVER, REDUNDANT DOWNSTREAM TEMPERATURE SENSORS PROVIDE DATA WHICH COMPENSATES FOR THE FAILED SENSOR.

REFERENCES:

REPORT DATE 11/24/87  C-133
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 2015

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: TEMPERATURE SENSOR
FAILURE MODE: ERRONEOUS OUTPUT, FAILS OFF-SCALE (HIGH/LOW)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY
3) FLOW CONTROL ASSEMBLY
4) TEMPERATURE SENSOR
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LOCATION: MIDBODY-AREA 40
PART NUMBER: 40V63A24MT1, A24MT2, A26MT1, A26MT2, A25MT1, A25MT2, A21MT1, A21MT2

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION, MECHANICAL SHOCK, THERMAL STRESS

EFFECTS/RATIONALE:
A FAILED SENSOR LEADS TO LOSS OF INPUT FOR ONE OF TWO RADIATOR FLOW CONTROLLERS. IF THERE IS A LOSS OF REDUNDANT TEMPERATURE SENSORS, FREON TEMPERATURE WITHIN ONE LOOP CANNOT BE AUTOMATICALLY CONTROLLED.

REFERENCES:

REPORT DATE 11/24/87 C-134
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/2R
MDAC ID: 2016  ABORT: 3/2R

ITEM: CIRCUIT BREAKER 14 (FREON RADIATOR CONTROLLER)
FAILURE MODE: OPEN (ELECTRICAL)

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR FLOW CONTROL VALVE
4) PANEL 015 (P NL 014)
5) CIRCUIT BREAKER 14 (CBI5)

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LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 33V73A15-CB14, CB15; 33V73A14-CB14, CB15

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
THERE IS A LOSS OF CAPABILITY TO SUPPLY POWER TO ONE OF TWO RADIATOR FLOW CONTROLLERS FOR ONE FREON COOLANT LOOP. IF A LOSS OF BOTH FLOW CONTROLLERS OCCURS, FREON TEMPERATURE WITHIN ONE LOOP CANNOT BE AUTOMATICALLY CONTROLLED. IF THE PAYLOAD REQUIRES PARTICIPATION BY ALL CREW MEMBERS, MISSION OBJECTIVE IS LOST, SINCE ONE CREW MEMBER MUST MANUALLY CONTROL FLOW IN ONE FREON COOLANT LOOP.

REFERENCES:

REPORT DATE 11/24/87  C-135
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87
SUBSYSTEM: ATCS
MDAC ID: 2017

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: SWITCH 26 (RADIATOR CONTROL LOOP)
FAILURE MODE: FAILS TO SWITCH FROM "OFF" POSITION

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR FLOW CONTROL VALVE
4) PANEL L1A2
5) SWITCH 26 (S27)

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LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-S26, S27

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
THere is a loss of one of two flow control valve motors for one freon coolant loop. if there is a loss of both flow controllers, freon temperature within one loop cannot be automatically controlled. if the payload requires participation by all crew members, mission objective is lost, since one crew member must manually control flow in one freon coolant loop.

REFERENCES:

REPORT DATE 11/24/87 C-136
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87
SUBSYSTEM: ATCS
MDAC ID: 2018

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: SWITCH 26 (RADIATOR CONTROL LOOP)
FAILURE MODE: FAILS TO SWITCH FROM A (B) POSITION

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR FLOW CONTROL VALVE
4) PANEL L1A2
5) SWITCH 26 (S27)

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LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-S26, S27

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
AN INABILITY TO SWITCH TO REDUNDANT RADIATOR FLOW CONTROLLERS RESULTS. A SECOND FAILURE WHICH ELIMINATES THE ACTIVE CONTROLLER RESULTS IN LOSS OF MISSION, DUE TO THE INABILITY TO AUTOMATICALLY CONTROL THE FREON TEMPERATURE WITHIN ONE COOLANT LOOP.
IF THE PAYLOAD REQUIRES PARTICIPATION BY ALL CREW MEMBERS, MISSION OBJECTIVE IS LOST, SINCE ONE CREW MEMBER MUST MANUALLY CONTROL FLOW IN ONE FREON COOLANT LOOP.

REFERENCES:

REPORT DATE 11/24/87  C-137
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87

SUBSYSTEM: ATCS
MDAC ID: 2019

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: DIODE (RADIATOR FLOW CONTROLLER)
FAILURE MODE: OPEN (ELECTRICAL)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR FLOW CONTROLLER
4) PANEL L1A2
5) DIODE

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LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-A4CR1, A4CR2, A4CR3, A4CR4

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
ONE RADIATOR FLOW CONTROLLER WILL NOT AUTOMATICALLY CONTROL THE BYPASS VALVE FOR ONE FREON COOLANT LOOP. FOR LOSS OF SECOND FLOW CONTROLLER, FREON TEMPERATURE WITHIN ONE LOOP CANNOT AUTOMATICALLY BE CONTROLLED. IF THE PAYLOAD REQUIRES PARTICIPATION BY ALL CREW MEMBERS, MISSION OBJECTIVE IS LOST, SINCE ONE CREW MEMBER MUST MANUALLY CONTROL FLOW IN ONE FREON COOLANT LOOP.

REFERENCES:

REPORT DATE 11/24/87 C-138
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87
SUBSYSTEM: ATCS
MDAC ID: 2020

ITEM: DIODE (RADIATOR FLOW CONTROLLER)
FAILURE MODE: SHORTED

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR FLOW CONTROLLER
4) PANEL L1A2
5) DIODE

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LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-A4CR1, A4CR2, A4CR3, A4CR4

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
Both flow control valve stepping motors operate at the same time. Loss of all redundancy to control the bypass valve in one freon loop leads to loss of capability to control the rate of freon exiting the radiator results in loss of mission.

REFERENCES:

REPORT DATE 11/24/87 C-139
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87

HIGHEST CRITICALITY

ITEM: RESISTOR (RADIATOR FLOW CONTROLLER)

FAILURE MODE: OPEN (ELECTRICAL)

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:

1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR FLOW CONTROLLER
4) PANEL 11A2
5) RESISTOR

CRITICALITIES

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: FLIGHT DECK-AREA 30

PART NUMBER: 31V73A1A2-A4R1, A4R2, A4R3, A4R4, A4R5, A4R6, A4R7, A4R8

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
A LOSS OF SWITCH POSITION FEEDBACK TO MDM RESULTS. HOWEVER, SENSORS WITHIN THE FREON COOLANT LOOP PROVIDE DATA WHICH COMPENSATES FOR THE FAILED RESISTOR.

REFERENCES:

REPORT DATE 11/24/87  C-140
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87
SUBSYSTEM: ATCS
MDAC ID: 2022

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

ITEM: RESISTOR (RADIACTOR FLOW CONTROLLER)
FAILURE MODE: SHORTED

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR FLOW CONTROLLER
4) PANEL L1A2
5) RESISTOR

CRITICALITIES

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-A4R1, A4R2, A4R3, A4R5, A4R6, A4R7, A4R8

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
A LOSS OF SWITCH POSITION FEEDBACK TO MDM RESULTS. HOWEVER, SENSORS WITHIN THE FREON COOLANT LOOP PROVIDE DATA WHICH COMPENSATES FOR THE FAILED RESISTOR.

REFERENCES:

REPORT DATE 11/24/87  C-141
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87
SUBSYSTEM: ATCS
MDAC ID: 2023

ITEM: SWITCH 25 (RADIATOR CONTROL OUTLET TEMPERATURE)
FAILURE MODE: FAILS TO SWITCH FROM "NORM" POSITION

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR FLOW CONTROLLER
4) PANEL L1A2
5) SWITCH 25

CRITICALITIES

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LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-S25

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
THERE IS A LOSS OF CAPABILITY TO AUTOMATICALLY ADJUST THE STEPPING MOTOR WHICH CONTROLS THE RADIATOR OUTLET TEMPERATURE BY VARYING THE AMOUNT OF FREON EXITING THE RADIATOR. LOSS OF CAPABILITY TO CONTROL THE RATE OF FREON EXITING THE RADIATORS FOR BOTH LOOPS RESULTS IN LOSS OF MISSION.

REFERENCES:
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87
SUBSYSTEM: ATCS
MDAC ID: 2024

ITEM: SWITCH 25 (RADIATOR CONTROL OUTLET TEMPERATURE)
FAILURE MODE: FAILS TO SWITCH FROM "HI" POSITION

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR FLOW CONTROLLER
4) PANEL L1A2
5) SWITCH 25
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CRITICALITIES

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LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-S25

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
THERE IS A LOSS OF CAPABILITY TO AUTOMATICALLY ADJUST THE STEPPING MOTOR WHICH CONTROLS THE RADIATOR OUTLET TEMPERATURE BY VARYING THE AMOUNT OF FREON EXITING THE RADIATOR. LOSS OF CAPABILITY TO THE RATE OF FREON EXITING THE RADIATORS FOR BOTH LOOPS RESULTS IN LOSS OF MISSION.

REFERENCES:

REPORT DATE 11/24/87  C-143
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 2025
HIGHEST CRITICALITY
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: CIRCUIT BREAKER (RADIATOR BYPASS VLV)
FAILURE MODE: OPEN (ELECTRICAL)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR BYPASS VALVE
4) PANEL L4
5) CIRCUIT BREAKER
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LOCATION: FLIGHT DECK - AREA 30
PART NUMBER: 31V73A4-CB128, CB129, CB44, CB47

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
THERE IS AN INABILITY TO PROVIDE POWER TO ONE OF THE RADIATOR BYPASS VALVE MOTORS FOR ONE FREON COOLANT LOOP. LOSS OF ALL REDUNDANCY TO CONTROL BYPASS VALVE FOR ONE LOOP RESULTS IN LOSS OF CAPABILITY TO CONTROL THE RATE OF FREON EXITING THE RADIATOR THIS LEADS TO LOSS OF MISSION.

REFERENCES:

REPORT DATE 11/24/87 C-144
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
MDAC ID: 2026

ITEM: SWITCH 29 (RADIATOR MANUAL SELECT)
FAILURE MODE: FAILS IN "RADIATOR FLOW" POSITION

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR BYPASS VALVE
4) PANEL L1A2
5) SWITCH 29 (RADIATOR MANUAL SELECT)

CRITICALITIES

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LOCATION: FLIGHT DECK - AREA 30
PART NUMBER: 31V73A1A2-S29, S30

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL
FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
THERE IS A LOSS OF MANUAL CAPABILITY TO POSITION BYPASS VALVE;
HOWEVER, SWITCHING FROM BYPASS TO RADIATOR FLOW CAN BE DONE USING
EITHER CONTROLLER. LOSS OF ALL REDUNDANCY TO POSITION THE BYPASS
VALVE WITHIN ONE FREON COOLANT LOOP LEADS TO LOSS OF
MISSION, SINCE FREON TEMPERATURE CANNOT BE CONTROLLED.

REFERENCES:

REPORT DATE 11/24/87 C-145
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 2027

ITEM: SWITCH 29 (RADIATOR MANUAL SELECT)
FAILURE MODE: FAILS IN "BYPASS" POSITION

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR BYPASS VALVE
4) PANEL L1A2
5) SWITCH 29 (RADIATOR MANUAL SELECT)

CRITICALITIES

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LOCATION: FLIGHT DECK - AREA 30
PART NUMBER: 31V73A1A2-S29, S30

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
THERE IS A LOSS OF MANUAL CAPABILITY TO POSITION BYPASS VALVE; HOWEVER, SWITCHING FROM BYPASS TO RADIATOR FLOW CAN BE DONE USING EITHER CONTROLLER. LOSS OF ALL REDUNDANCY TO POSITION THE BYPASS VALVE WITHIN ONE FREON COOLANT LOOP LEADS TO LOSS OF MISSION, SINCE FREON TEMPERATURE CANNOT BE CONTROLLED.

REFERENCES:

REPORT DATE 11/24/87 C-146
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 2028

ITEM: SWITCH 29 (RADIATOR MANUAL SELECT)
FAILURE MODE: FAILS IN INTERMEDIATE POSITION

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR BYPASS VALVE
4) PANEL L1A2
5) SWITCH 29 (RADIATOR MANUAL SELECT)

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LOCATION: FLIGHT DECK - AREA 30
PART NUMBER: 31V73A1A2-S9, S30

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL
FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
THERE IS A LOSS OF MANUAL CAPABILITY TO POSITION BYPASS VALVE;
HOWEVER, SWITCHING FROM BYPASS TO RADIATOR FLOW CAN BE DONE USING
EITHER CONTROLLER. LOSS OF ALL REDUNDANCY TO POSITION THE BYPASS
VALVE WITHIN ONE FREON COOLANT LOOP LEADS TO LOSS OF
MISSION, SINCE FREON TEMPERATURE CANNOT BE CONTROLLED.

REFERENCES:

REPORT DATE 11/24/87 C-147
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/2R
MDAC ID: 2029  ABORT: 3/2R

ITEM: RESISTOR (PRECEDES S35)
FAILURE MODE: OPEN (ELECTRICAL)

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR BYPASS VALVE
4) PANEL L1A2
5) RESISTOR (PRECEDES S35)
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LOCATION: FLIGHT DECK - AREA 30
PART NUMBER: 31V73A1A2-A4R21, A4R22, A4R23, A4R24

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
THERE IS AN INABILITY TO MANUALLY CONTROL ONE OF THE BYPASS VALVE MOTORS. LOSS OF ALL REDUNDANCY TO POSITION THE BYPASS VALVE WITHIN ONE FREON COOLANT LOOP LEADS TO LOSS OF MISSION, SINCE FREON TEMPERATURE CANNOT BE CONTROLLED.

REFERENCES:

REPORT DATE 11/24/87  C-148
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 2030

ITEM: RESISTOR (PRECEDES S35)
FAILURE MODE: SHORTED

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR BYPASS VALVE
4) PANEL 1A2
5) RESISTOR (PRECEDES S35)
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LOCATION: FLIGHT DECK - AREA 30
PART NUMBER: 31V73A1A2-A4R21, A4R22, A4R23, A4R24

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
THERE IS AN INABILITY TO MANUALLY CONTROL ONE OF THE BYPASS VALVE MOTORS. LOSS OF ALL REDUNDANCY TO POSITION THE BYPASS VALVE WITHIN ONE FREON COOLANT LOOP LEADS TO LOSS OF MISSION, SINCE FREON TEMPERATURE CANNOT BE CONTROLLED.

REFERENCES:

REPORT DATE 11/24/87 C-149
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 2031

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: SWITCH 35 (RADIATOR CONTROLLER BYPASS VALVE)
FAILURE MODE: FAILS IN THE "AUTO" POSITION

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR BYPASS VALVE
4) PANEL L1A2
5) SWITCH 35 (RADIATOR CONTROLLER BYPASS VALVE)

CRITICALITIES

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LOCATION: FLIGHT DECK - AREA 30
PART NUMBER: 31V73A1A2-S35, S36

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
THERE IS A LOSS OF MANUAL CAPABILITY TO POSITION BYPASS VALVE;
HOWEVER, SWITCHING FROM BYPASS TO RADIATOR FLOW CAN BE DONE USING EITHER CONTROLLER. LOSS OF ALL REDUNDANCY TO POSITION THE BYPASS VALVE WITHIN ONE FREON COOLANT LOOP LEADS TO LOSS OF MISSION, SINCE FREON TEMPERATURE CANNOT BE CONTROLLED.

REFERENCES:

REPORT DATE 11/24/87 C-150
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 2032

ITEM: SWITCH 35 (RADIATOR CONTROLLER BYPASS VALVE)
FAILURE MODE: FAILS IN THE "MANUAL" POSITION

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR BYPASS VALVE
4) PANEL L1A2
5) SWITCH 35 (RADIATOR CONTROLLER BYPASS VALVE)
6) 
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LOCATION: FLIGHT DECK - AREA 30
PART NUMBER: 31V73A1A2-S35, S36

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL
FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
THERE IS AN INABILITY TO AUTOMATICALLY CONTROL BYPASS VALVE
MOTORS. LOSS OF ALL REDUNDANCY TO POSITION THE BYPASS VALVE
WITHIN ONE FREON COOLANT LOOP LEADS TO LOSS OF MISSION, SINCE THE
FREON TEMPERATURE CANNOT BE CONTROLLED.

REFERENCES:

REPORT DATE 11/24/87 C-151
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 2033

ITEM: HYBRID DRIVER
FAILURE MODE: OPEN (ELECTRICAL), FAILS OFF

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR BYPASS VALVE
4) MPCA
5) HYBRID DRIVER
6) 
7) 
8) 
9) 

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: MIDBODY - AREA 40
PART NUMBER: 40V76A25-AR46, AR47, 40V76A26-AR38; 40V76A27-AR23

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
AN INABILITY TO MANUALLY CONTROL ONE OF THE BYPASS VALVE MOTORS RESULTS. HOWEVER, BYPASS VALVE MAY BE CONTROLLED BY THE RADIATOR CONTROLLERS.

REFERENCES:

REPORT DATE 11/24/87 C-152
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 2034

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

ITEM: HYBRID DRIVER
FAILURE MODE: SHORTED, FAILS ON

LEAD ANALYST: W. E. PARKMAN
SUBSYS LEAD: W. E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR BYPASS VALVE
4) MPCA
5) HYBRID DRIVER
6) 
7) 
8) 
9) 

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: MIDBODY - AREA 40
PART NUMBER: 40V76A25-AR46, AR47; 40V76A26-AR38, 40V76A27-AR23

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
AN INABILITY TO MANUALLY CONTROL ONE OF THE BYPASS VALVE MOTORS RESULTS. HOWEVER, BYPASS VALVE MAY BE CONTROLLED BY THE RADIATOR CONTROLLERS.

REFERENCES:

REPORT DATE 11/24/87 C-153
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/10/87
SUBSYSTEM: ATCS
MDAC ID: 2035

ITEM: RESISTOR (BYPASS VALVE INDICATOR)
FAILURE MODE: OPEN (ELECTRICAL)

LEAD ANALYST: W. E. PARKMAN
SUBSYS LEAD: W. E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR FLOW CONTROLLER
4) PANEL L1A2
5) RESISTOR A4R19 (A4R20)
6) 
7) 
8) 
9) 

CRITICALITIES

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-A4R19, A4R20

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
AN OPEN RESISTOR IS UNABLE TO SUPPLY CURRENT FOR FEEDBACK TO MDMS AND PANEL INDICATOR, WHICH PROVIDE BYPASS VALVE POSITION FOR ONE FREON COOLANT LOOP. HOWEVER, REDUNDANT DOWNSTREAM TEMPERATURE SENSORS PROVIDE DATA WHICH COMPENSATES FOR THE FAILED INDICATOR AND MDMS FEEDBACKS.

REFERENCES:

REPORT DATE 11/24/87 C-154
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/10/87
SUBSYSTEM: ATCS
MDAC ID: 2036

ITEM: RESISTOR (BYPASS VALVE INDICATOR)
FAILURE MODE: SHORTS

LEAD ANALYST: W. E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR FLOW CONTROLLER
4) PANEL L1A2
5) RESISTOR A4R19 (A4R20)

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-A4R19, A4R20

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
AN OVERCURRENT IN THE CIRCUIT COULD DAMAGE MDMS AND THE PANEL INDICATOR. HOWEVER, REDUNDANT DOWNSTREAM TEMPERATURE SENSORS PROVIDE DATA WHICH COMPENSATES FOR THE FAILED INDICATOR AND MDMS.

REFERENCES:

REPORT DATE 11/24/87  C-155
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/10/87  
SUBSYSTEM: ATCS  
MDAC ID: 2037  

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

ITEM: DIODE (BYPASS VALVE INDICATOR)  
FAILURE MODE: OPEN

LEAD ANALYST: W. E. PARKMAN  
SUBSYS LEAD: W. E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR FLOW CONTROLLER
4) PANEL L1A2
5) DIODE (A4CR5)
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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-A4CR5, A4CR6, A4CR7, A4CR8

CAUSES: VIBRATION, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, MECHANICAL SHOCK

EFFECTS/RATIONALE:
THERE IS A LOSS OF PANEL INDICATOR DUE TO INABILITY TO PASS CURRENT THROUGH THE COMPENTENT. HOWEVER, REDUNDANT MDMS PROVIDE DATA WHICH COMPENSATES FOR THE FAILED INDICATOR.

REFERENCES:

REPORT DATE 11/24/87  C-156
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/10/87
SUBSYSTEM: ATCS
MDAC ID: 2038

ITEM: DIODE (BYPASS VALVE INDICATOR)
FAILURE MODE: SHORTS

LEAD ANALYST: W. E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR FLOW CONTROLLER
4) PANEL L1A2
5) DIODE (A4CR5)

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: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-A4CR5, A4CR6, A4CR7, A4CR8

CAUSES: VIBRATION, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, MECHANICAL SHOCK

EFFECTS/RATIONALE:
THE INDICATOR WILL CONTINUE TO OPERATE; HOWEVER, FEEDBACK TO THE MDMS WILL INCORRECTLY INDICATE THAT THE VALVE IS IN BOTH THE BYPASS AND RADIATOR POSITIONS.

REFERENCES:

REPORT DATE 11/24/87 C-157
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/10/87
HIGHEST CRITICALITY
HDW/FUNC

SUBSYSTEM: ATCS
FLIGHT: 3/3
MDAC ID: 2039
ABORT: 3/3

ITEM: BYPASS VALVE INDICATOR
FAILURE MODE: FAILS TO OPERATE

LEAD ANALYST: W. E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) RADIATOR AND FLOW CONTROL ASSEMBLY EPD&C
3) RADIATOR FLOW CONTROLLER
4) PANEL L1A2
5) BYPASS VALVE INDICATOR
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-DS3, DS4

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, VIBRATION, THERMAL STRESS

EFFECTS/RATIONALE:
THERE IS A LOSS OF FLIGHT DECK PANEL INDICATION. HOWEVER, REDUNDANT MDMS PROVIDE DATA WHICH COMPENSATES FOR THE FAILED INDICATOR.

REFERENCES:

REPORT DATE 11/24/87 C-158
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/13/87
SUBSYSTEM: ATCS
MDAC ID: 3000

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

ITEM: FES HI LOAD FEEDLINE TEMPERATURE SENSOR
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR
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5) 
6) 
7) 
8) 
9) 

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: AFT BODY - HI LOAD FEEDLINE

CAUSES: LOSS OF INPUT, MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
SENSOR FAILURE WILL CAUSE INCORRECT DATA DISPLAY ON SM DISPLAY. CREW/GROUND MALFUNCTION PROCEDURES CAN ISOLATE PROBLEM TO FAILED SENSOR. NO IMPACT ON FUTURE OPERATIONS. SENSORS ARE ONLY APPLICABLE ON ORBIT.

REFERENCES: VS70-960102 (60FH, 60FJ, FR); SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-159
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/27/87  HIGHEST CRITICALITY  FLIGHT: 3/1R
SUBSYSTEM: ATCS                HDW/FUNC: ABORT: 3/1R
MDAC ID: 3001

ITEM: HI LOAD FEEDLINE FROM CUT-OFF TO NOZZLE
FAILURE MODE: RESTRICTED FLOW

LEAD ANALYST: S.K. SINCLAIR       SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR
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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
BLOCKAGE IN THE FEEDLINE DEDICATED TO THE HI LOAD EVAPORATOR WILL RESULT IN THE LOSS OF THE INPUTS OF THE HI LOAD EVAPORATOR. BLOCKAGE OF BOTH FEEDLINES RESULTS IN THE LOSS OF THE HI LOAD EVAPORATOR. LOSS OF THE HIGH LOAD EVAPORATOR MEANS LOSS OF MISSION AND ENTRY TO NEXT PLS. LOSS OF THE HIGH LOAD EVAPORATOR COMBINED WITH LOSS OF ONE FREON LOOP MAY MEAN LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH, 60FJ); SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-160
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/14/87
SUBSYSTEM: ATCS
MDAC ID: 3002

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

ITEM: HI LOAD FEEDLINE FROM CUT OFF TO NOZZLE (PLUMBING)
FAILURE MODE: INTERNAL/EXTERNAL LEAKAGE

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR
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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
LEAKAGE IN THE HI LOAD FEEDLINE WILL RESULT IN LOSS OF ENTIRE FEEDLINE IF LEAK IS UPSTREAM OF VALVES OR LOSS OF 1/2 OF HI LOAD IF LEAK IS DOWNSTREAM OF VALVES. LOSS OF ALL REDUNDANCY WILL STILL RESULT IN RETURN AT NEXT PRIMARY LANDING SITE OPPORTUNITY DUE TO LOSS OF HIGH LOAD EVAPORATOR. LOSS OF HIGH LOAD COMBINED WITH LOSS OF ONE FREON LOOP CAN RESULT IN LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH, 60FJ); SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-161
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/08/87
SUBSYSTEM: ATCS
MDAC ID: 3003

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

ITEM: FES HI LOAD FEEDLINE HEATER
FAILURE MODE: LOSS OF OUTPUT, NO HEAT

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR
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LOCATION: AFT BODY
PART NUMBER: FDLN A: HTR 1-50V63HR36 CONNECTIONS 1 & 2, HTR 2-50V63HR36 CONNECTIONS 3 & 4. FDLN B: HTR 1-50V63HR42 CONNECTIONS 1 & 2, HTR 2-50V63HR42 CONNECTIONS 3 & 4

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:

REFERENCES: VS70-960102 (60FH, 60FJ, 60FL); SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-162
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/27/87

SUBSYSTEM: ATCS
MDAC ID: 3004

HIGHEST CRITICALITY

FLIGHT: 3/2R
ABORT: 3/2R

ITEM: FES HI LOAD FEEDLINE HEATER THERMOSTAT
FAILURES MODE: FAILS CLOSED (REFLECTING LOW TEMPERATURE)

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR

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LOCATION:

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
A THERMOSTAT FAILED CLOSED (REFLECTING A LOW TEMPERATURE) IS THE SAME AS A HEATER FAILED ON. HEATERS FAILED ON CAN CAUSE OVERTEMP SITUATIONS.

REFERENCES: VS70-960102 (60FH, 60FJ, 60FL); SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-163
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/27/87
SUBSYSTEM: ATCS
MDAC ID: 3005

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

ITEM: FES HI LOAD FEEDLINE HEATER THERMOSTAT
FAILURE MODE: FAILS OPEN - REFLECTING HIGH TEMPERATURE

LEAD ANALYST: S.K. SINCLAIR SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR

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LOCATION: AFT FUSELAGE
PART NUMBER: FDLN A: HTR 1-50V63S45, HTR 2-50V63S47. FDLN B:
HTR 2-50V63S42, HTR 2-50V63S50

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
A THERMOSTAT FAILED OPEN (REFLECTING A HIGH TEMPERATURE) IS THE
SAME AS A HEATER FAILED OFF. BECAUSE OF THE HEATERS LOCATION,
ITS OPERATION COULD AFFECT THE PERFORMANCE OF THE WATER
VALVE/SPRAY NOZZLE ASSEMBLIES. LOSS OF ALL THERMOSTATS AND
HEATERS WILL RESULT IN THE LOSS OF THE HIGH LOAD EVAPORATOR AND
ENTRY TO NEXT PRIMARY LANDING SITE. LOSS OF THE HIGH LOAD
COMBINED WITH THE LOSS OF ONE FREON LOOP CAN RESULT IN THE LOSS
OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH, 60FJ, 60FL); SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-164
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/11/87
SUBSYSTEM: ATCS
MDAC ID: 3006

ITEM: 40 MICRON FILTER-HI LOAD WATER VALVE
FAILURE MODE: RESTRICTED FLOW

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR
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LOCATION: AFT FUSELAGE - HI LOAD FEEDWATER SYSTEM

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
A FILTER IS PRESENT IN EACH FEEDWATER VALVE/NOZZLE ASSEMBLY ON BOTH EVAPORATORS. IF A BLOCKAGE OCCURS, THAT VALVE/NOZZLE ASSEMBLY WILL BE NON-FUNCTIONAL. SHOULD ALL FILTERS BE BLOCKED, BOTH FESs WILL BE LOST RESULTING IN A RETURN AT NEXT PRIMARY LANDING SITE OPPORTUNITY. LOSS OF BOTH FESs COMBINED WITH THE LOSS OF ONE FREON LOOP CAN RESULT IN THE LOSS OF THE CREW/VEHICLE.

REFERENCES: JSC-19935

REPORT DATE 11/24/87  C-165
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/28/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/1R
MDAC ID: 3007  ABORT: 3/1R

ITEM: HI LOAD ISOLATION VALVE
FAILURE MODE: FAILS OPEN

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR
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LOCATION: AFT FUSELAGE - HI LOAD FEEDWATER SYSTEM
PART NUMBER:

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL, VIBRATION, INADVERTENT OPERATION/ACTIVATION

EFFECTS/RATIONALE:
THE HI LOAD ISOLATION VALVE IS DESIGNED TO PULSE OPEN SIMULTANEOUSLY WITH THE PULSER VALVE. IF THE ISOLATION VALVE IS FAILED OPEN, A CONTINUOUS STREAM OF WATER WILL GO TO THE PULSER VALVE WHICH COULD, IN TURN ALLOW EXCESSIVE AMOUNTS OF WATER INTO THE HI LOAD EVAPORATOR CORE. THIS WATER COULD RESULT IN FREEZING AND ICING OF THE EVAPORATOR CORE MEANING THE LOSS OF THE HI LOAD EVAPORATOR. (ADDITIONALLY, UNLESS THE FLOW IS CUT OFF FROM ANOTHER LOCATION, IT COULD RESULT IN A DEPLETION OF THE SUPPLY WATER TANK.) LOSS OF THE HIGH LOAD COMBINED WITH A LOSS OF ONE FREON LOOP CAN RESULT IN LOSS OF CREW/VEHICLE.

REFERENCES: JSC-19935; CSD-SH-126; VS70-960102 (60FH, 60FJ, 60FR); SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87  C-166
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/27/87
SUBSYSTEM: ATCS
MDAC ID: 3008

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

ITEM: HI LOAD ISOLATION VALVE
FAILURE MODE: FAILS TO OPEN

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR
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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: LOSS OF INPUT, MECHANICAL SHOCK, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
THE NORMALLY CLOSED ISOLATION VALVE (NORMALLY PULSED OPEN AT THE SAME FREQUENCY AS THE PULSER VALVE) FAILURE TO OPEN WILL RESULT IN NO WATER GETTING TO THE SPRAY NOZZLE AND TO THE HI LOAD EVAPORATOR. A LOSS OF BOTH ISOLATION VALVES MEANS A LOSS OF THE HI LOAD EVAPORATOR AND ENTRY AT NEXT PRIMARY LANDING SITE. LOSS OF THE HIGH LOAD EVAPORATOR COMBINED WITH THE LOSS OF ONE FREON LOOP CAN RESULT IN THE LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH, 60FJ, 60FR); SSSH 7.3 SHEET 1 OF 2; CSD-SH-126

REPORT DATE 11/24/87 C-167
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/28/87
SUBSYSTEM: ATCS
MDAC ID: 3009

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

ITEM: HI LOAD PULSER VALVE
FAILURE MODE: FAILS CLOSED

LEAD ANALYST: S.K. SINCLAIR SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR
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LOCATION: AFT FUSELAGE - HI LOAD EVAPORATOR INPUT LINES

PART NUMBER:

CAUSES: LOSS OF INPUT, MECHANICAL SHOCK, MISHANDLING/ABUSE, PIECE-PART STRUCTURAL, VIBRATION

EFFECTS/RATIONALE:
The normally closed pulser valves are pulsed open at a variable frequency depending upon thermal requirements and heat loads. If it fails closed, no water will get to the spray nozzle. Loss of both pulser valves will result loss of hi load evap and entry to next primary landing site. Loss of the high load combined with the loss of one freon loop can result in the loss of crew/vehicle.

REFERENCES: VS70-960102 (60FH, 60FJ); CSD-SH-126; SSSH 7.3 SHEETS 1 & 2; JSC-19935

REPORT DATE 11/24/87 C-168
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/28/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/1R
MDAC ID: 3010  ABORT: 3/1R

ITEM: HI LOAD PULSER VALVE
FAILURE MODE: FAILS OPEN

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR
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LOCATION: AFT FUSELAGE - HI LOAD FEEDLINE
PART NUMBER:

CAUSES: ERRONEOUS INPUT, MECHANICAL SHOCK, MISHANDLING/ABUSE

EFFECTS/RATIONALE:
The pulser valve is designed to be pulsed open at the same frequency as the hi load isolation valve. If the pulser valve fails open and the isolation valve operates correctly, this failure will have no effect. A subsequent failure of the isolation valve may result in the loss of the high load evaporator and landing at next pls. Loss of the high load combined with a loss of one freon loop may result in loss of crew/vehicle.

REFERENCES: VS70-960102 (60FH, 60FP); CSD-SH-126; SSSH 7.3 SHEETS 1 & 2; JSC-19935

REPORT DATE 11/24/87  C-169
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/28/87
SUBSYSTEM: ATCS
MDAC ID: 3011

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

ITEM: HI LOAD SPRAY NOZZLES
FAILURE MODE: RESTRICTED FLOW

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR

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LOCATION: AFT FUSELAGE - HI LOAD FEEDLINE

PART NUMBER:

CAUSES: THERMAL

EFFECTS/RATIONALE:
ICING WOULD CAUSE A BLOCKAGE IN THE SPRAY NOZZLE OF THE HI LOAD EVAPORATOR AND NO WATER INTRODUCED INTO THE EVAPORATOR. A LOSS OF BOTH SPRAY NOZZLE MEANS A LOSS OF THE HI LOAD EVAPORATOR AND ENTRY TO NEXT PRIMARY LANDING SITE. LOSS OF THE HIGH LOAD COMBINED WITH A LOSS OF ONE FREON LOOP CAN RESULT IN THE LOSS OF THE CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH, 60FP); CSD-SH-126; SSSH 7.3 SHEETS 1 & 2; JSC-19935

REPORT DATE 11/24/87 C-170
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/15/87
SUBSYSTEM: ATCS
MDAC ID: 3012

ITEM: HI LOAD EVAPORATOR CORE
FAILURE MODE: INTERNAL LEAKAGE (FREON)

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR

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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE

EFFECTS/RATIONALE:

REFERENCES: CSD-SH-126; JSC-19935

REPORT DATE 11/24/87 C-171
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/28/87

HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS FLIGHT: 3/1R
MDAC ID: 3013 ABORT: 3/1R

ITEM: HI LOAD VALVE MOUNTING PLATE
FAILURE MODE: INTERNAL RESTRICTED FLOW OF FREON

LEAD ANALYST: S.K. SINCLAIR SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR
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CRITICALITIES

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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: CONTAMINATION, MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
THE MOUNTING PLATE IS A PIN FIN HEAT EXCHANGER WHICH SERVES TO MAINTAIN A SUFFICIENTLY HIGH TEMPERATURE TO PREVENT FREEZING OF THE NOZZLES. RESTRICTED FLOW OF FREON COULD ALLOW FREEZE-UP AND LOSS OF THE EVAPORATOR. LOSS OF THE HIGH LOAD EVAPORATOR COMBINED WITH A LOSS OF ONE FREON LOOP CAN MEAN LOSS OF CREW/VEHICLE.

REFERENCES: JSC-19935

REPORT DATE 11/24/87 C-172
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/28/87
SUBSYSTEM: ATCS
MDAC ID: 3014

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

ITEM: HI LOAD VALVE MOUNTING PLATE
FAILURE MODE: INTERNAL/EXTERNAL LEAKAGE (FREON)

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR

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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:

REFERENCES: JSC-19935

REPORT DATE 11/24/87 C-173
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/28/87
SUBSYSTEM: ATCS
MDAC ID: 3015

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

ITEM: HI LOAD VALVE MOUNTING PLATE
FAILURE MODE: EXTERNAL LEAKAGE, STRUCTURAL FAILURE (RUPTURE)

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR
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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:

REFERENCES: VS70-960102; JSC-19935; SSSH 7.3

REPORT DATE 11/24/87 C-174
INDEPENDENT ORBITER ASSESSMENT
ORBITER subsystem ANALYSIS WORKSHEET

DATE: 5/28/87
SUBSYSTEM: ATCS
MDAC ID: 3016

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

ITEM: HI LOAD EVAPORATOR ANTI-CARRYOVER DEVICE (ACOD)
FAILURE MODE: INTERNAL LEAKAGE (FREON TO WATER)

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR

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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: MECHANICAL SHOCK, MISSHANDLING/ABUSE, PIECE-PART STRUCTURAL, VIBRATION

EFFECTS/RATIONALE:
THE ACOD IS A PIN FIN TYPE HEAT EXCHANGER WHICH PREVENTS UNEVAPORATED WATER DROPLETS FROM ENTERING THE STEAM DUCT. A LEAK IN THE ACOD WILL RESULT IN A MIXTURE OF DISSIMILAR HEAT EXCHANGER FLUIDS (FREON-21 AND WATER). FLIGHT RULES DICTATE A MINIMUM DURATION FLIGHT. THE LEAK CAN RESULT IN LOSS OF BOTH HIGH LOAD EVAPORATOR AND ONE FREON LOOP WITH SUBSEQUENT POSSIBLE LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102; JSC-19935; SSSH 7.3

REPORT DATE 11/24/87  C-175
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/28/87
SUBSYSTEM: ATCS
MDAC ID: 3017

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

ITEM: HI LOAD EVAPORATOR ANTI-CARRYOVER DEVICE
FAILURE MODE: EXTERNAL LEAKAGE (FREON)

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR
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LOCATION: AFT FUSELAGE

PART NUMBER:

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, PIECE-PART STRUCTURAL, VIBRATION

EFFECTS/RATIONALE:
AN EXTERNAL LEAK IN THE ANTI-CARRYOVER DEVICE WOULD RESULT IN LOSS OF FREON WITHIN ONE COOLANT LOOP. LOSS OF ONE FREON LOOP MEANS LANDING AT NEXT PLS. LOSS OF FREON LOOP COMBINED WITH LOSS OF THE HIGH LOAD EVAPORATOR CAN RESULT IN THE LOSS OF THE CREW/VEHICLE.

REFERENCES: VS70-960102; JSC-19935; SSHH 7.3

REPORT DATE 11/24/87 C-176
**INDEPENDENT ORBITER ASSESSMENT**
**ORBITER SUBSYSTEM ANALYSIS WORKSHEET**

**DATE:** 6/01/87  **HIGHEST CRITICALITY** HDW/FUNC  
**SUBSYSTEM:** ATCS  **FLIGHT:** 3/3  
**MDAC ID:** 3018  **ABORT:** 3/3

**ITEM:** HI LOAD ANTI-CARRYOVER DEVICE  
**FAILURE MODE:** NO FLOW OF FREON

**LEAD ANALYST:** S.K. SINCLAIR  **SUBSYS LEAD:** W.E. PARKMAN

**BREAKDOWN HIERARCHY:**
1) ACTIVE THERMAL CONTROL SYSTEM  
2) FLASH EVAPORATOR SYSTEM  
3) HI LOAD EVAPORATOR

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**REDUNDANCY SCREENS:** A [ ]  B [ ]  C [ ]

**LOCATION:** AFT FUSELAGE  
**PART NUMBER:**

**CAUSES:** CONTAMINATION, PIECE-PART STRUCTURAL

**EFFECTS/RATIONALE:**
THE ACOD IS A PIN FIN TYPE HEAT EXCHANGER WHICH REDUCES THE PERCENTAGE OF WATER DROPLETS IN THE EXIT DUCT BY PROVIDING AN ADDITIONAL HOT SURFACE FOR EVAPORATION. A FAILURE WHICH RESULTS IN NO FLOW OF FREON THRU THE ACOD WOULD MEAN MORE WATER DROPS IN THE EXIT DUCT.

**REFERENCES:** JSC-19935

**REPORT DATE 11/24/87**  C-177
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/28/87
SUBSYSTEM: ATCS
MDAC ID: 3019
HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 2/1R
ABORT: 2/1R

ITEM: HI LOAD EXIT DUCT
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR
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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: PIECE-PART STRUCTURAL, MECHANICAL SHOCK

EFFECTS/RATIONALE:
THE HI LOAD EXIT DUCT CARRIES THE STREAM FROM THE HI LOAD EVAPORATOR TO THE SONIC NOZZLE FOR DUMPING OVERBOARD. AN EXTERNAL LEAK WOULD RESULT IN WATER VAPOR BEING INTRODUCED INTO THE AFT FUSELAGE. SINCE ALL OF THE EQUIPMENT/WIRE BUNDLES IN THE AFT FUSELAGE ARE SEALED, THIS SHOULD NOT CAUSE A PROBLEM EXCEPT IN THE CASE OF A SECONDARY FAILURE OF THE SEALING SYSTEM. THIS LEAK MAY REQUIRE THAT THE HIGH LOAD EVAPORATOR BE SHUT DOWN WITH A LANDING AT THE NEXT PLS. A LOSS OF THE HIGH LOAD COMBINED WITH A LOSS OF ONE FREON LOOP CAN RESULT IN THE LOSS OF THE CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH)

REPORT DATE 11/24/87 C-178
DATE: 6/01/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 2/1R
MDAC ID: 3020  ABORT: 2/1R

ITEM: HI LOAD EXIT DUCT  HDW/FUNC
FAILURE MODE: NO FLOW

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR
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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
A RESTRICTION IN THE HI LOAD EXIT DUCT PREVENTING FLOW OF STEAM THRU THE HI LOAD EXIT DUCT MEANS THAT THE HI LOAD EVAPORATOR IS NO LONGER AVAILABLE. THE LOSS OF THE HIGH LOAD EVAPORATOR CALLS FOR AN ENTRY TO NEXT PRIMARY LANDING SITE. LOSS OF THE HIGH LOAD COMBINED WITH THE LOSS OF ONE FREON LOOP CAN RESULT IN THE LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH); SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87  C-179
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/01/87
SUBSYSTEM: ATCS
MDAC ID: 3021

ITEM: HI LOAD INBOARD AND OUTBOARD DUCT HEATERS - ZONE A AND B
FAILURE MODE: LOSS OF OUTPUT, NO HEAT

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR
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LOCATION: ZONE A AND B - HI LOAD EVAP DUCT; AFT FUSELAGE
PART NUMBER: 50V63HR28 , 50V63HR29

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION, OVERVOLTAGE

EFFECTS/RATIONALE:
The loss of all three duct heaters in each zone can result in the loss of the high load evaporator and subsequent entry to next PLS. Loss of the high load combined with the loss of one freon loop may result in the loss of the crew/vehicle.

REFERENCES: VS70-960102 (60FH, 60FM); SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87  C-180
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/26/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/3
MDAC ID: 3022  ABORT: 3/3

ITEM: HI LOAD INBOARD AND OUTBOARD DUCT TEMPERATURE
MONITOR
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: ZONE A - HI LOAD DUCT; AFT FUSELAGE
PART NUMBER: 50V63MT17A, 50V63MT36 (V63T1820A, V63T1821A)

CAUSES: ERRONEOUS INPUT, MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
ERRONEOUS OUTPUT FROM THE TEMPERATURE SENSOR WILL RESULT IN INCORRECT MONITORING DATA. THE CREW/GROUND CAN ISOLATE FAILURE TO SENSOR FAILURE AND TAKE APPROPRIATE ACTION WITH NO FURTHER IMPACT ON FUTURE OPERATIONS.

REFERENCES: VS70-960102 (60FH, 60FP); SSSH 7.3 SHEET 1 OF 2
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/27/87
SUBSYSTEM: ATCS
MDAC ID: 3023

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

ITEM: HI LOAD INBOARD AND OUTBOARD DUCT HEATER THERMOSTATS
FAILURE MODE: FAILS OPEN - REFLECTING HIGH TEMPERATURE

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
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LOCATION: ZONE A AND B - HI LOAD DUCT; AFT FUSELAGE
PART NUMBER: HEATER CONTROLLERS FOR 50V63HR28 AND 50V63HR29

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:

REFERENCES: VS70-960102 (60FH, 60FM); SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87  C-182
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/01/87
SUBSYSTEM: ATCS
MDAC ID: 3024

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: HI LOAD INBOARD AND OUTBOARD DUCT HEATER

FAILURE MODE: FAILS CLOSED - REFLECTING LOW TEMPERATURE

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR

CRITICALITIES

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LOCATION: ZONE A AND B - HI LOAD DUCT; AFT FUSELAGE

PART NUMBER: HEATER CONTROLLERS FOR 50V63HR28 AND 50V63HR29

CAUSES: LOSS OF INPUT, MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
A THERMOSTAT REFLECTING A LOW TEMPERATURE IS EQUIVALENT TO A STUCK ON HEATER. A SINGLE THERMOSTAT FAILURE OF THIS TYPE WILL RESULT IN A LOCAL OVERTEMP SITUATION.

REFERENCES: VS70-960102 (60FH, 60FM); SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-183
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/01/87
SUBSYSTEM: ATCS
MDAC ID: 3025

ITEM: HI LOAD NOZZLE HEATER
FAILURE MODE: FAILS OFF

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR
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LOCATION: HI LOAD NOZZLE; AFT FUSELAGE
PART NUMBER: HEATER A: 50V63A27HR21; HEATER B: 50V63A27HR2;
HEATER C: 50V63A27HR3

CAUSES: LOSS OF INPUT, MECHANICAL SHOCK, MISHANDLING/ABUSE,
VIBRATION

EFFECTS/RATIONALE:
THE HI LOAD NOZZLE HEATER IS ENABLED WHEN REQUIRED - NORMALLY
DURING DEORBIT PREP. IF THE HEATER FAILS OFF, THE HI LOAD NOZZLE
HI LOAD EVAPORATOR, AND ENTRY TO NEXT PLS. LOSS OF THE
HI LOAD EVAPORATOR COMBINED WITH THE LOSS OF ONE FREON LOOP CAN
RESULT IN THE LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH, 60FM, 60FP); SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-184
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/28/87
SUBSYSTEM: ATCS
MDAC ID: 3026

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

ITEM: HI LOAD NOZZLE TEMPERATURE SENSOR/HEATER
FAILURE MODE: FAILS REFLECTING HIGH TEMPERATURE

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR
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LOCATION: HI LOAD NOZZLE; AFT FUSELAGE
PART NUMBER: 50V63A27 NOZZLE ASSEMBLY

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
THE HI LOAD NOZZLE HEATERS ARE CONTROLLED BY AN ARRANGEMENT OF A TEMPERATURE SENSOR, A RESISTANCE BRIDGE, AND A TEMPERATURE CONTROLLER. A FAILURE IN ANY OF THESE COMPONENTS WHICH RESULT IN A HIGH TEMPERATURE BEING REFLECTED WILL HAVE THE SAME EFFECT. A HIGH REFLECTED TEMPERATURE IS EQUIVALENT TO A HEATER FAILED OFF. A LOSS OF ALL NOZZLE HEATER CONTROL ASSEMBLIES WILL RESULT IN POSSIBLE FREEZE-UP OF THE NOZZLE, A LOSS OF THE HIGH LOAD EVAPORATOR, AND ENTRY TO NEXT PLS. LOSS OF THE HIGH LOAD EVAPORATOR COMBINED WITH THE LOSS OF ONE FREON LOOP CAN RESULT IN THE LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH, 60FM, 60FP); SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-185
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/28/87
SUBSYSTEM: ATCS
MDAC ID: 3027

HIGHEST CRITICALITY
HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: HI LOAD NOZZLE TEMPERATURE SENSOR/HEATER CONTROLLER ASSEMBLY
FAILURE MODE: FAILS REFLECTING LOW TEMPERATURE

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR
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LOCATION: HI LOAD NOZZLE; AFT FUSELAGE
PART NUMBER: 50V63A27 NOZZLE ASSEMBLY

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
THE HI LOAD NOZZLE HEATERS ARE CONTROLLED BY AN ARRANGEMENT OF A TEMPERATURE SENSOR, A RESISTANCE BUDGE, AND A TEMPERATURE CONTROLLER. A FAILURE IN ANY OF THESE COMPONENTS WHICH RESULTS IN A LOW TEMPERATURE BEING REFLECTED WILL HAVE THE SAME EFFECT AND BE EQUIVALENT TO A HEATER STUCK ON.

REFERENCES: VS70-960102 (60FH, 60FM, 60FP); SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-186
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/27/87
SUBSYSTEM: ATCS
MDAC ID: 3028

ITEM: HI LOAD DUCT NOZZLE TEMPERATURE MONITOR
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR

CRITICALITIES

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: HI LOAD NOZZLE; AFT FUSELAGE
PART NUMBER: 50V63MT37 (V63T1890A)

CAUSES: ERRONEOUS INPUT, MECHANICAL SHOCK, VIBRATION

EFFECTS/RATIONALE: ERRONEOUS OUTPUT FROM A SENSOR WILL RESULT IN INCORRECT SM DATA AND FALSE ALARMS. CREW/GROUND MALFUNCTION PROCEDURES WILL ISOLATE THE PROBLEM TO A FAILED SENSOR WITH NO IMPACT ON FUTURE OPERATIONS.

REFERENCES: VS70-960102 (60FH, 60FP); SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87

C-187
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/01/87
SUBSYSTEM: ATCS
MDAC ID: 3029

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

ITEM: HI LOAD NOZZLE
FAILURE MODE: RESTRICTED FLOW

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR
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LOCATION: HI LOAD NOZZLE - AFT FUSELAGE
PART NUMBER: 50V63TP268

CAUSES: ICING

EFFECTS/RATIONALE:

REFERENCES: VS70-960102 (60FH)

REPORT DATE 11/24/87 C-188
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/09/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 2/1R
MDAC ID: 3030  ABORT: 2/1R

ITEM: HI LOAD NOZZLE  FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR
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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
LEAKAGE FROM THE HI LOAD SONIC NOZZLE INTO THE AFT FUSELAGE. ALL COMPONENTS IN THE AFT FUSELAGE ARE COMPLETELY SEALED. HOWEVER, WORST CASE OF A LEAK IN THIS AREA WILL REQUIRE SHUTTING DOWN THE HIGH LOAD EVAPORATOR AND LANDING AT NEXT PLS. A LOSS OF THE HIGH LOAD EVAPORATOR COMBINED WITH A LOSS OF ONE FREON LOOP CAN RESULT IN LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH)

REPORT DATE 11/24/87  C-189
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/02/87
SUBSYSTEM: ATCS
MDAC ID: 3031

HIGHEST CRITICALITY
HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: FES TOPPING FEEDLINE HEATER
FAILURE MODE: NO HEAT

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
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LOCATION: AFT FUSELAGE
PART NUMBER: FDLN A: 50V63HR34; FDLN B: 50V63HR40; HTR 1-CONNECTIONS 1 AND 2; HTR 2-CONNECTIONS 3 AND 4

CAUSES: LOSS OF INPUT, MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
A HEATER WHICH FAILS OFF WILL RESULT IN LOWER TEMPERATURE WATER BEING INTRODUCED INTO THE TOPPING EVAPORATOR AND POSSIBLE IN THE FEEDLINE. WORST CASE IS A LOSS OF THE TOPPING EVAPORATOR WHICH MEANS A MINIMUM DURATION FLIGHT.

REFERENCES: VS70-960102 (60FH, 60FL), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-190
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/02/87
SUBSYSTEM: ATCS
MDAC ID: 3032

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: FES TOPPING FEEDLINE HEATER THERMOSTAT
FAILURE MODE: FAILS CLOSED - REFLECTING LOW TEMPERATURE

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
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LOCATION: AFT FUSELAGE
PART NUMBER: FDLN A: HTR 1-50V63S44, HTR2-50V63S46; FDLN B: HTR 1-50V63S48, HTR 2-50V63S50

CAUSES: LOSS OF INPUT, MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
A THERMOSTAT FAILING REFLECTING A LOW TEMPERATURE IS EQUIVALENT TO A HEATER FAILING ON. THE RESULT WILL BE AN OVERTEMP SITUATION AND LOSS OF THE HEATER DUE TO UNAVAILABILITY OF THE HEATER CONTROL. WORST CASE RESULTS IN THE LOSS OF THE TOPPING EVAPORATOR AND A MINIMUM DURATION FLIGHT.

REFERENCES: VS70-960102 (60FH, 60FL), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-191
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/02/87
SUBSYSTEM: ATCS
MDAC ID: 3033

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: FES TOPPING FEEDLINE HEATER THERMOSTAT
FAILURE MODE: FAILS OPEN - REFLECTING HIGH TEMPERATURE

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
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LOCATION: AFT FUSELAGE
PART NUMBER: FDLN A: HTR 1-50V63S44; HTR 2-50V63S46. FDLN B: HTR 1-50V63S48; HTR 2-50V63S50.

CAUSES: LOSS OF INPUT, MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
A THERMOSTAT FAILED REFLECTING A HIGH TEMPERATURE IS EQUIVALENT TO A HEATER FAILING OFF. THE RESULT WILL BE AN UNDETERMTEMP SITUATION WITH A LOWER TEMPERATURE FLUID BEING DELIVERED TO THE TOPPING EVAPORATOR, POSSIBLE ICING IN EITHER THE FEEDLINE OR THE NOZZLE AND LOSS OF THE TOPPING EVAPORATOR.

REFERENCES: VS70-960102 (60FH, 60FL), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-192
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/02/87
SUBSYSTEM: ATCS
MDAC ID: 3034

ITEM: FES TOPPING FEEDLINE HEATER TEMPERATURE SENSOR
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR

CRITICALITIES

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: AFT FUSELAGE

CAUSES: ERRONEOUS INPUT, MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
ERRONEOUS OUTPUT FROM THE TEMPERATURE SENSOR WILL RESULT IN INCORRECT DATA BEING DISPLAYED ON SM DISPLAY AND SPURIOUS ALARMS. CREW/GROUND MALFUNCTION PROCEDURES CAN ISOLATE THE PROBLEM TO A FAILED SENSOR WITH NO IMPACT ON FUTURE OPERATIONS.

REFERENCES: VS70-960102 (60FH, 60FQ, 60FJ), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87  C-193
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/03/87
SUBSYSTEM: ATCS
MDAC ID: 3035

HIGHEST CRITICALITY

FLIGHT: 3/2R
ABORT: 3/2R

ITEM: TOPPING EVAPORATOR WATER VALVE ASSEMBLY-40 MICRON FILTER
FAILURE MODE: RESTRICTED FLOW

LEAD ANALYST: S.K. SINCLAIR

SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
4)
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9)

ACTIVITIES

CRITICALITIES

FLIGHT PHASE
PRELAUNCH: /NA
LIFTOFF: 3/2R
ONORBIT: 3/2R
DEORBIT: 3/2R
LANDING/SAFING: /NA

HDW/FUNC
RTLS: 3/3
TAL: 3/3
AOA: 3/3
ATO: 3/2R

ABORT

HDW/FUNC

REFERENCES: JSC-19935

REPORT DATE 11/24/87 C-194
INDEPENDENT ORBITER ASSESSMENT
ORBiter SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/03/87
SUBSYSTEM: ATCS
MDAC ID: 3036

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

ITEM: TOPPING EVAPORATOR ISOLATION VALVE
FAILURE MODE: FAILS OPEN

LEAD ANALYST: S.K. SINCLAIR SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, PIECE-PART STRUCTURAL, VIBRATION

EFFECTS/RATIONALE:
THE TOPPING EVAPORATOR ISOLATION VALVE REMAINS OPEN DURING ALL TOPPING EVAPORATOR OPERATIONS. THIS HAS NO AFFECT ON FUTURE OPERATIONS SINCE "OPEN" IS THE NORMAL POSITION OF THE VALVE DURING OPERATIONS.

REFERENCES: VS70-960102 (60FH, 60FJ), JSC-19935, SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-195
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/03/87
SUBSYSTEM: ATCS
MDAC ID: 3037

HIGHEST CRITICALITY
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: TOPPING EVAPORATOR ISOLATION VALVE
FAILURE MODE: FAILS CLOSED

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
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CRITICALITIES

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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: LOSS OF INPUT, MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:

REFERENCES: VS70-960102 (60FH, 60FJ), JSC-19935

REPORT DATE 11/24/87 C-196
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/03/87

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

SUBSYSTEM: ATCS
MDAC ID: 3038

ITEM: TAPPING EVAPORATOR INTEGRAL PULSER/SHUTOFF

FAILURE MODE: PULSER FAILS CLOSED

LEAD ANALYST: S.K. SINCLAIR

SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR

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LOCATION: AFT FUSELAGE

PART NUMBER:

CAUSES: LOSS OF INPUT, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
THE PULSER VALVE FAILING CLOSED IN THE TOPPING EVAPORATOR MEANS LOSS OF THAT FEEDLINE/NOZZLE COMBINATION. BOTH PULSER VALVES FAILING CLOSED MEANS LOSS OF THE TOPPING EVAPORATOR AND A MINIMUM DURATION FLIGHT.

REFERENCES: VS70-960102 (60FH, 60FL), JSC-19935, SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-197
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/03/87
SUBSYSTEM: ATCS
MDAC ID: 3039

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: TOPPING EVAPORATOR INTEGRAL PULSER/SHUTOFF
VALVE/NOZZLE
FAILURE MODE: PULSER FAILS OPEN

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES:

EFFECTS/RATIONALE:
SINCE THE TOPPING ISOLATION VALVE REMAINS OPEN DURING ALL TOPPING EVAPORATOR OPERATIONS, THE PULSER/SHUTOFF VALVE FAILING OPEN WILL RESULT IN A LARGE AMOUNT OF WATER BEING INTRODUCED INTO THE EVAPORATOR CORE. THIS MEANS POSSIBLE ICING IN THE CORE/EXIT DUCT, LOSS OF THE TOPPING EVAPORATOR AND AN MDF.

REFERENCES: VS70-960102 (60FH, 60FL), JSC-19935, SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-198
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 3040

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: TOPPING EVAPORATOR INTEGRAL PULSER/SHUTOFF
VALVE/NOZZLE
FAILURE MODE: RESTRICTED FLOW IN NOZZLE

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
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CRITICALITIES

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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: CONTAMINATION, TEMPERATURE

EFFECTS/RATIONALE:
LOSS OF THE INPUT NOZZLE TO THE TOPPING EVAPORATOR MEANS POSSIBLE LOSS OF THE TOPPING EVAPORATOR IF BOTH NOZZLES ARE LOST. BY FLIGHT RULES, THIS MEANS A MINIMUM DURATION FLIGHT. BY THE MISSION SPECIFIC GUIDELINES, IT ALSO MEANS A LOSS OF MISSION DUE TO REQUIRED ATTITUDE AND POWER LEVEL CHANGES.

REFERENCES: VS70-960102 (60FH, 60FL), JSC-19935, SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87  C-199
INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET  

DATE: 6/09/87  
SUBSYSTEM: ATCS  
MDAC ID: 3041  

HIGHEST CRITICALITY  HDW/FUNC  
FLIGHT: 3/2R  
ABORT: 3/2R  

ITEM: TOPPING EVAPORATOR FEEDLINE  
FAILURE MODE: NO FLOW  

LEAD ANALYST: S.K. SINCLAIR  
SUBSYS LEAD: W.E. PARKMAN  

BREAKDOWN HIERARCHY:  
1) ACTIVE THERMAL CONTROL SYSTEM  
2) FLASH EVAPORATOR SYSTEM  
3) TOPPING EVAPORATOR  

CRITICALITIES  

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LOCATION: AFT FUSELAGE  
PART NUMBER:  

CAUSES: CONTAMINATION, TEMPERATURE  

EFFECTS/RATIONALE:  
IF BOTH FEEDLINES ARE BLOCKED, NO FLOW THRU THE TOPPING EVAPORATOR FEEDLINE WILL RESULT IN A LOSS OF THE TOPPING EVAPORATOR. LOSS OF THE TOPPING EVAPORATOR MEANS A MINIMUM DURATION FLIGHT.  

REFERENCES: VS70-960102 (60FH), SSSH 7.3 SHEET 1 OF 2  

REPORT DATE 11/24/87  
C-200
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/09/87
SUBSYSTEM: ATCS
MDAC ID: 3042

ITEM: TOPPING EVAPORATOR FEEDLINE
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: S.K. SINCLAIR        SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR

CRITICALITIES

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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: MISHANDLING/ABUSE, PIECE-PART STRUCTURAL, VIBRATION

EFFECTS/RATIONALE:
LEAKAGE FROM THE TOPPING EVAPORATOR FEEDLINE INTO THE AFT FUSELAGE COMPARTMENT WILL RESULT, WORST CASE, IN A LOSS OF THE TOPPING EVAPORATOR. LOSS OF THE TOPPING EVAPORATOR MEANS A MINIMUM DURATION FLIGHT.

REFERENCES: VS70-960102 (60FH), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87         C-201
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/09/87

SUBSYSTEM: ATCS
MDAC ID: 3043

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: TOPPING EVAPORATOR ISOLATION VALVE
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
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CRITICALITIES

FLIGHT PHASE HDW/FUNC ABORT HDW/FUNC
PRELAUNCH: /NA RTLS: 3/3
LIFTOFF: 3/2R TAL: 3/3
ONORBIT: 3/2R AOA: 3/3
DEORBIT: 3/2R ATO: 3/2R
LANDING/SAFING: /NA


LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, PIECE-PART STRUCTURAL, TEMPERATURE, VIBRATION

EFFECTS/RATIONALE:
LEAKAGE FROM THE ISOLATION VALVE INTO THE AFT FUSELAGE. THIS RESULTS, WORST CASE, IN A MINIMUM DURATION FLIGHT DUE TO LOSS OF THE TOPPING EVAPORATOR.

REFERENCES: SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-202
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/09/87
SUBSYSTEM: ATCS
MDAC ID: 3044

HIGHEST CRITICALITY
HDW/FUNC

FLIGHT: 3/2R
ABORT: 3/2R

ITEM: TOPPING EVAPORATOR INTEGRAL PULSER/SHUTOFF
VALVE/NOZZLE
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: S.K. SINCLAIR	SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
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LOCATION:
PART NUMBER:

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, PIECE-PART STRUCTURAL, TEMPERATURE, VIBRATION

EFFECTS/RATIONALE:
LEAKAGE FROM THE VALVE INTO THE AFT FUSELAGE RESULTING IN A LOSS OF THE TOPPING EVAPORATOR AND A MINIMUM DURATION FLIGHT.

REFERENCES: SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-203
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 3045

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: TOPPING EVAPORATOR WATER VALVE/NOZZLE MOUNTING PLATE
FAILURE MODE: NO FLOW OF FREON

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
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LOCATION: AFT FUSELAGE

PART NUMBER:

CAUSES: CONTAMINATION, MECHANICAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
The mounting plate is a pin fin heat exchanger which serves to maintain a sufficiently high temperature to prevent freezing of the nozzles. Restricted flow of freon could allow freeze-up and loss of the evaporator. Loss of the topping evaporator requires a minimum duration flight.

REFERENCES: JSC-19935

REPORT DATE 11/24/87 C-204
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 3046

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

ITEM: TOPPING EVAPORATOR WATER VALVE/NOZZLE MOUNTING PLATE
FAILURE MODE: LEAK BETWEEN WATER/FREON

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
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CRITICALITIES

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LOCATION: AFT FUSELAGE

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
A LEAK BETWEEN THE WATER AND FREON IN THE TOPPING EVAPORATOR WATER VALVE/NOZZLE MOUNTING PLATE WILL RESULT IN A PRIORITY FLIGHT, BY FLIGHT RULES. LOSS OF THE FREON LOOP COMBINED WITH EITHER A LOSS OF THE HIGH LOAD EVAPORATOR OR LOSS OF THE SECOND FREON LOOP CAN MEAN A LOSS OF CREW/VEHICLE.

REFERENCES: JSC-19935

REPORT DATE 11/24/87 C-205
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 3047

ITEM: TOPPING EVAPORATOR WATER VALVE/NOZZLE MOUNTING PLATE
FAILURE MODE: STRUCTURAL FAILURE (RUPTURE)

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR

CRITICALITIES

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: PIECE-PART STRUCTURAL, MECHANICAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
A STRUCTURAL FAILURE OF THE WATER VALVE/NOZZLE PLATE WOULD RESULT IN A TOTAL LOSS OF THE TOPPING EVAPORATOR AND A BREAK IN THE FREON COOLANT LOOP. THIS MEANS A LOSS OF THE TWO FREON LOOPS.

REFERENCES: JSC-19935

REPORT DATE 11/24/87 C-206
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 3048

ITEM: TOPPING EVAPORATOR CORE
FAILURE MODE: INTERNAL LEAKAGE OF FREON

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
A INTERNAL LEAK OF FREON INTO THE TOPPING EVAPORATOR CORE RESULTS IN A LEAK BETWEEN DISSIMILAR FLUIDS AND A PRIORITY FLIGHT. IF LEAK CAUSES LOSS OF THE FREON LOOP, THEN LOSS OF CREW/VEHICLE CAN RESULT WITH A SUBSEQUENT FAILURE OF EITHER THE SECOND FREON LOOP OR THE HIGH LOAD EVAPORATOR.

REFERENCES: VS70-960102 (60FH), JSC-19935, SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87  C-207
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 2/2
MDAC ID: 3049  ABORT: 2/2

ITEM: TOPPING EVAPORATOR CORE
FAILURE MODE: RESTRICTED FLOW (WATER)

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: AFT FUSELAGE

PART NUMBER:

CAUSES: ICING, TEMPERATURE, THERMAL SHOCK

EFFECTS/RATIONALE:
ICING WITHIN THE TOPPING EVAPORATOR RESULTS IN THE LOSS OF THE TOPPING EVAPORATOR AND PROBABLE LOSS OF MISSION DUE TO ATTITUDE AND POWER LEVEL ADJUSTMENTS.

REFERENCES: VS70-960102 (60FH), JSC-19935, SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87  C-208
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/08/87
HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS
FLIGHT: 3/3
MDAC ID: 3050
ABORT: 3/3

ITEM: TOPPING EVAPORATOR ANTI CARRYOVER DEVICE
FAILURE MODE: RESTRICTED FLOW OF FREON

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: CONTAMINATION, MISHANDLING/ABUSE

EFFECTS/RATIONALE:
THE ACOD IS A PIN FIN TYPE HEAT EXCHANGER WHICH REDUCES THE PERCENTAGE OF WATER DROPLETS IN THE EXIT DUCT BY PROVIDING AN ADDITIONAL HOT SURFACE FOR EVAPORATION. A FAILURE WHICH RESULTS IN NO FLOW OF FREON THRU THE ACOD WOULD MEAN MORE WATER DROPS IN THE EXIT DUCT.

REFERENCES: VS70-960102 (60FH), JSC-19935

REPORT DATE 11/24/87 C-209
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/08/87

SUBSYSTEM: ATCS
MDAC ID: 3051

ITEM: TOPPING EVAPORATOR ANTI CARRYOVER DEVICE
FAILURE MODE: INTERNAL LEAKAGE OF FREON

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
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LOCATION: AFT FUSELAGE

PART NUMBER:

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, PIECE-PART STRUCTURAL, VIBRATION

EFFECTS/RATIONALE:
INTERNAL LEAKAGE OF FREON FROM THE ACOD RESULTS IN A LEAK BETWEEN DISSIMILAR FLUIDS AND A PRIORITY FLIGHT. IF LEAK CAUSES LOSS OF THE FREON LOOP, A SUBSEQUENT LOSS OF EITHER THE SECOND FREON LOOP OR THE HIGH LOAD EVAPORATOR CAN RESULT IN THE LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH), JSC-19935

REPORT DATE 11/24/87 C-210
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/08/87  
SUBSYSTEM: ATCS  
MDAC ID: 3052  

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

ITEM: TOPPING EVAPORATOR ANTI CARRYOVER DEVICE
FAILURE MODE: STRUCTURAL FAILURE (RUPTURE)

LEAD ANALYST: S.K. SINCLAIR  
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL, THERMAL SHOCK

EFFECTS/RATIONALE:
A COMPLETE STRUCTURAL LOSS OF THE ACOD MEANS LOSS OF THE TOPPING EVAPORATOR AND A LEAK WITHIN THE FREON LOOP SYSTEM.

REFERENCES: VS70-960102 (60FH), JSC-19935
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/08/87

HIGHEST CRITICALITY

SUBSYSTEM: ATCS

HDW/FUNC

MDAC ID: 3053

FLIGHT: 2/2

ABORT: 2/2

ITEM: TOPPING EVAPORATOR EXIT DUCT

FAILURE MODE: RESTRICTED FLOW (WATER)

LEAD ANALYST: S.K. SINCLAIR

SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:

1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: AFT FUSELAGE

PART NUMBER:

CAUSES: CONTAMINATION, MISHANDLING/ABUSE, THERMAL SHOCK

EFFECTS/RATIONALE:

RESTRICTED FLOW WITHIN THE TOPPING EVAPORATOR EXIT DUCT WILL MEAN, WORST CASE, A COMPLETE LOSS OF THE TOPPING EVAPORATOR. LOSS OF THE TOPPING EVAPORATOR MEANS A MINIMUM DURATION FLIGHT.

REFERENCES: VS70-960102 (60FH), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-212
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/08/87
SUBSYSTEM: ATCS
MDAC ID: 3054

ITEM: TOPPING EVAPORATOR EXIT DUCT
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR

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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL, VIBRATION

EFFECTS/RATIONALE:
EXTERNAL LEAKAGE OF STEAM FROM THE TOPPING EVAPORATOR EXIT DUCT WILL RESULT IN MOISTURE BEING INTRODUCED INTO THE AFT FUSELAGE. IF ALL COMPONENTS IN THE FUSELAGE ARE ADEQUATELY SEALED AND PROTECTED, THIS WILL NOT CAUSE ANY ADDITIONAL PROBLEMS. HOWEVER, IF THE MOISTURE CAN REACH AVIONICS BAY OR WIDE BUNDLES, NUMEROUS ELECTRICAL PROBLEMS CAN OCCUR. WORST CASE WILL RESULT IN THE TOPPING EVAPORATOR BEING DISABLED TO ELIMINATE THE SOURCE OF THE STEAM AND A MINIMUM DURATION MISSION.

REFERENCES: VS70-960102 (60FH), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-213
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/08/87

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

SUBSYSTEM: ATCS
MDAC ID: 3055

ITEM: TOPPING EVAPORATOR - EXIT DUCT - ZONE D, E, F, AND H HEATERS
FAILURE MODE: FAILS OFF

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
4) EXIT DUCT
5) HEATERS
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LOCATION: AFT FUSELAGE
PART NUMBER: 50V63HR30, 31, 32, 33

CAUSES: LOSS OF INPUT, MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
A HEATER FAILED OFF WILL MEAN THE LOSS OF THAT HEATER SYSTEM OVER THE ENTIRE TOPPING EVAPORATOR EXIT DUCT. LOSS OF ALL REDUNDANT HEATERS ON THE TOPPING EVAPORATOR EXIT DUCT WILL MEAN LOSS OF THE DUCT, LOSS OF THE EVAPORATOR, AND A MINIMUM DURATION FLIGHT.

REFERENCES: VS70-960102 (60FH, 60FN), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-214
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/08/87
SUBSYSTEM: ATCS
MDAC ID: 3056

ITEM: H THERMOSTATS
FAILURE MODE: TOPPING EVAPORATOR - EXIT DUCT - ZONE D, E, F, AND
FAILS CLOSED - REFLECTING LOW TEMPERATURE

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
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LOCATION: AFT FUSELAGE
PART NUMBER: CONTROLLERS FOR 50V63HR30, 31, 32, AND 33

CAUSES:

EFFECTS/RATIONALE:
A THERMOSTAT FAILED REFLECTING A LOW TEMPERATURE IS EQUIVALENT TO
A HEATER FAILED ON. THIS FAILURE WILL RESULT IN THE FAILURE OF
ALL HEATERS ON THE SAME SYSTEM.

REFERENCES: VS70-960102 (60FH, 60FN), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/08/87
SUBSYSTEM: ATCS
MDAC ID: 3057

ITEM: TOPPING EVAPORATOR - EXIT DUCT - ZONE D, E, F, AND H THERMOSTATS
FAILURE MODE: FAILS OPEN - REFLECTING HIGH TEMPERATURE

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR

CRITICALITIES

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LOCATION: AFT FUSELAGE
PART NUMBER: CONTROLLERS FOR 50V63HR30, 31, 32, AND 33

CAUSES: LOSS OF INPUT, MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
A THERMOSTAT FAILED REFLECTING A HIGH TEMPERATURE IS EQUIVALENT TO A HEATER FAILED OFF. A LOSS OF ALL REDUNDANT HEATERS ON THE EXIT DUCT WILL MEAN LOSS OF THE TOPPING EVAPORATOR AND A MINIMUM DURATION FLIGHT.

REFERENCES: VS70-960102 (60FH, 60FN), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-216
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/08/87
SUBSYSTEM: ATCS
MDAC ID: 3058

ITEM: TOPPING EVAPORATOR - EXIT DUCT - ZONE D, E, F, AND H TEMPERATURE MONITOR
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR

CRITICALITIES

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REDUNDANCY SCREENS:  A [ ]  B [ ]  C [ ]

LOCATION: AFT FUSELAGE
PART NUMBER: 50V63MT34, 35, 15A, 16A (V62T1801A, 1802A, 1800A, 1810A)

CAUSES: ERRONEOUS INPUT, LOSS OF INPUT, MECHANICAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
A MONITOR GIVING AN ERRONEOUS OUTPUT WILL GIVE ERRONEOUS INFORMATION ON SM DISPLAYS AND IN DOWNLINK DATA. THE CREW/GROUND CAN ISOLATE THE PROBLEM TO A FAILED SENSOR THRU MALFUNCTION PROCEDURES WITH NO FURTHER IMPACT ON OPERATIONS.

REFERENCES: VS70-960102 (60FH, 60FP), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87  C-217
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/09/87
SUBSYSTEM: ATCS
MDAC ID: 3059

ITEM: TOPPING EVAPORATOR - EXIT DUCT ZONE F AND H
OVERTEMP THERMOSTAT
FAILURE MODE: FAILS TO OPEN

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
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LOCATION:  AFT FUSELAGE
PART NUMBER:

CAUSES: ERRONEOUS INPUT, LOSS OF INPUT, MISHANDLING/ABUSE

EFFECTS/RATIONALE:
The failure of the overtemp thermostat to open will result in a temperature in excess of 285-295 degree F. Note: In order for this situation to occur, a double failure must have happened - the controlling thermostat must have failed closed, the overtemp thermostat must have failed to open, and the monitoring/annunciation system must be outputting erroneous information so that the overtemp condition was not recognized. The end result will still be the operational loss of all heaters on the failed system.

REFERENCES:  VS70-960102 (60FH, 60FN), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87  C-218
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/09/87
SUBSYSTEM: ATCS
MDAC ID: 3060

HIGHEST CRITICALITY
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: TOPPING EVAPORATOR - RH AND LH SONIC NOZZLES
FAILURE MODE: RESTRICTED FLOW

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR

CRITICALITIES

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LOCATION: AFT FUSELAGE
PART NUMBER: 50V63TP227, 228

CAUSES: CONTAMINATION, TEMPERATURE

EFFECTS/RATIONALE:
LOSS OF ONE TOPPING EVAPORATOR EXIT DUCT WOULD AFFECT ORBIT ATTITUDE, DUE TO A NONBALANCED PROPELLIVE FORCE. THIS WILL MEAN LOSS OF THE TOPPING EVAPORATOR AND A MINIMUM DURATION FLIGHT.

REFERENCES: VS70-960102, SSSH 7.3 SHEET 1 OF 2, JSC-19935
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/09/87
SUBSYSTEM: ATCS
MDAC ID: 3061

ITEM: TOPPING EVAPORATOR - RH AND LH SONIC NOZZLE
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
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LOCATION: AFT FUSELAGE
PART NUMBER: 50V63TP227, 228

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
EXTERNAL LEAKAGE FROM THE SONIC NOZZLE WITHIN THE VEHICLE ENVELOPE MEANS MOISTURE BEING INTRODUCED INTO THE AFT FUSELAGE COMPARTMENT. IF THE AVIONICS AREAS AND WIRE BUNDLES ARE ADEQUATELY SEALED, THEN THE MOISTURE SHOULD NOT CAUSE ANY ADDITIONAL PROBLEMS. HOWEVER, MOISTURE INTRODUCED INTO AN UNSEALED ENVIRONMENT COULD CAUSE NUMEROUS ELECTRICAL PROBLEMS. ONCE A LEAK IN THE NOZZLE HAS BEEN CONFIRMED, THE TOPPING EVAPORATOR SHOULD BE SHUT OFF.

REFERENCES: VS70-960102 (60FH), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87  C-220
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/09/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/2R
MDAC ID: 3062  ABORT: 3/2R

ITEM: TOPPING EVAPORATOR - RH AND LH NOZZLE HEATER ZONE
G AND I
FAILURE MODE: FAILS OFF

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
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LOCATION: AFT FUSELAGE
PART NUMBER: 50V63A17, 50V63A18

CAUSES: ERRONEOUS INPUT, LOSS OF INPUT, MISHANDLING/ABUSE

EFFECTS/RATIONALE:
A HEATER WHICH FAILS OFF WILL RESULT IN AN UNDERTEMP CONDITION. THE SECONDARY HEATER IS STILL AVAILABLE FOR USE. HOWEVER, IF BOTH HEATERS ARE LOST, THE NOZZLE IS ALSO CONSIDERED LOST AS IS THE TOPPING EVAPORATOR. LOSS OF THE TOPPING EVAPORATOR WILL RESULT IN A MINIMUM DURATION FLIGHT.

REFERENCES: VS70-960102 (60FH, 60FN), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87  C-221
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/09/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/2R
MDAC ID: 3063  ABORT: 3/2R

ITEM: TOPPING EVAPORATOR - RH AND LH NOZZLE ZONE G AND I
HEATER CONTROLLERS
FAILURE MODE: FAILS REFLECTING HIGH TEMPERATURE

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: ERRONEOUS INPUT, ELECTROMAGNETIC FIELDS, LOSS OF INPUT, VIBRATION

EFFECTS/RATIONALE:
THE HEATER CONTROL CIRCUIT FOR THE TOPPING EVAPORATOR NOZZLE
CONSISTS OF A TEMPERATURE SENSOR, A RESISTANCE BRIDGE, AND A
CONTROLLER. ANY ITEM IN THAT CIRCUIT ("THE BLACK BOX") WHICH
Fails SO THAT IT APPEARS THE TEMPERATURE IS ALWAYS OVER THE UPPER
LIMIT WILL PRODUCE THE SAME RESPONSE AS HAVING THE HEATER FAILED
TOPPING EVAPORATOR. LOSS OF THE TOPPING EVAPORATOR MEANS A MINIMUM DURATION FLIGHT.

REFERENCES: VS70-960102 (60FH, 60FN), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87  C-222
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/09/87
SUBSYSTEM: ATCS
MDAC ID: 3064

ITEM: TOPPING EVAPORATOR - RH AND LH NOZZLE ZONE G AND I
FAILURE MODE: FAILS REFLECTING LOW TEMPERATURE

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR

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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: ERRONEOUS INPUT, ELECTROMAGNETIC FIELDS, LOSS OF INPUT, VIBRATION

EFFECTS/RATIONALE:
THE HEATER CONTROL CIRCUIT FOR THE TOPPING EVAPORATOR NOZZLE CONSISTS OF A TEMPERATURE SENSOR, A RESISTANCE BRIDGE, AND A CONTROLLER. ANY ITEM IN THE CIRCUIT WHICH FAILS SUCH THAT THE TEMPERATURE IS ALWAYS SHOWN TO BE BELOW THE LOWER LIMIT WILL HAVE THE SAME EFFECT AS FAILING A HEATER ON.

REFERENCES: VS70-960102 (60FH, 60FN), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87  C-223
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/09/87
HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS
FLIGHT: 3/3
MDAC ID: 3065
ABORT: 3/3

ITEM: TOPPING EVAPORATOR - RH AND LH NOZZLE TEMPERATURE MONITORS - ZONES G AND I
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) TOPPING EVAPORATOR
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: AFT FUSELAGE
PART NUMBER: 50V63MT27, 26A (V63T1879A, 1878A)

CAUSES: ERRONEOUS INPUT, LOSS OF INPUT

EFFECTS/RATIONALE:
SENSORS GIVING ERRONEOUS DATA CAN BE DETERMINED BY CREW/GROUND MALFUNCTION PROCEDURES WITH NO IMPACT ON FUTURE OPERATIONS.

REFERENCES: VS70-960102 (60FH, 60FP), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-224
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/01/87
HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS
MDAC ID: 3066
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: FES FEEDLINE A/B FROM WATER SUPPLY TO VALVE/WATER
NOZZLE ASSEMBLIES
FAILURE MODE: NO FLOW (RESTRICTED FLOW)

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) FEEDLINE/SUPPLY SYSTEM
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LOCATION: FORWARD/MID/AFT FUSELAGE
PART NUMBER:

CAUSES: CONTAMINATION, BLOCKAGE, MISHANDLING/ABUSE

EFFECTS/RATIONALE:
FES FEEDLINES A AND B TRANSPORT WATER FROM THE POTABLE WATER SUPPLY TANKS TO THE FLASH EVAPORATORS. NO FLOW THRU FEEDLINE A WILL MEAN FEEDLINE B MUST BE USED. IF FEEDLINE B THEN FAILS, THE RESULT WILL BE THE LOSS OF BOTH FLASH EVAPORATORS AND BY FLIGHT RULES, ENTRY AT NEXT PRIMARY LANDING SITE GO/NO GO POINT. LOSS OF ALL FES COOLING COMBINED WITH A LOSS OF ONE FREON LOOP CAN RESULT IN THE LOSS OF CREW/VEHICLE. SCREEN B IS NOT APPLICABLE BECAUSE THE TWO FEEDLINES ARE "STANBY REDUNDANT" TO EACH OTHER, THEREBY NOT REQUIRING SCREEN B TO BE APPLIED.

REFERENCES: VS70-960102 (60FH, 60FJ), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87
C-225
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/01/87
SUBSYSTEM: ATCS
MDAC ID: 3067

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ITEM: FES FEEDLINE A/B FROM WATER SUPPLY TO WATER/VALVE NOZZLE ASSEMBLIES
FAILURE MODE: LEAKAGE

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) FEEDLINE/SUPPLY SYSTEM
4)...

CRITICALITIES

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LOCATION: FORWARD/MID/AFT FUSELAGE

PART NUMBER:

CAUSES: MECHANICAL SHOCK, VIBRATION, MISHANDLING/ABUSE

EFFECTS/RATIONALE:
A LEAK IN FEEDLINE B CAN BE CONTAINED BY CLOSING THE B SUPPLY ISOLATION VALVE. THIS HAS NO IMPACT ON MISSION SUCCESS OR FAILURE. HOWEVER, A LEAK IN FEEDLINE A REQUIRES THE SUPPLY WATER CROSS-OVER VALVE PLUS SUPPLY WATER TANKS A AND B OUTLET VALVES BE CLOSED. THIS ELIMINATES THE WATER DUMP CAPABILITY AND THE ABILITY TO RECHARGE THE EMU. IT ALSO ALLOWS ONLY TWO WATER TANKS TO BE USED DURING ENTRY. THE LEAK IN FEEDLINE A IS A DEFINITE MISSION IMPACT. LEAKS IN BOTH FEEDLINES ELIMINATE ALL METHODS OF GETTING RID OF EXCESS WATER EXCEPT FOR THE FUEL CELL WATER VENT. LOSS OF THIS FINAL, UNLIKE REDUNDANCY WOULD MEAN FLOODING OF THE FUEL CELLS.

REFERENCES: VS70-960102 (60FH, 60FJ), SSSH 6.4 SHEET 1 OF 1, SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-226
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/12/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/1R
MDAC ID: 3068  ABORT: 3/1R

ITEM: FES FEEDLINE HEATERS
FAILURE MODE: LOSS OF OUTPUT, NO HEAT

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) FEEDLINE/SUPPLY SYSTEM
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LOCATION: FORWARD/MID/AFT FUSELAGE
PART NUMBER: FDLN A: 40V63HR7-14; 50V63HR15, 16, 35  FDLN B: 40V63HR17-24; 50V63HR25, 26, 41

CAUSES: LOSS OF INPUT, MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
WITHIN EACH FEEDLINE, THERE ARE TWO REDUNDANT HEATERS. LOSS OF BOTH HEATERS CAN RESULT IN A LINE FREEZE-UP AND NO FLOW THRU THE FEEDLINE. NO FLOW THRU THE FEEDLINE WILL RESULT IN ENTRY AT NEXT PRIMARY LANDING SITE IF BOTH FEEDLINES ARE LOST. LOSS OF BOTH FEEDLINES MEANS LOSS OF FES WHICH WHEN COMBINED WITH LOSS OF ONE FREON LOOP MAY RESULT IN THE LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH, 60FJ, 60FL), SSSH 7.3 SHEET 1 OF 2
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/12/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/2R
MDAC ID: 3069  ABORT: 3/2R

ITEM: FES FEEDLINE FORWARD HEATER THERMOSTATS
FAILURE MODE: FAILS REFLECTING LOW TEMPERATURE

LEAD ANALYST: S.K. SINCLAIR    SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) FEEDLINE/SUPPLY SYSTEM
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LOCATION: FORWARD/MID/AFT FUSELAGE
PART NUMBER: FDLN A: 40V63S5-10; 50V63S2, 5, 45, 47  FDLN B:
40V63S11-16; 50V63S3, 4, 49, 51

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
THE THERMOSTAT FAILING IN A LOW TEMPERATURE MODE WILL FAIL THE
HEATER ON. THIS WILL EVENTUALLY RESULT IN AN OVERTEMPERATURE
SITUATION AND AN SM ALERT. THIS FAILURE WILL RESULT IN THE LOSS
OF ALL HEATERS ON THE SAME SYSTEM AS THE FAILED THERMOSTAT.

REFERENCES: VS70-960102 (60FH, 60FJ, 60FL), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87   C-228
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/12/87         HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS         FLIGHT: 3/1R
MDAC ID: 3070          ABORT: 3/1R

ITEM: FES FEEDLINE FORWARD HEATER THERMOSTATS
FAILURE MODE: FAILS REFLECTING HIGH TEMPERATURE

LEAD ANALYST: S.K. SINCLAIR       SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) FEEDLINE/SUPPLY SYSTEM
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LOCATION: FORWARD/AFT/MID FUSELAGE
PART NUMBER: FDLN A: 40V63S5-10; 50V63S2, 5, 45, 47  FDLN B: 40V63S11-16; 50V63S3, 4, 49, 51

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
HEATER WILL REMAIN OFF IF THERMOSTAT FAILED IN A MODE REFLECTING HIGH TEMPERATURE. LOSS OF ONE THERMOSTAT WILL RESULT IN THE EFFECTIVE LOSS OF ALL HEATERS ON THE SAME SYSTEM. LOSS OF BOTH HEATER SYSTEMS ON THE SAME FEEDLINE WILL RESULT IN THE LOSS OF THAT FEEDLINE AND LOSS OF BOTH FEEDLINES WILL RESULT IN THE LOSS OF THE FES. LOSS OF FES COMBINED WITH THE LOSS OF ONE FREON LOOP CAN RESULT IN THE LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH, 60FJ, 60FL), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87   C-229
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/12/87

SUBSYSTEM: ATCS
MDAC ID: 3071

ITEM: FES FEEDLINE TEMPERATURE SENSOR
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) FEEDLINE/SUPPLY SYSTEM
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FORWARD/AFT/MID FUSELAGE
PART NUMBER: MSIDs: V63T1870A-77A, 92A, 94A
FDLN A: 40V63MT18, 20, 22, 24; 50V63MT41
FDLN B: 40V63MT19, 21, 23, 25; 50V63MT43

CAUSES: ERRONEOUS INPUT, MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
TEMPERATURE SENSOR WITH AN ERRONEOUS OUTPUT WILL REFLECT INCORRECT DATA ON SM DISPLAYS AND IN SM ALERT STATUSES. CREW/GROUND CAN ISOLATE FAILURE TO A FAILED SENSOR THRU MALFUNCTION PROCEDURES. LOSS WILL NOT AFFECT FUTURE OPERATIONS.

REFERENCES: VS70-960102 (60FH, 60FJ, 60FL), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-230
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/13/87
SUBSYSTEM: ATCS
MDAC ID: 3072

ITEM: FES ACCUMULATOR HEATER
FAILURE MODE: LOSS OF OUTPUT, NO HEAT

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) FEEDLINE/SUPPLY SYSTEM
4) ACCUMULATOR
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LOCATION: AFT FUSELAGE - FES FEEDLINE
PART NUMBER: FDLN A: HTR 1-50V63HR90 CONNECTORS 1 & 2; HTR 2-50V63HR90 CONNECTORS 3 & 4. FDLN B: HTR 1-50V63HR91 CONNECTORS 1 & 2; HTR 2-50V63HR91 CONNECTORS 3 & 4

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
LOSS OF A HEATER IN THE ACCUMULATOR AREA COULD AFFECT ACCUMULATOR OPERATION. LOSS OF BOTH ACCUMULATORS WOULD RESULT IN LOSS OF BOTH FLASH EVAPORATORS AND ENTRY AT NEXT PRIMARY LANDING SITE BY FLIGHT RULES. LOSS OF BOTH FLASH EVAPORATOR COMBINED WITH LOSS OF ONE FREON LOOP MAY MEAN LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH, 60FJ, 60FL), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-231
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/13/87
SUBSYSTEM: ATCS
MDAC ID: 3073

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

ITEM: FES ACCUMULATOR HEATER THERMOSTAT
FAILURE MODE: FAILS REFLECTING HIGH TEMPERATURE

LEAD ANALYST: S.K. SINCLAIR   SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) FEEDLINE/SUPPLY SYSTEM
4) ACCUMULATOR
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LOCATION: AFT FUSELAGE - FES FEEDLINE
PART NUMBER: FDLN A: HTR 1-50V63S40; HTR 2-50V63S48. FDLN B: HTR 1-50V63S45; HTR 2-50V63S43

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
A THERMOSTAT FAILED REFLECTING A HIGH TEMPERATURE MEANS THE HEATER WILL NEVER TURN ON. THIS IS AN EQUIVALENT FAILURE TO HEATER FAILED OFF. LOSS OF A HEATER IN THE ACCUMULATOR AREA COULD AFFECT ACCUMULATOR OPERATION. LOSS OF BOTH ACCUMULATORS WILL MEAN LOSS OF BOTH FLASH EVAPORATORS AND ENTRY AT NEXT PRIMARY LANDING SITE. LOSS OF ALL FES COOLING COMBINED WITH LOSS OF ONE FREON LOOP CAN RESULT IN THE LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH, 60FJ, 60FL), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-232
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/13/87

SUBSYSTEM: ATCS

MDAC ID: 3074

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: FES ACCUMULATOR HEATER THERMOSTAT
FAILURE MODE: FAILS REFLECTING LOW TEMPERATURE

LEAD ANALYST: S.K. SINCLAIR

SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) FEEDLINE/SUPPLY SYSTEM
4) ACCUMULATOR
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LOCATION: AFT FUSELAGE - FEEDLINE ACCUMULATOR

PART NUMBER: FDLN A: HTR 1-50V63S40; HTR 2-50V63S48. FDLN B: HTR 1-50V3S45; HTR 2-50V63S43.

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
THE THERMOSTAT FAILING IN A LOW TEMPERATURE MODE WILL FAIL THE HEATER ON. THIS WILL EVENTUALLY RESULT IN AN OVERTEMPATURE SITUATION, AN SM ALERT, AND EFFECTIVE LOSS OF ALL HEATERS ON THE SAME SYSTEM AS THE FAILED THERMOSTAT.

REFERENCES: VS70-960102 (60FH, 60FJ, 60FL), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-233
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/05/87
SUBSYSTEM: ATCS
MDAC ID: 3075

ITEM: FES ACCUMULATOR TEMPERATURE MONITOR
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) FEEDLINE/SUPPLY SYSTEM
4) ACCUMULATOR
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: AFT FUSELAGE
PART NUMBER: V63T1750A, 50V63MT38 - PRIMARY; V63T1760A, 50V63MT39 - SECONDARY

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
TEMPERATURE SENSOR REFLECTING ERRONEOUS OUTPUT WILL REFLECT INCORRECT DATA ON SM DISPLAYS AND IN SM ALERT STATUSES. CREW/GROUND CAN ISOLATE FAILURE TO A FAILED SENSOR THRU MALFUNCTION PROCEDURES. LOSS WILL NOT AFFECT FUTURE OPERATIONS.

REFERENCES: VS70-960102 (60FH, 60FJ, 60FP), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-234
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/13/87  HIGHEST CRITICALITY
SUBSYSTEM: ATCS               HDW/FUNC
MDAC ID: 3076                FLIGHT: 3/3
                      ABORT: 3/3

ITEM: FES FEEDLINE ACCUMULATOR STATUS MONITOR
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: S.K. SINCLAIR   SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM
3) FEEDLINE/SUPPLY SYSTEM
4) ACCUMULATOR
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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: AFT FUSELAGE
PART NUMBER: PRIMARY-S1-V63X1751E; SECONDARY-V63X1761E

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
SENSOR REFLECTS ONLY IF PRESSURE IS "'OK" OR "NOT OK". ERRONEOUS OUTPUT WILL BE REFLECTED ON SM DISPLAYS AND IN SM ALERTS. PROBLEM CAN BE ISOLATED TO SENSOR FAILURE THRU GROUND/CREW MALFUNCTION PROCEDURES. FAILURE WILL NOT AFFECT FUTURE OPERATIONS.

REFERENCES: VS70-960102 (60FH, 60FJ) SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87      C-235
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/26/87
SUBSYSTEM: ATCS
MDAC ID: 3077

ITEM: FES FEEDLINE ACCUMULATOR
FAILURE MODE: LOSES N2 CHARGE

LEAD ANALYST: S.K. SINCLAIR SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR
3) FEEDLINE SYSTEM
4) ACCUMULATOR

CRITICALITIES

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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE

EFFECTS/RATIONALE:
LOSS OF N2 CHARGE IN ACCUMULATOR CAN CAUSE WATER HAMMER EFFECT IN THE FEEDLINE AND ERRATIC FES OPERATIONS. WORST CASE RESULT OF ERRATIC FES OPERATION WILL BE EFFECTIVE LOSS OF BOTH FLASH EVAPORATORS. LOSS OF ALL FES COOLING COMBINED WITH THE LOSS OF ONE FREON LOOP CAN MEAN THE LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH, 60FJ), SSSH 7.3 SHEET 1 OF 2, JSC FLIGHT RULES

REPORT DATE 11/24/87 C-236
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/26/87
SUBSYSTEM: ATCS
MDAC ID: 3078

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

ITEM: FES FEEDLINE ACCUMULATOR
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR
3) FEEDLINE SYSTEM
4) ACCUMULATOR
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CRITICALITIES

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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
A LEAK IN THE FEEDLINE ACCUMULATOR WILL HAVE THE SAME EFFECT AS A LEAK IN THE FEEDLINE ITSELF AND WILL CAUSE THE FEEDLINE TO BE LOST. LOSS OF BOTH FEEDLINES WILL RESULT IN LOSS OF BOTH FLASH EVAPORATORS AND ENTRY AT NEXT PRIMARY LANDING SITE. LOSS OF ALL FES COOLING COMBINED WITH THE LOSS OF ONE FREON LOOP CAN MEAN THE LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH, 60FJ), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-237
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/22/87

SUBSYSTEM: ATCS
MDAC ID: 3079

ITEM: FES CONTROLLER - SWITCH
FAILURE MODE: FAILS IN "ON"

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROLLER

CRITICALITIES

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: PANEL L1A2
PART NUMBER: PRIMARY A - S31; PRIMARY B - S32; SECONDARY - S33

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
FAILURE OF ANY FES CONTROLLER SWITCH IN THE "ON" POSITION DURING LAUNCH OR DEORBIT ALLOWS THE POSSIBILITY TO EXIST FOR OPERATION AT LOWER THAN DESIRED ALTITUDES. THIS MEANS DAMAGE TO THE EVAPORATOR CORE AND LOSS OF THE EVAPORATOR DURING FUTURE OPERATIONS. THE FAILURE ALSO CONSTRAINS THE SYSTEM TO OPERATION ON THE "FAILED SYSTEM" (ONLY ONE SYSTEM CAN BE ACTIVATED AT A TIME.)

REFERENCES: VS70-960102 (60FG), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87 C-238
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/22/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/1R
MDAC ID: 3080  ABORT: 3/1R

ITEM: FES CONTROLLER - SWITCH
FAILURE MODE: FAILS IN "OFF"

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROLLER

CRITICALITIES

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LOCATION: PANEL L1A2
PART NUMBER: PRIMARY A - S31; PRIMARY B - S32; SECONDARY - S33

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL, VIBRATION

EFFECTS/RATIONALE:
FAILURE OF ANY FES CONTROLLER SWITCH IN THE "OFF" POSITION ELIMINATES THAT SYSTEM FROM FUTURE OPERATIONS. ALL THREE CONTROLLER SWITCHES FAILED TO "OFF" MEANS LOSS OF ALL FLASH EVAPORATORS. LOSS OF ALL FLASH EVAPORATORS FOLLOWED BY A LOSS OF ONE FREON LOOP CAN RESULT IN THE LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FG), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87  C-239
INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/22/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/1R
MDAC ID: 3081  ABORT: 3/1R

ITEM: FES CONTROLLER - SWITCH  FAILURE MODE: FAILS IN "GPC"

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROLLER

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LOCATION: PANEL L1A2
PART NUMBER: PRIMARY A - S31; PRIMARY B - S32; SECONDARY - S33

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL, VIBRATION

EFFECTS/RATIONALE:
DURING LAUNCH AND DEORBIT, FAILURE OF THE FIRST CONTROLLER SWITCH IN GPC HAS NO AFFECTION OPERATIONS. IF MORE THAN ONE SWITCH IS FAILED IN GPC, THEN THE POSSIBILITY EXISTS FOR MORE THAN ONE CONTROLLER TO RECEIVE THE "ON" COMMAND FROM THE BFS. THIS CAN ACTIVATE MULTIPLE NOZZLES AND INTRODUCE TOO MUCH SPRAY INTO THE FES WITH POSSIBLE FREEZING/CORE DAMAGE. DURING ON-ORBIT, THE FAILURE RESULTS IN LOSS OF THAT FES SYSTEM. (GPC COMMANDS ARE SENT BY THE BFS). FREEZING OF BOTH FESs FOLLOWED BY AN INABILITY TO THAW THEM OUT COMBINED WITH LOSS OF ONE FREON LOOP CAN RESULT IN THE LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FG), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87  C-240
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/22/87
HIGHEST CRITICALITY: HDW/FUNC
SUBSYSTEM: ATCS
MDAC ID: 3082
FLIGHT: 3/3
ABORT: 3/3

ITEM: FES CONTROLLER SWITCH STATUS
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROLLER
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CRITICALITIES

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLIGHT DECK

PART NUMBER: PRIMARY A: ON-V63S1610E, GPC-V63S1600E; PRIMARY B:
ON-V63S1660E, GPC-V63S1650E; SECONDARY: ON-V63S1710E, GPC-
V63S1700E

CAUSES: ERRONEOUS INPUT, LOSS OF INPUT

EFFECTS/RATIONALE:
ERRONEOUS INFORMATION ON THE SWITCH STATUS MEANS ERRONEOUS DATA
BEING DISPLAYED IN THE DOWNLINK. NO AFFECTS ON ACTUAL
OPERATIONS.

REFERENCES: VS70-960102 (60FG), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87 C-241
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/22/87
SUBSYSTEM: ATCS
MDAC ID: 3083

ITEM: FES CONTROLLER INPUT DIODES
FAILURE MODE: OPEN (ELECTRICAL)

LEAD ANALYST: S.K. SINCLAIR SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROLLER
4) CONTROL POWER DIODES

CRITICALITIES

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LOCATION: FLIGHT DECK

CAUSES: MECHANICAL SHOCK, MIS HANDLING/ABUSE, PIECE-PART STRUCTURAL, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

REFERENCES: VS70-960102 (60FG), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87 C-242
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/22/87
SUBSYSTEM: ATCS
MDAC ID: 3084

ITEM: FES CONTROLLER INPUT RESISTORS
FAILURE MODE: OPEN (ELECTRICAL)

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROLLER
4) CONTROL RESISTORS

CRITICALITIES

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLIGHT DECK
PART NUMBER: PRIMARY A: A2R2, A3R1; PRIMARY B: A3R5, A2R4; SECONDARY: A3R7, A2R6

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, PIECE-PART STRUCTURAL, THERMAL SHOCK

EFFECTS/RATIONALE:
THESE RESISTORS SERVE AS LOAD LEVELERS OF THE MDM INPUT. FAILING THEM OPEN MEANS ERRONEOUS DATA WILL BE SENT TO THE MDM AND DISPLAYED ON CREW/GROUND DISPLAY. NO EFFECT ON FUTURE FES OPERATIONS.

REFERENCES: VS70-960102 (60FG), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87  C-243
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/22/87
SUBSYSTEM: ATCS
MDAC ID: 3085
HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: FES CONTROL SWITCH INPUT RESISTORS
FAILURE MODE: OPEN (ELECTRICAL)

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROLLER
4) STATUS SIGNAL RESISTORS
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LOCATION: PANEL L1A2

CAUSES: MECHANICAL SHOCK, MISNADLING/ABUSE, PIECE-PART STRUCTURAL, THERMAL SHOCK

EFFECTS/RATIONALE:
THE INPUT RESISTOR FAILING OPEN WILL RESULT IN THE LOSS OF POWER TO ONE COMMAND/SWITCH POSITION ON ONE FES SYSTEM. LOSS OF ALL RESISTORS MEANS THE LOSS OF ALL FES. LOSS OF ALL FES FOLLOWED BY THE LOSS OF ONE FREON LOOP CAN RESULT IN THE LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FG)

REPORT DATE 11/24/87  C-244
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/22/87
SUBSYSTEM: ATCS
MDAC ID: 3086

ITEM: FES CONTROL SWITCH INPUT RESISTORS
FAILURE MODE: SHORTS

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROLLER
4) CONTROL BUS POWER

CRITICALITIES

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLIGHT DECK - PANEL L1A2

CAUSES: MISHANDLING/ABUSE, PIECE-PART STRUCTURAL, THERMAL SHOCK

EFFECTS/RATIONALE:
AN INPUT RESISTOR FAILING IN A "SHORTED" CONDITION MEANS THAT INCORRECT VOLTAGES MAY BE APPLIED ACROSS DOWNSTREAM COMPONENTS. THIS SHOULD HAVE NO EFFECT ON OPERATIONS.

REFERENCES: VS70-960102 (60FG)

REPORT DATE 11/24/87 C-245
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/22/87
SUBSYSTEM: ATCS
MDAC ID: 3087

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

ITEM: FES CONTROLLER POWER APPLICATION COMPONENTS
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROLLER
4) POWER APPLICATION CIRCUIT
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LOCATION: AFT FUSELAGE
PART NUMBER: 10AMP FUSES, PNP TRANSISTORS, NAND GATES - 2 PER CONTROLLER, 5.1K RESISTOR

CAUSES: MISHANDLING/ABUSE, PIECE-PART STRUCTURAL, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

REFERENCES: VS70-960102 (60FG), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87 C-246
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87
SUBSYSTEM: ATCS
MDAC ID: 3088

ITEM: HI-LOAD ENABLE SWITCH
FAILURE MODE: ONE OR MORE CONTACTS STUCK IN "OFF" POSITION

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) HI-LOAD EVAPORATOR
4) ENABLE SWITCH
5) 
6) 
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8) 
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CRITICALITIES

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LOCATION: PANEL L1A2
PART NUMBER: S34

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
Each FES controller receives the "HIGH LOAD OFF" signal from a different set of contacts on the HI-LOAD ENABLE SWITCH. Any or all contacts stuck in "OFF" means the HI-LOAD evaporator cannot be operated on that controller. Loss of all contacts or a mechanical failure of the switch means a total loss of the HI-LOAD evap. (Note: The contrlr does not receive a HI-LOAD ENABLE signal; it simply receives an input that the HI-LOAD EVAP is no longer "OFF"). Screen C fails because a mechanical jam of the switch will eliminate the HI-LOAD from all controllers. Failure is assigned a 2/1R criticality because, worst case, the HI-LOAD EVAP is no longer available, & the next failure (loss of one freon loop) could result in the loss of crew/vehicle.

REFERENCES: VS70-960102 (60FG), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87 C-247
### INDEPENDENT ORBITER ASSESSMENT
### ORBITER SUBSYSTEM ANALYSIS WORKSHEET

**DATE:** 6/23/87  
**SUBSYSTEM:** ATCS  
**MDAC ID:** 3089

**ITEM:** HI-LOAD ENABLE SWITCH  
**FAILURE MODE:** ONE OR MORE CONTACTS NOT MAKING IN "OFF" POSITION

**LEAD ANALYST:** S.K. SINCLAIR  
**SUBSYS LEAD:** W.E. PARKMAN

#### BREAKDOWN HIERARCHY:
1. ACTIVE THERMAL CONTROL SYSTEM
2. FLASH EVAPORATOR SYSTEM EPD&C
3. HI-LOAD EVAPORATOR
4. ENABLE SWITCH
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**Location:** PANEL L1A2  
**Part Number:** S34: PRIMARY A - CONTACT 4; PRIMARY B - CONTACT 7; PRIMARY C - CONTACT 12

**Causes:** CONTAMINATION, MISHANDLING/ABUSE, PIECE-PART STRUCTURAL

#### EFFECTS/RATIONALE:

The circuitry associated with the HI-LOAD ENABLE SWITCH does not reflect the system is enabled, it tells the associated controller that the HI-LOAD EVAP is no longer "OFF". Therefore, loss of one "OFF" contact means the HI-LOAD EVAP will be enabled whenever the CNTRLR associated with that contact is selected. Loss of all "OFF" contacts or a mechanical jam of the switch means the HI-LOAD EVAP will always be enabled. Screen C fails since only one switch is involved, one mechanical jam eliminates all control paths. Constant enable of the HI-LOAD will present a problem during on-orbit phases when water mgmt problems must be addressed or when the spray interferes with payload experiments. During ascent and entry, the HI-LOAD is enabled anyway.

**References:** VS70-960102 (60FG)

**Report Date:** 11/24/87  
**C-248**
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/3
MDAC ID: 3090  ABORT: 3/3

ITEM: HI-LOAD ENABLE SWITCH STATUS
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) HI-LOAD EVAPORATOR
4) ENABLE SWITCH
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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: FLIGHT DECK
PART NUMBER: V63K1620E

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
THIS MEASUREMENT REFLECTS THE HI-LOAD EVAPORATOR SWITCH IS OR IS NOT IN THE ENABLE POSITION. ERRONEOUS OUTPUT OF THIS DATA WILL MEAN INCORRECT DATA IN DISPLAY BUT WILL NOT AFFECT FUTURE OPERATIONS.

REFERENCES: VS70-960102 (60FG)

REPORT DATE 11/24/87  C-249
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87
SUBSYSTEM: ATCS
MDAC ID: 3091

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

ITEM: FES CONTROLLER POWER SUPPLY
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROLLER POWER

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LOCATION: AFT FUSELAGE

CAUSES: MECHANICAL SHOCK, TEMPERATURE, LOSS OF INPUT

EFFECTS/RATIONALE:
THE POWER SUPPLY COMPONENTS FUNCTION TOGETHER TO SUPPLY 9 VOLTS DC TO THE LOGIC CIRCUITS AND 28V DC TO THE VALVE DRIVER CIRCUIT. A FAILURE OF ANY FES CONTROLLER POWER SUPPLY MEANS A LOSS OF THAT CONTROLLER. LOSS OF ALL POWER SUPPLIES MEAN A LOSS OF ALL FES. LOSS OF EITHER THE 9V DC LOGIC POWER OR THE 28V DC VALVE DRIVER IS EQUIVALENT TO A TOTAL LOSS OF THE POWER SUPPLY. FOLLOWING THE LOSS OF ALL FES, A SUBSEQUENT LOSS OF ONE FREON LOOP CAN RESULT IN THE LOSS OF THE CREW/VEHICLE.

REFERENCES: VS70-960102 (60FG)

REPORT DATE 11/24/87 C-250
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/1R
MDAC ID: 3092  ABORT: 3/1R

ITEM: FES PRIMARY CONTROLLER MIDPOINT TEMPERATURE SENSOR
FAILURE MODE: ERRONEOUS OUTPUT-LESS THAN 41 DEGREES F

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROLLER
4) TEMPERATURE INPUTS

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LOCATION: AFT FUSELAGE
PART NUMBER: CONTROLLER A: 807-1; CONTROLLER B: 807-2

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
A CONSTANT OUTPUT OF LESS THAN 41 DEGREES F WILL PREVENT THE
FLASH EVAPORATOR TURNING ON. THIS IS EQUIVALENT TO A LOSS OF THE
CONTROLLER FOR A FAILURE OF ONLY ONE TEMPERATURE SENSOR AND A
LOSS OF ONE FLASH EVAPORATOR IF BOTH PRIMARY TEMPERATURE
SENSORS ARE LOST (THE SECONDARY CONTROLLER WHICH IS STILL
AVAILABLE CAN ONLY OPERATE ONE FES AT A TIME.) HOWEVER, LOSS OF
ALL THREE CONTROLLERS WILL RESULT IN THE LOSS OF ALL FES, WHICH,
WHEN COMBINED WITH THE LOSS OF ONE FREON LOOP CAN RESULT IN THE
LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH, 60FJ), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87  C-251
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87
SUBSYSTEM: ATCS
MDAC ID: 3093

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

ITEM: FES PRIMARY CONTROLLER MIDPOINT TEMPERATURE SENSOR
FAILURE MODE: ERRONEOUS OUTPUT—GREATER THAN 41 DEGREES F BUT LESS THAN 63 DEGREES F

LEAD ANALYST: S.K. SINCLAIR SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROLLER
4) TEMPERATURE INPUTS
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LOCATION: AFT FUSELAGE
PART NUMBER: CONTROLLER A: 807-1; CONTROLLER B: 807-2

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
A SENSOR REFLECTING A TEMPERATURE IN THE RANGE OF 41–63 DEGREES F MEANS THE TOPPING ISOLATION VALVE WILL REMAIN OPEN. THE ACTUAL WATER PULSING INTO THE EVAPORATOR IS CONTROLLED BY THE OUTLET TEMPERATURE SENSOR SO CORE DAMAGE/ICING SHOULD NOT BE A RESULT. ADDITIONALLY, IN THIS RANGE, IF THE HI LOAD EVAPORATOR IS ALREADY ENABLED WHEN THE FAILURE OCCURS, IT WILL CONTINUE TO OPERATE AND NEVER BE DISABLED. IF THE HI-LOAD IS NOT ENABLED, IT WILL NEVER BE OPERABLE ON THE FAILED CONTROLLER. LOSS OF ALL CONTROLLERS WILL RESULT IN THE LOSS OF ALL FES COOLING WHICH WHEN COUPLED WITH THE LOSS OF ONE FREON LOOP CAN RESULT IN THE LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH, 60FJ), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87 C-252
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87
SUBSYSTEM: ATCS
MDAC ID: 3094

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

ITEM: FES PRIMARY CONTROLLER MIDPOINT TEMPERATURE SENSOR
FAILURE MODE: ERRONEOUS OUTPUT—GREATER THAN 63 DEGREES F

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROLLER
4) TEMPERATURE INPUTS
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: AFT FUSELAGE
PART NUMBER: CONTROLLER A: 807-1; CONTROLLER B: 807-2

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL EFFECTS/RATIONALE:
THE TEMPERATURE OUTPUT IN EXCESS OF 63 DEGREES F MEANS THE TOPPING EVAPORATOR ISOLATION VALVE WILL REMAIN OPEN AND THE HI-LOAD EVAPORATOR ENABLED. IF THE HI-LOAD ENABLE SWITCH IS IN THE APPROPRIATE POSITION. ACTUAL OPERATION OF THE EVAPORATORS IS CONTROLLED BY ANOTHER TEMPERATURE SENSOR, SO THERE SHOULD BE NO CORE DAMAGE/ICING AS A RESULT OF THIS FAILURE.

REFERENCES: VS70-960102 (60FH, 60FJ), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87 C-253
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87
SUBSYSTEM: ATCS
MDAC ID: 3095

HIGHEST CRITICALITY
HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: FES SECONDARY CONTROLLER MIDPOINT TEMPERATURE SENSOR
FAILURE MODE: ERRONEOUS OUTPUT-LESS THAN 62 DEGREES F

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROLLER
4) TEMPERATURE INPUTS
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LOCATION: AFT FUSELAGE
PART NUMBER: 807-3

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
A SECONDARY CONTROLLER TEMPERATURE LESS THAN 62 DEGREES F MEANS THE TOPPING EVAPORATOR WILL NOT TURN ON. IF THE HIGH LOAD EVAPORATOR HAS BEEN SELECTED FOR USE, ITS OPERATION IS CONTROLLED BY THE OUTPUT FROM A DIFFERENT TEMPERATURE SENSOR AND WILL NOT BE AFFECTED BY 807-3. THE PRIMARY CONTROLLERS ARE STILL AVAILABLE, AND LOSS OF TOPPING EVAPORATOR IS DEFINED ONLY AS A LOSS OF MISSION.

REFERENCES: VS70-960102 (60FH, 60FK), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87 C-254
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87
SUBSYSTEM: ATCS
MDAC ID: 3096

HIGHEST CRITICALITY
HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: FES SECONDARY CONTROLLER MIDPOINT TEMPERATURE SENSOR
FAILURE MODE: ERRONEOUS OUTPUT—GREATER THAN 62 DEGREES F

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROLLER
4) TEMPERATURE INPUTS
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LOCATION: AFT FUSELAGE
PART NUMBER: 807-3

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
FAILURE OF THE SECONDARY MIDPOINT TEMPERATURE SENSOR IN SUCH A WAY THAT THE TEMPERATURE ALWAYS APPEARS GREATER THAN 62 DEGREES F MEANS THE TOPPING EVAPORATOR WILL ALWAYS BE OPERATING. DEPENDING ON THE TEMPERATURE REFLECTED AND THE HEAT LOADS INVOLVED THIS CAN LEAD TO ICING AND EVAPORATOR CORE DAMAGE—EFFECTIVELY A LOSS OF THE TOPPING EVAPORATOR.

REFERENCES: VS70-960102 (60FH, 60FK), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87 C-255
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87
SUBSYSTEM: ATCS
MDAC ID: 3097

ITEM: FES PRIMARY CONTROLLER EVAPORATOR OUT TEMPERATURE SENSOR
FAILURE MODE: ERRONEOUS OUTPUT—LESS THAN 39 DEGREES F

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROLLER
4) TEMPERATURE INPUTS
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LOCATION: AFT FUSELAGE
PART NUMBER: CONTROLLER A: 807-4; CONTROLLER B: 807-5

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:

REFERENCES: VS70-960102 (60FH, 60FJ), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87  C-256
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/1R
MDAC ID: 3098  ABORT: 3/1R

ITEM: FES PRIMARY CONTROLLER EVAPORATOR OUT TEMPERATURE SENSOR
FAILURE MODE: ERRONEOUS OUTPUT—GREATER THAN 39 DEGREES F

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROLLER
4) TEMPERATURE INPUTS
5) 
6) 
7) 
8) 
9) 

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LOCATION:  AFT FUSELAGE
PART NUMBER: CONTROLLER A: 807-4; CONTROLLER: 807-5

CAUSES: CONTAMINATION, MISHANDELING/ABUSE, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
THE PULSER VALVES ARE OPERATED AT A FREQUENCY PROPORTIONAL TO THE
DIFFERENCE BETWEEN THE OUTPUT TEMPERATURE AND 39 DEGREES F, PLUS
A CORRECTION FACTOR FOR THE RATE OF CHANGE OF THE INPUT
TEMPERATURE. THEREFORE AN INCORRECT TEMPERATURE WILL MEAN AN
INCORRECT PULSING FREQUENCY. HOWEVER, ADDITIONAL PROTECTION IS
PROVIDED BY THE MIDPOINT AND SHUTDOWN TEMPERATURE SENSORS. IF
THESE SENSORS ARE OPERATING CORRECTLY, THERE SHOULD BE NO DAMAGE
TO THE EVAPORATOR ALTHOUGH THE CONTROLLER MUST BE CONSIDERED
LOST. LOSS OF ALL CONTROLLERS MEANS A LOSS OF ALL FES COOLING
WHICH COMBINED WITH A LOSS OF ONE FREON LOOP CAN RESULT IN THE
LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH, 60FJ), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87  C-257
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87

SUBSYSTEM: ATCS
MDAC ID: 3099

ITEM: FES SECONDARY CONTROLLER EVAPORATOR OUT TEMPERATURE SENSOR
FAILURE MODE: ERRONEOUS OUTPUT—LESS THAN 62 DEGREES F

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROLLER
4) TEMPERATURE INPUTS

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LOCATION: AFT FUSELAGE
PART NUMBER: 807-6

CAUSES: CONTAMINATION, MISHANDLING/ABUSE, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
THE SELECTED EVAPORATOR WILL NOT BE OPERABLE ON THE SECONDARY CONTROLLER. THE ACTIVATION TEMPERATURE WILL NEVER BE REACHED. THIS IS EFFECTIVELY THE SAME AS THE LOSS OF THE SECONDARY CONTROLLER. LOSS OF ALL CONTROLLERS MEANS A LOSS OF ALL FES COOLING. LOSS OF ALL FES COOLING COMBINED WITH A LOSS OF ONE FREON LOOP COULD RESULT IN THE LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH, 60FK), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87 C-258
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87
SUBSYSTEM: ATCS
MDAC ID: 3100

ITEM: FES SECONDARY CONTROLLER EVAPORATOR OUT
TEMPERATURE SENSOR
FAILURE MODE: ERRONEOUS OUTPUT—GREATER THAN 62 DEGREES F

LEAD ANALYST: S.K. SINCLAIR    SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROLLER
4) TEMPERATURE INPUTS
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LOCATION: AFT FUSELAGE
PART NUMBER: 807-6

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
THE SELECTED EVAPORATOR WILL OPERATE AT AN INCORRECT PULSE
FREQUENCY BASED ON THE INCORRECT INPUT TEMPERATURE. THIS MAY
LEAD TO ICING AND CORE DAMAGE SINCE THERE IS NO ADDITIONAL
SHUTDOWN LOGIC FOR THE SECONDARY CONTROLLER. WORST CASE WOULD BE
LOSS OF THE HIGH LOAD EVAPORATOR WHICH COMBINED WITH A LOSS OF
ONE FREON LOOP CAN MEAN A LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH, 60FK), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87  C-259
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87
SUBSYSTEM: ATCS
MDAC ID: 3101

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

ITEM: FES PRIMARY CONTROLLER SHUTDOWN LOGIC TEMPERATURE SENSOR
FAILURE MODE: ERRONEOUS OUTPUT—GREATER THAN 41.5 DEGREES F OR LESS THAN 37 DEGREES F

LEAD ANALYST: S.K. SINCLAIR SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROLLER
4) TEMPERATURE INPUTS
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LOCATION: AFT FUSELAGE
PART NUMBER: CONTROLLER A: 807-9; CONTROLLER B: 807-8;
SECONDARY: 807-9

CAUSES: CONTAMINATION, ERRONEOUS INPUT, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
The shutdown sensor stuck in one of the above temperature ranges will result in a premature shutdown of the FES by the associated controller. The FES will still be operational on the remaining controller(s), (note, the secondary sensor provides backup shutdown logic for controller A.) However, this should be considered as a loss of the controller. Loss of all controllers means loss of all FES cooling which if combined with a loss of one Freon loop could result in a loss of crew/vehicle.

REFERENCES: VS70-960102 (60FH, 60FJ), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87 C-260
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/2R
MDAC ID: 3102  ABORT: 3/2R

ITEM: FES PRIMARY CONTROLLER SHUTDOWN LOGIC TEMPERATURE SENSOR
FAILURE MODE: ERRONEOUS OUTPUT-BETWEEN 37.5 DEGREES F AND 41 DEGREES F

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROLLER
4) TEMPERATURE INPUTS

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LOCATION: AFT FUSELAGE
PART NUMBER: CONTROLLER A: 807-7; CONTROLLER B: 807-8;
SECONDARY: 807-9

CAUSES: CONTAMINATION, MISHANDLING/ABUSE, PIECE-PART STRUCTURAL EFFECTS/RATIONALE:
STICKING THE SHUTDOWN TEMPERATURE SENSOR IN THE NOMINAL TEMPERATURE RANGE ELIMINATES ONE LEVEL OF PROTECTIVE REDUNDANCY. ASSUMING NO OTHER FAILURES, THIS FAILURE SHOULD HAVE NO EFFECT. HOWEVER, IF ANY OF THE REMAINING TEMPERATURE CONTROL MECHANISMS FAILS, THEN ICING AND/OR CORE DAMAGE COULD RESULT WITH THE SUBSEQUENT LOSS OF THE EVAPORATOR. NOTE: THE "SECONDARY" CONTROLLER PROVIDES BACKUP SHUTDOWN LOGIC FOR CONTROLLER A.

REFERENCES: VS70-960102 (60FH, 60FJ), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87  C-261
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87
SUBSYSTEM: ATCS
MDAC ID: 3103

MDAC ID: 6123187
HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/1R
ABORT: 3/1R

ITEM: FES CONTROLLER SHUTDOWN LOGIC
FAILURE MODE: INADVERTENT OPERATION

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROLLER
4) SHUTDOWN LOGIC
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LOCATION: AFT FUSELAGE (741-1, 741-2)
PART NUMBER: VARIOUS COMPONENTS INCLUDING: 1-AND GATE; 2-OR GATES; 9 NAND GATES, 8 NOR GATES, 1 AMP.; 6 INVERTING AMPS; 4 FLIP FLOPS; 2 CLOCK/TIME DELAY; 3 COMPARATORS; 1 RATE SAMPLER; 1 RELAY; 1 DIODE

CAUSES: OVERVOLTAGE, THERMAL SHOCK, CONTAMINATION

EFFECTS/RATIONALE:
INADVERTENT OPERATION OF THE PRIMARY CONTROLLERS SHUTDOWN LOGIC RESULTS IN THE SHUTDOWN OF THE FES BY THE ACTIVE CONTROLLER. THE SECONDARY SHUTDOWN LOGIC PROVIDES BACKUP SHUTDOWN LOGIC TO THE ACTIVE CONTROLLER.

REFERENCES: VS70-960102 (60FH, 60FJ), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87 C-262
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

ITEM: FES CONTROLLER SHUTDOWN LOGIC
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: S.K. SINCLAIR    SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROLLER
4) SHUTDOWN LOGIC
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LOCATION: AFT FUSELAGE
PART NUMBER: VARIOUS COMPONENTS INCLUDING: 1-AND GATE; 2-OR GATES; 9 NAND GATES; 8 NOR GATES; 1 AMP.; 6 INVERTING AMPLIFIERS; 4 FLIP FLOPS; 2 CLOCK/TIME DELAY; 3 COMPARATORS; 1 RATE SAMPLER; 1 RELAY; 1 DIODE

CAUSES: OVERVOLTAGE, THERMAL SHOCK, CONTAMINATION

EFFECTS/RATIONALE:
THE FAILURE OF THE SHUTDOWN LOGIC TO OPERATE WHEN REQUIRED MEANS THAT ICING OF THE EVAPORATOR CAN OCCUR. SINCE THIS ICING OCCURS ONLY ON-ORBIT, THE FAILURE WILL ELIMINATE THE TOPPING EVAPORATOR ONLY AND WILL NOT AFFECT THE HIGH LOAD. NOTE: THE SHUTDOWN LOGIC IS REQUIRED ONLY WHEN AN ADDITIONAL FAILURE HAS OCCURED.

REFERENCES: VS70-960102 (60FH), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87    C-263
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 3105

ITEM: HI-LOAD VALVE PULSER ELECTRONICS (PRIMARY A, B, AND SECONDARY)
FAILURE MODE: GENERATES INCORRECT FREQUENCY (SLOW)

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROL LOGIC
4) HI-LOAD VALVE CONTROL

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LOCATION: AFT FUSELAGE
PART NUMBER: VARIOUS LOGIC GATES, INVERTORS, INTEGRATORS, SUMMERS, AND VOLTAGE SHAPERS

CAUSES: MISHANDLING/ABUSE, ELECTROMAGNETIC FIELDS, LOSS OF INPUT, VIBRATION

EFFECTS/RATIONALE:
A FREQUENCY WHICH IS TOO SLOW WILL RESULT IN INSUFFICIENT COOLING. IF ALL VALVE CONTROL CIRCUITS FAIL IN THE SAME WAY, CREW ACTIONS MAY BE REQUIRED TO REDUCE ORBITER POWER LEVELS. WORST CASE, THIS CAN RESULT IN THE LOSS OF THE HIGH LOAD EVAPORATOR CAUSING A LANDING AT THE NEXT PRIMARY LANDING SITE. LOSS OF THE HIGH LOAD EVAPORATOR FOLLOWED BY LOSS OF ONE FREON LOOP CAN RESULT IN THE LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH, 60FJ, 60FK), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87 C-264
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87

SUBSYSTEM: ATCS
MDAC ID: 3106

ITEM: HI-LOAD VALVE PULSER ELECTRONICS (PRIMARY A, B, AND SECONDARY)
FAILURE MODE: GENERATES INCORRECT FREQUENCY-(FAST)

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) CONTROL LOGIC
4) HI-LOAD VALVE CONTROL
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LOCATION: AFT FUSELAGE
PART NUMBER: VARIOUS LOGIC GATES, INVERTERS, INTEGRATORS, SUMMERS, AND VOLTAGE SHAPERS

CAUSES: MISHANDLING/ABUSE, ELECTROMAGNETIC FIELDS

EFFECTS/RATIONALE:
A FREQUENCY WHICH IS TOO FAST WILL RESULT IN TOO MUCH WATER BEING INTRODUCED INTO THE EVAPORATOR. THE WATER WILL NOT BE COMPLETELY VAPORIZED. THIS CAN LEAD TO ICING AND LOSS OF THE EVAPORATOR IF NOT DETECTED. LOSS OF THE HIGH LOAD EVAPORATOR FOLLOWED BY A LOSS OF ONE FREON LOOP CAN CAUSE LOSS OF CREW/VEHICLE. LOSS OF THE HIGH LOAD EVAPORATOR, ALONE, MEANS AUTOMATIC LOSS OF MISSION AND LANDING AT NEXT PRIMARY LANDING SITE.

REFERENCES: VS70-960102 (60FH, 60FJ, 60FK), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87  C-265
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 3107

ITEM: HI-LOAD ISOLATION VALVE RELAY (PRIMARY A, B, AND SECONDARY)
FAILURE MODE: INTERMITTENT OPERATION

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) HI-LOAD VALVE CONTROL
4) ISOLATION VALVE RELAY

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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: VIBRATION, MECHANICAL SHOCK, OVERVOLTAGE, CONTAMINATION

EFFECTS/RATIONALE:
THE VALVE RELAY FAILING WITH INTERMitTENT OPERATION MEANS THE
ISOLATION VALVE AND SPRAY VALVE WILL NOT BE OPERATING IN TANDEM
AS DESIGNED. THIS, IN TURN, MEANS THE COOLING REQUIREMENTS WILL
NOT BE MET USING THE FAILED CONTROLLER/RELAY. LOSS OF ALL
CONTROLLER/RELAY COMBINATIONS MEANS LOSS OF THE HI-LOAD
EVAPORATORS AND LANDING AT NEXT PRIMARY LANDING SITE. LOSS OF
THE HIGH LOAD EVAPORATOR COMBINED WITH LOSS OF ONE FREON LOOP MAY
MEAN LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH, 60FJ, 60FK), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87 C-266
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/1R
MDAC ID: 3108  ABORT: 3/1R

ITEM: HI-LOAD SPRAY VALVE RELAY (PRIMARY A, B, AND SECONDARY)
FAILURE MODE: INTERMITTENT OPERATION

LEAD ANALYST: S.K. SINCLAIR SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) HI-LOAD VALVE CONTROL
4) ISOLATION VALVE RELAY
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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: VIBRATION, MECHANICAL SHOCK, OVERVOLTAGE, CONTAMINATION

EFFECTS/RATIONALE:
THE VALVE RELAY FAILING WITH INTERMITTENT OPERATION MEANS THE SPRAY VALVE AND ISOLATION VALVE WILL NOT BE OPERATING IN TANDEM AS DESIGNED. THIS, IN TURN, MEANS THE COOLING REQUIREMENTS WILL NOT BE MET USING THE FAILED CONTROLLER/RELAY AND EFFECTIVE LOSS OF THE HIGH LOAD EVAPORATOR. LOSS OF THE HIGH LOAD MEANS AUTOMATIC LOSS OF MISSION AND LANDING AT NEXT PLS. LOSS OF HIGH LOAD COMBINED WITH LOSS OF ONE FREON LOOP CAN RESULT IN LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FJ, 60FK)

REPORT DATE 11/24/87 C-267
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 3109

HIGHEST CRITICALITY: HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: TOPPING EVAPORATOR ISOLATION VALVE/HOLDING COIL
FAILURE MODE: FAILS TO OPEN

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) TOPPING EVAPORATOR VALVE CONTROL
4) ISOLATION VALVE RELAY
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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: MISHANDLING/ABUSE, LOSS OF INPUT

EFFECTS/RATIONALE:
THE TOPPING EVAPORATOR ISOLATION VALVE/HOLDING COILS RELAY SERVE TO OPEN AND HOLD OPEN THE TOPPING EVAPORATOR ISOLATION VALVE. FAILURE OF OPERATION MEANS THE ISOLATION VALVE WILL REMAIN CLOSED RESULTING IN THE LOSS OF ONE CONTROLLER OF THE FES.

REFERENCES: VS70-960102 (60FH, 60FJ, 60FK), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87  C-268
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 3110
HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: TOPPING EVAPORATOR SPRAY VALVE RELAY
FAILURE MODE: INTERMITTENT OPERATION

LEAD ANALYST: S.K. SINCLAIR    SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) TOPPING EVAPORATOR VALVE CONTROL
4) SPRAY VALVE RELAY

CRITICALITIES

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LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: CONTAMINATION, MISHANDLING/ABUSE

EFFECTS/RATIONALE:
OPERATION OF THE SPRAY VALVE RELAY AT AN OFF-NOMINAL FREQUENCY MEANS THE COOLING REQUIREMENTS OF THE SYSTEM WILL NOT BE MET. LOSS OF ALL RELAYS IN THE SAME MANNER MEANS CREW ACTIONS MAY BE REQUIRED TO REDUCE ORBITER POWER LEVELS.

REFERENCES: VS70-960102 (60FH, 60FJ, 60FK), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87    C-269
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 3111

HIGHEST CRITICALITY
FLIGHT: 3/3
ABORT: 3/3

ITEM: GROUND OPERATIONS DIAGNOSTIC MEASUREMENTS
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C

CRITICALITIES

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: AFT FUSELAGE
PART NUMBER: (V63) K8111A; T8121A; K8101A; K8110A; F8006A; F8010A; C8056A; F8061A; K8020E; K8050E; K8000E; T8122A; K8150E; T8120A; K8100A; F8005A; F8010A; C8056A; F8061A; C8055A; F8060A

CAUSES: MISHANDLING/ABUSE, ELECTROMAGNETIC FIELDS

EFFECTS/RATIONALE:
THESE SENSORS ARE USED ONLY DURING GROUND OPS FOR DIAGNOSTIC PURPOSES. ERRONEOUS OUTPUT FROM ANY OF THEM WILL AFFECT GROUND TURN AROUND TIME BUT WILL NOT IMPACT OPERATIONS.

REFERENCES: VS70-960102 (60FH, 60FJ, 60FK)

REPORT DATE 11/24/87 C-270
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87

SUBSYSTEM: ATCS
MDAC ID: 3112

ITEM: FES SECONDARY SUPPLY SELECT SWITCH
FAILURE MODE: FAILS TO EITHER A OR B POSITION

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) SECONDARY CONTROLLER
4) SUPPLY SELECT SWITCH

CRITICALITIES

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: PANEL L1A2
PART NUMBER: S45

CAUSES: CONTAMINATION, MECHANICAL SHOCK, MISHANDLING/ABUSE, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
RESTRICTS SECONDARY CONTROLLER TO EITHER A OR B WATER SUPPLY WHEN HI LOAD EVAPORATOR IS ENABLED. NO EFFECT ON TOPPING EVAPORATOR OPERATIONS. (PROBLEMS WILL ARISE IF SELECTED SYSTEM FAILS AND BOTH PRIMARY CONTROLLERS ALSO FAIL.)

REFERENCES: VS70-960102 (60FK), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87 C-271
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87

SUBSYSTEM: ATCS
MDAC ID: 3113

ITEM: FES SECONDARY SUPPLY SELECT SWITCH
FAILURE MODE: ONE "A" CONTACT FAILS TO MAKE

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) SECONDARY CONTROLLER
4) SUPPLY SELECT SWITCH
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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: PANEL L1A2
PART NUMBER: S45

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
THE SECONDARY SUPPLY SWITCH IS DESIGNED SO THAT THE CIRCUIT IS COMPLETED WHEN THE "A" POSITION IS SELECTED AND OPENED WHEN THE "B" POSITION IS COMPLETED. FAILING OF ONE "A" CONTACT THEN MEANS THAT THE B SUPPLY IS ALWAYS SELECTED. NOTE: THIS ONLY AFFECTS THE HIGH LOAD OPERATION ON THE SECONDARY CONTROLLER. THE TOPPING EVAPORATOR USES BOTH FEEDWATER SYSTEMS SIMULTANEOUSLY. (PROBLEMS WILL ARISE IF THE B SUPPLY DEVELOPS A LEAK OR A BLOCKAGE AND IF BOTH PRIMARY CONTROLLERS FAIL TO OPERATE.)

REFERENCES: VS70-960102 (60FK), SSSH 7.3 SHEET 2 OF 2

REPORT DATE 11/24/87 C-272
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87
SUBSYSTEM: ATCS
MDAC ID: 3114

HIGHEST CRITICALITY
HDW/FUNC

FLIGHT: 3/1R
ABORT: 3/1R

ITEM: FES FEEDLINE HEATER SELECT SWITCH
FAILURE MODE: JAMMED IN "OFF" POSITION

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) FEEDLINE SYSTEM
4) HEATER SELECT SWITCH
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LOCATION: PANEL L1A2
PART NUMBER: A SUPPLY - S23; B SUPPLY - S24

CAUSES: MECHANICAL SHOCK, MISHANLDING/ABUSE

EFFECTS/RATIONALE:
FAILING EITHER FEEDLINE HEATER SELECT SWITCH IN THE "OFF" POSITION MEANS THAT THE AFFECTED SYSTEM WILL HAVE NO HEAT APPLIED TO IT AND WILL FREEZE-UP. THIS ELIMINATES ONE FEEDWATER PATH TO THE EVAPORATORS. LOSS OF BOTH FEEDLINES MEANS THE LOSS OF THE FES AND ENTRY TO NEXT PLS. LOSS OF THE FES COMBINED WITH THE LOSS OF ONE FREON LOOP MAY MEAN THE LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FL), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-273
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87

SUBSYSTEM: ATCS
MDAC ID: 3115

HIGHEST CRITICALITY HDW/FUNC

FLIGHT: 3/3
ABORT: 3/3

ITEM: FES FEEDLINE HEATER SELECT SWITCH
FAILURE MODE: FAILS TO POSITION "1" OR TO POSITION "2"

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) FEEDLINE SYSTEM
4) HEATER SELECT SWITCH

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: PANEL L1A2
PART NUMBER: A SUPPLY - S23; B SUPPLY - S24

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, CONTAMINATION

EFFECTS/RATIONALE:
FAILURE OF THE FEEDLINE HEATER SELECT SWITCH TO ONE OF THE TWO OPERATING POSITIONS SIMPLY MEANS THE OTHER HEATING SYSTEM CANT NOT BE USED. ASSUMING NO ADDITIONAL FAILURES, THIS FAILURE SHOULD HAVE NO IMPACT ON OPERATIONS. (ONE SET OF HEATERS ON EACH FEEDLINE IS ALWAYS ENABLED.)

REFERENCES: VS70-960102 (60FL), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-274
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87

SUBSYSTEM: ATCS

MDAC ID: 3116

HIGHEST CRITICALITY

FLIGHT: 3/3

ABORT: 3/3

ITEM: FES FEEDLINE HEATER SWITCH STATUS

FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: S.K. SINCLAIR

SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:

1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) FEEDLINE SYSTEM
4) HEATER SELECT SWITCH-STATUS
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: PANEL L1A2

PART NUMBER: A SUPPLY: V631860E, V631861E; B SUPPLY: V631865E, V631866E

CAUSES: CONTAMINATION, MISHANDLING/ABUSE, THERMAL SHOCK

EFFECTS/RATIONALE:
A SENSOR REFLECTING INCORRECT DATA CAN BE IDENTIFIED AS SUCH BY CREW AND/OR GROUND MALFUNCTION PROCEDURES WITH NO IMPACT ON FUTURE OPERATIONS.

REFERENCES: VS70-960102 (60FL), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-275
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/1R
MDAC ID: 3117  ABORT: 3/1R

ITEM: FES FEEDLINE HEATER FUSES
FAILURE MODE: OPEN (ELECTRICAL)

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) FEEDLINE HEATER SYSTEM
4) INPUT FUSES
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LOCATION: AFT FUSELAGE
PART NUMBER: 5 AND 10 AMP FUSES BETWEEN THE INPUT POWER AND THE HEATERS

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, OVERLOAD, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:

REFERENCES: VS70-960102 (60FL), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87  C-276
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87
SUBSYSTEM: ATCS
MDAC ID: 3118

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

ITEM: TOPPING EVAPORATOR HEATER SELECT SWITCH
FAILURE MODE: FAILS IN "OFF" POSITION

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) TOPPING EVAPORATOR
4) HEATER SELECT SWITCH
5) 
6) 
7) 
8) 
9)

CRITICALITIES

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: PANEL L1A2
PART NUMBER: S39

CAUSES: CONTAMINATION, MECHANICAL SHOCK, MISHANDLING/ABUSE

EFFECTS/RATIONALE:
FAILURE OF THE HEATER SELECT SWITCH IN THE "OFF" POSITION MEANS THAT THE TOPPING EVAPORATOR HEATERS WILL NO LONGER BE AVAILABLE - AND THAT THE TOPPING EVAPORATOR WILL NOT BE AVAILABLE. LOSS OF TOPPING EVAPORATOR MEANS A MINIMUM DURATION FLIGHT.

REFERENCES: VS70-960102 (60FN), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-277
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87

SUBSYSTEM: ATCS
MDAC ID: 3119

HIGHEST CRITICALITY
FLIGHT: 3/3
ABORT: 3/3

ITEM: TOPPING EVAPORATOR HEATER SELECT SWITCH
FAILURE MODE: FAILS IN "A", "B", "A/B", OR "C" POSITION

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) TOPPING EVAPORATOR
4) HEATER SELECT SWITCH
5)
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7)
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9)

CRITICALITIES
FLIGHT PHASE HDW/FUNC ABORT HDW/FUNC
PRELAUNCH: /NA RTLS: 3/3
LIFTOFF: 3/3 TAL: 3/3
ONORBIT: 3/3 AOA: 3/3
DEORBIT: 3/3 ATO: 3/3
LANDING/SAFING: /NA

REDUNDANCY SCREENS:  A [ ]  B [ ]  C [ ]

LOCATION: PANEL L1A2
PART NUMBER: S39

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, CONTAMINATION

EFFECTS/RATIONALE:
A MECHANICAL FAILURE OF THE HEATER SELECT SWITCH MEANS THAT ONLY ONE HEATER SYSTEM WILL BE AVAILABLE. ASSUMING NO OTHER FAILURES, THERE SHOULD BE NO IMPACT ON FUTURE OPERATIONS. A FAILURE DUE TO CONTAMINATION ALLOWS THE POSSIBILITY OF MULTIPLE HEATER SYSTEMS BEING ENABLED SIMULTANEOUSLY. AGAIN, NO IMPACT ON FUTURE OPERATIONS.

REFERENCES: VS70-960102 (60FN), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87  C-278
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87

SUBSYSTEM: ATCS
MDAC ID: 3120

HIGHEST CRITICALITY
FLIGHT: 3/3
ABORT: 3/3

ITEM: TOPPING EVAPORATOR HEATER SELECT SWITCH STATUS
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) TOPPING EVAPORATOR
4) HEATER SELECT SWITCH
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION:
PART NUMBER: V63S2631E(C); V63S2621E(B); V63S2611E(A/B); V63S2601E(A)

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL, ELECTROMAGNETIC FIELDS

EFFECTS/RATIONALE:
A SENSOR PROVIDING ERRONEOUS DATA CAN BE IDENTIFIED AS SUCH WITH NO IMPACT ON FUTURE OPERATIONS.

REFERENCES: VS70-960102 (60FN), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87  C-279
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87  SUBSYSTEM: ATCS
MDAC ID: 3121   HIGHEST CRITICALITY HDW/FUNC
            FLIGHT: 3/2R  ABORT: 3/2R

ITEM: TOPPING EVAPORATOR HEATER SELECT SWITCH FUSES
FAILURE MODE: OPEN (ELECTRICAL)

LEAD ANALYST: S.K. SINCLAIR SUBSYS LEAD: W. E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) TOPPING EVAPORATOR
4) HEATER SELECT SWITCH
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LOCATION: PANEL L1A2
PART NUMBER: 1 AMP FUSES BETWEEN CONTROL BUS AND HEATER SELECT SWITCH (F10-F18)

CAUSES: CONTAMINATION, MECHANICAL SHOCK, OVERLOAD, PIECE-PART STRUCTURAL, ELECTROMAGNETIC FIELDS

EFFECTS/RATIONALE:

REFERENCES: VS70-960102 (60FN), SSSH 7.3 SHEET 1 OF 2
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/2R
MDAC ID: 3122  ABORT: 3/2R

ITEM: TOPPING EVAPORATOR HEATER FUSES/RPCS
FAILURE MODE: OPEN (ELECTRICAL)

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) TOPPING EVAPORATOR
4) HEATER SELECT INPUT FUSES
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LOCATION: AFT FUSELAGE
PART NUMBER: 10 AMP FUSES PLUS 15 AND 20 AMP RPCS BETWEEN INPUT POWER AND HEATERS

CAUSES: CONTAMINATION, MECHANICAL SHOCK, OVERLOAD, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:

REFERENCES: VS70-960102 (60FN), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87  C-281
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87

HIGHEST CRITICALITY

FLIGHT: 3/2R
ABORT: 3/2R

SUBSYSTEM: ATCS
MDAC ID: 3123

ITEM: TOPPING EVAPORATOR HEATER RELAY
FAILURE MODE: DELAYED OPERATION, OPEN (ELECTRICAL)

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) TOPPING EVAPORATOR
4) DUCT HEATERS
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LOCATION: AFT FUSELAGE
PART NUMBER: RELAY USED TO COMPLETE HEATER CONTROL CIRCUITS

CAUSES: PIECE-PART STRUCTURAL, LOSS OF INPUT

EFFECTS/RATIONALE:
FAILURE OF A RELAY TO OPERATE PROPERLY RESULTS IN AN INCOMPLETE HEATER CONTROL CIRCUIT AND NO POWER TO THE AFFECTED HEATERS. LOSS OF ONE RELAY ACTION MEANS LOSS OF ONE HEAT SYSTEM; LOSS OF ALL RELAYS MEAN LOSS OF ALL HEATERS AND LOSS OF THE TOPPING EVAPORATOR. LOSS OF THE TOPPING EVAPORATOR REQUIRES A MINIMUM DURATION FLIGHT.

REFERENCES: SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-282
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87
SUBSYSTEM: ATCS
MDAC ID: 3124

HIGHEST CRITICALITY
FLIGHT: 3/2R
ABORT: 3/2R

ITEM: TOPPING EVAPORATOR NOZZLE HEATER SELECT SWITCH
FAILURE MODE: FAILS IN "OFF"

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) TOPPING EVAPORATOR
4) NOZZLE HEATER SELECT SWITCH
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LOCATION: PANEL L1A2
PART NUMBER: LEFT- S37; RIGHT - S38

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:

REFERENCES: VS70-960102 (60FN), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-283
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/3
MDAC ID: 3125  ABORT: 3/3

ITEM: TOPPING EVAPORATOR NOZZLE HEATER SELECT SWITCH
STATUS
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) TOPPING EVAPORATOR
4) HEATER SELECT SWITCH
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION:
PART NUMBER: LEFT: HTR A-V63S1880E; HTR B-V63S1881E. RIGHT:
HTR A-V631885E; HTR B-V631886E

CAUSES: CONTAMINATION, ERRONEOUS INPUT, MECHANICAL SHOCK, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
A SENSOR FAILED SO AS TO GIVE INCORRECT INFORMATION CAN BE IDENTIFIED AS SUCH BY CREW/GROUND MALFUNCTION PROCEDURES WITH NO ADDITIONAL IMPACT ON FUTURE OPERATIONS.

REFERENCES: VS70-960102 (60FN), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87  C-284
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87
SUBSYSTEM: ATCS
MDAC ID: 3126

HIGHEST CRITICALITY
HDW/FUNC

FLIGHT: 3/3
ABORT: 3/3

ITEM: TOPPING EVAPORATOR NOZZLE HEATER SELECT SWITCH
FAILURE MODE: FAILS TO "A AUTO" OR "B AUTO"

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) TOPPING EVAPORATOR
4) NOZZLE HEATER SELECT SWITCH
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: PANEL L1A2
PART NUMBER: LEFT - S37; RIGHT - S38

CAUSES: CONTAMINATION, MECHANICAL SHOCK, MISHANDLING/ABUSE, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
FAILURE OF A SWITCH IN A SINGLE POSITION DUE TO A MECHANICAL JAM RESULTS IN THAT HEATER SYSTEM BEING THE ONLY ONE AVAILABLE FOR USE DURING FUTURE OPERATIONS. IF CONTAMINATION IS THE CAUSE OF THE PROBLEM, THE POSSIBILITY EXISTS FOR BOTH HEATER SYSTEMS TO BE ACTIVATED AT THE SAME TIME. THIS CONDITION, HOWEVER, SHOULD BE DETECTABLE AND CORRECTABLE BY CREW/GROUND ACTIONS.

REFERENCES: VS70-960102 (60FN), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-285
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87  HIGHEST CRITICALITY
SUBSYSTEM: ATCS FLIGHT: 3/2R
MDAC ID: 3127 ABORT: 3/2R

ITEM: TOPPING EVAPORATOR NOZZLE HEATER FUSES
FAILURE MODE: OPEN (ELECTRICAL)

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) TOPPING EVAPORATOR
4) NOZZLE HEATER SELECT SWITCH
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LOCATION: AFT FUSELAGE
PART NUMBER: 10 AMP FUSES BETWEEN INPUT POWER AND HEATERS

CAUSES: OVERLOAD

EFFECTS/RATIONALE:
A FUSE "BLOWING" CAUSES AN OPEN CIRCUIT AND NO POWER TO THE HEATERS. LOSS OF THE HEATERS WILL MEAN LOSS OF THE TOPPING EVAPORATOR AND A MINIMUM DURATION FLIGHT.

REFERENCES: VS70-960102 (60FN), SSSH 7.3 SHEET 1 OF 2
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87

SUBSYSTEM: ATCS
MDAC ID: 3128

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

ITEM: HI-LOAD HEATER SELECT SWITCH
FAILURE MODE: FAILED TO "OFF"

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) HI-LOAD EVAPORATOR
4) HEATER SELECT
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LOCATION: PANEL L1A2
PART NUMBER: S41

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
FAILURE OF THE HI-LOAD HEATER SELECT SWITCH TO "OFF" MEANS HEAT IS NO LONGER AVAILABLE AND THE HI-LOAD EXIT DUCT/NOZZLE WILL FREEZE-UP. LOSS OF THE HI-LOAD EVAPORATOR MEANS ENTRY AT NEXT PRIMARY LANDING SITE, AND IF COMBINED WITH A LOSS OF ONE FREON LOOP, POSSIBLE LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FM), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87  C-287
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87
SUBSYSTEM: ATCS
MDAC ID: 3129

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

ITEM: HI-LOAD HEATER SELECT SWITCH
FAILURE MODE: FAILS TO "A", "B", "A/B", OR "C" POSITION

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) HI-LOAD EVAPORATOR
4) HEATER SELECT
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: PANEL L1A2
PART NUMBER: S41

CAUSES: CONTAMINATION, MECHANICAL SHOCK, MISHANDLING/ABUSE

EFFECTS/RATIONALE:
THE MECHANICAL JAMMING OF A SWITCH TO A GIVEN HEATER SYSTEM MEANS THAT ONLY ONE SYSTEM WILL BE AVAILABLE FOR FUTURE OPERATIONS. ASSUMING NO ADDITIONAL FAILURES, THIS SHOULD BE AN ACCEPTABLE CONDITION. A FAILURE BY CONTAMINATION RAISES THE POSSIBILITY THAT MORE THAN ONE SYSTEM COULD BE POWERED AT THE SAME TIME. THIS CAN BE IDENTIFIED AND CORRECTED BY CREW AND/OR GROUND PROCEDURES WITH NO IMPACT ON OPERATIONS.

REFERENCES: VS70-960102 (60FM), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-288
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/3
MDAC ID: 3130  ABORT: 3/3

ITEM: HI-LOAD DUCT HEATER SWITCH STATUS
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) HI-LOAD EVAPORATOR
4) HEATER SELECT SWITCH
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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: PANEL L1
PART NUMBER: V63S2511E(A/B); V63S2501E(A); V63S2521E(B); V63S2531E(C)

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, ELECTROMAGNETIC FIELDS

EFFECTS/RATIONALE:
A SENSOR PROVIDING ERRONEOUS INFORMATION CAN BE IDENTIFIED AS SUCH BY CREW/GROUND MALFUNCTION PROCEDURES WITH NO FURTHER IMPACT TO OPERATIONS.

REFERENCES: VS70-960102 (60FM), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87  C-289
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87
SUBSYSTEM: ATCS
MDAC ID: 3131

ITEM: HI-LOAD DUCT HEATER SWITCH FUSES
FAILURE MODE: OPEN (ELECTRICAL)

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) HI-LOAD EVAPORATOR
4) HEATER SELECT SWITCH FUSES
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LOCATION: PANEL L1A2
PART NUMBER: 1 AMP FUSES BETWEEN CONTROL BUS AND SWITCH

CAUSES: OVERLOAD, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:

REFERENCES: VS70-960102 (60FM), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87  C-290
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/1R
MDAC ID: 3132  ABORT: 3/1R

ITEM: HI-LOAD DUCT HEATER FUSES/RPCS
FAILURE MODE: PREMATURE OPERATION, OPEN (ELECTRICAL)

LEAD ANALYST: S.K. SINCLAIR  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) HI-LOAD EVAPORATOR
4) HEATER SELECT
5) INPUT POWER FUSES/RPCS
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LOCATION: AFT FUSELAGE
PART NUMBER: 5 AMP FUSES PLUS 15 AND 20 AMP FUSES BETWEEN INPUT POWER AND HEATERS

CAUSES: MECHANICAL SHOCK, OVERLOAD, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:

REFERENCES: VS70-960102 (60FH), SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87  C-291
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87

SUBSYSTEM: ATCS
MDAC ID: 3133

ITEM: HI-LOAD DUCT HEATER RELAYS
FAILURE MODE: DELAYED OPERATION, OPEN (ELECTRICAL)

LEAD ANALYST: S.K. SINCLAIR
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FLASH EVAPORATOR SYSTEM EPD&C
3) HI-LOAD EVAPORATOR
4) DUCT HEATERS
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LOCATION: AFT FUSELAGE
PART NUMBER: RELAY USED TO COMPLETE HEATER CONTROL CIRCUITS

CAUSES: PIECE-PART STRUCTURAL, LOSS OF INPUT

EFFECTS/RATIONALE:
FAILURE OF A RELAY TO OPERATE PROPERLY RESULTS IN AN INCOMPLETE HEATER CONTROL CIRCUIT AND NO POWER TO THE AFFECTED HEATERS. LOSS OF ONE RELAY ACTION MEANS LOSS OF ONE HEAT SYSTEM; LOSS OF ALL RELAYS MEAN LOSS OF ALL HEATERS AND LOSS OF THE HI-LOAD EVAPORATOR. LOSS OF THE HIGH LOAD REQUIRES ENTRY TO NEXT PLS. LOSS OF THE HIGH LOAD COMBINED WITH LOSS OF ONE FREON LOOP CAN RESULT IN LOSS OF CREW/VEHICLE.

REFERENCES: SSSH 7.3 SHEET 1 OF 2

REPORT DATE 11/24/87 C-292
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/3
MDAC ID: 4001  ABORT: 2/1R

ITEM: RELIEF VALVE (NH3)
FAILURE MODE: FAILS TO OPEN

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM (ABS)
3) AMMONIA STORAGE (A&B)
4) RELIEF VALVE (NH3)
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LOCATION: AFT BODY-AREA 50
PART NUMBER: 50V63A1

CAUSES: CONTAMINATION, CORROSION, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, MECHANICAL SHOCK

EFFECTS/RATIONALE:
OVERPRESSURIZATION OF ONE AMMONIA TANK COULD INITIATE AN EXTERNAL LEAK IN ONE AMMONIA SYSTEM. THIS LEAKAGE WOULD LEAD TO LOSS OF ONE REDUNDANT SYSTEM WHICH IS REQUIRED TO COOL THE FREON LOOPS DURING ABORTS PHASES (EXCEPT ATO). A FAILURE IN THE REDUNDANT SYSTEM ELIMINATE COOLING OF THE FREON LOOPS BY THE AMMONIA SYSTEM AND RESULT IN LOSS OF CREW AND VEHICLE DURING RTLS, TAL, AND AOA ABORTS.

REFERENCES:

REPORT DATE 11/24/87  C-293
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 4002

ITEM: RELIEF VALVE
FAILURE MODE: FAILS TO CLOSE

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM (ABS)
3) AMMONIA STORAGE (A&B)
4) RELIEF VALVE (NH3)

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LOCATION: AFT BODY-AREA 50
PART NUMBER: 50V63A1

CAUSES: CONTAMINATION, CORROSION, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, MECHANICAL SHOCK

EFFECTS/RATIONALE:
DEPLETION OF AMMONIA FROM ONE OF TWO TANKS RESULTS IN LOSS OF ONE LEVEL OF REDUNDANCY DURING RTLS, TAL AND AOA ABORTS. LOSS OF ALL REDUNDANCY TO COOL THE FREON LOOPS BY AMMONIA SYSTEM LEADS TO LOSS OF CREW AND VEHICLE DURING ABORTS PHASES (EXCEPT ATO). THE AMMONIA EXITS THE ORBITER THROUGH THE DISCHARGE VENT.

REFERENCES:

REPORT DATE 11/24/87
C-294
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 4003

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

ITEM: PRESSURE TRANSDUCER (NH3 TANK)
FAILURE MODE: ERRONEOUS OUTPUT, FAILS OFF-SCALE (HIGH/LOW)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM (ABS)
3) AMMONIA STORAGE (A&B)
4) PRESSURE TRANSDUCER (NH3 TANK)

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: AFT BODY-AREA 50
PART NUMBER: 50V63A1

CAUSES: MECHANICAL SHOCK, VIBRATION, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS

EFFECTS/RATIONALE:
THERE IS AN INABILITY TO CALCULATE AMMONIA QUANTITY FOR ONE SYSTEM. LOSS OF THE PRESSURE SENSOR IN REDUNDANT SYSTEM LEADS TO INABILITY TO CALCULATE AMMONIA QUANTITIES; HOWEVER, SYSTEMS SHOULD CONTINUE TO FUNCTION PROPERLY.

REFERENCES:

REPORT DATE 11/24/87  C-295
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 4004

ITEM: TEMPERATURE TRANSUDER (NH3 TANK)
FAILRE MODE: ERRONEOUS OUTPUT, FAILS OFF-SCALE (HIGH/LOW)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM (ABS)
3) AMMONIA STORAGE (A&B)
4) TEMPERATURE TRANSUDER (NH3 TANK)
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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: AFT BODY-AREA 50
PART NUMBER: 50V63-MT48, MT49

CAUSES: MECHANICAL SHOCK, VIBRATION, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS

EFFECTS/RATIONALE:
THERE IS AN INABILITY TO CALCULATE AMMONIA QUANTITY FOR ONE SYSTEM. LOSS OF THE TEMPERATURE SENSOR IN REDUNDANT SYSTEM LEADS TO INABILITY TO CALCULATE AMMONIA QUANTITIES; HOWEVER, SYSTEMS SHOULD CONTINUE TO FUNCTION PROPERLY.

REFERENCES:

REPORT DATE 11/24/87 C-296
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/17/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS FLIGHT: 3/3
MDAC ID: 4005 ABORT: 2/1R

ITEM: AMMONIA CONTROLLER A
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: W.E. PARKMAN SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM (ABS)
3) CONTROLLER A (B)
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LOCATION: AFT BODY-AREA 50
PART NUMBER: 50V63A1-A1, A2

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
THERE IS AN INABILITY TO OPEN/CLOSE VALVES FOR ONE AMMONIA SYSTEM DUE TO THE FAILED CONTROLLER. ANY OTHER FAILURE THAT ELIMINATES THE REDUNDANT SYSTEM LEADS TO LOSS OF CREW/VEHICLE DURING RTLS, TAL, AND AOA ABORTS.

REFERENCES:

REPORT DATE 11/24/87 C-297
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/17/87
SUBSYSTEM: ATCS
MDAC ID: 4006

ITEM: AMMONIA CONTROLLER A
FAILURE MODE: PREMATURE OPERATION

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM (ABS)
3) CONTROLLER A (B)
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LOCATION: AFT BODY-AREA 50
PART NUMBER: 50V63A1-A1, A2

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
DURING ASCENT THE AMMONIA MAY PROVIDE GREATER THAN THE REQUIRED COOLING TO THE ORBITER, WHICH REQUIRES CREW ACTION. FOR ON-ORBIT OPERATIONS, HELIUM ESCAPES FROM THE TANK AND PRESSURE ON AMMONIA IS LOST. IF THIS FAILURE OCCURS DURING AN ABORT PHASE (EXCEPT ATO), ONE SYSTEM IS LOST DUE TO THE INABILITY TO CONTROL THE AMMONIA VALVES. ANOTHER FAILURE THAT ELIMINATES THE REDUNDANT SYSTEM LEADS TO LOSS OF CREW/VEHICLE DURING RTLS, TAL, AND AOA ABORTS.

REFERENCES:

REPORT DATE 11/24/87 C-298
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/3
MDAC ID: 4007  ABORT: 2/1R

ITEM: FLOW CONTROL VALVE (N.O.)
FAILURE MODE: FAILS TO OPEN

LEAD ANALYST: W.E. PARKMAN SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM (ABS)
3) CONTROLLER (A&B)
4) PRIMARY & SECONDARY
5) FLOW CONTROL VALVE (N.O.)
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LOCATION: AFT BODY-AREA 50
PART NUMBER: 50V63A1-LV3, LV4, LV5, LV6

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
BLOCKAGE OF AMMONIA EXITING ONE OF TWO TANKS RESULTS IN LOSS OF ONE LEVEL OF REDUNDANCY DURING RTLS, TAL, AND AOA ABORTS. LOSS OF ALL REDUNDANCY TO COOL THE FREON LOOPS BY THE AMMONIA SYSTEM, LEADS TO LOSS OF CREW AND VEHICLE DURING ABORT PHASES (EXCEPT ATO).

REFERENCES:

REPORT DATE 11/24/87 C-299
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/3
MDAC ID: 4008  ABORT: 3/3

ITEM: FLOW CONTROL VALVE (N.O.)
FAILURE MODE: FAILS TO CLOSE

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM (ABS)
3) CONTROLLER (A&B)
4) PRIMARY & SECONDARY
5) FLOW CONTROL VALVE (N.O.)
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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: AFT BODY-AREA 50
PART NUMBER: 50V63A1-LV3, LV4, LV5, LV6

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL STRESS

EFFECTS/RATIONALE:
LEVEL OF REDUNDANCY WITHIN A SYSTEM IS REDUCED DUE TO LOSS OF ONE CONTROL VALVE. A FAILURE TO THE REDUNDANT CONTROL VALVE LEADS TO LOSS OF ONE SYSTEM DURING RTLS, TAL, AND AOA ABORTS.

REFERENCES:

REPORT DATE 11/24/87  C-300
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 4009

ITEM: FLOW CONTROL VALVE (N.O.)
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM (ABS)
3) CONTROLLER (A&B)
4) PRIMARY & SECONDARY
5) FLOW CONTROL VALVE (N.O.)

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: AFT BODY-AREA 50
PART NUMBER: 50V63A1-LV3, LV4, LV5, LV6

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, MECHANICAL SHOCK

EFFECTS/RATIONALE: EXTERNAL LEAKAGE OF AMMONIA THROUGH THE VALVE REDUCES THE AMOUNT OF AMMONIA ENTERING THE HEAT EXCHANGER; HOWEVER, THE SYSTEMS SHOULD CONTINUE TO OPERATE IN A DEGRADED MODE. THE EFFECTS OF AMMONIA IN THE AFT BODY ARE UNKNOWN; HOWEVER, IT IS EXPECTED TO HAVE NO IMPACT ON ORBITER PERFORMANCE.

REFERENCES:

REPORT DATE 11/24/87 C-301
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/3
MDAC ID: 4010  ABORT: 3/3

ITEM: TEMPERATURE SENSOR (NH3 CONTROLLER)
FAILURE MODE: ERRONEOUS INPUT, FAILS OFF-SCALE (HIGH/LOW)

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM (ABS)
3) CONTROLLER (A&B)
4) PRIMARY & SECONDARY
5) TEMPERATURE SENSOR
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REDUNDANCY SCREENS:  A [ ]  B [ ]  C [ ]

LOCATION: AFT BODY-AREA 50
PART NUMBER: 50V63A1-MTI, MT2, MT3, MT4, MT5, MT6

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION, MECHANICAL SHOCK, THERMAL STRESS

EFFECTS/RATIONALE:
A FAILED TEMPERATURE SENSOR LEADS TO FEEDBACK LOSS TO THE AMMONIA CONTROLLER. THE FEEDBACK FROM THIS SENSOR IS USED TO POSITION A CONTROL VALVE. THE LOSS OF ALL REDUNDANCY TO POSITION THESE CONTROL VALVES RESULTS IN LOSS OF ONE AMMONIA SYSTEM.

REFERENCES:

REPORT DATE 11/24/87  C-302
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 4011

ITEM: TANK ISOLATION VALVE (N.C.)
FAILURE MODE: FAILS TO OPEN

LEAD ANALYST: W. E. PARKMAN
SUBSYS LEAD: W. E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM (ABS)
3) CONTROLLER (A&B)
4) TANK ISOLATION VALVE (N.C.)
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LOCATION: AFT BODY-AREA 50
PART NUMBER: 50V63A1-LV1, LV2

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL FAILURE, CORROSION, VIBRATION, MECHANICAL SHOCK, THERMAL STRESS

EFFECTS/RATIONALE:
BLOCKAGE OF AMMONIA EXITING ONE OF TWO TANKS RESULTS IN LOSS OF ONE LEVEL OF REDUNDANCY DURING RTLS, TAL, AND AOA ABORTS. LOSS OF ALL REDUNDANCY TO COOL BOTH FREON LOOPS BY THE AMMONIA SYSTEM, LEADS TO LOSS OF CREW AND VEHICLE DURING ABORT PHASES (WITH THE EXCEPTION OF ATO).

REFERENCES:

REPORT DATE 11/24/87 C-303
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 4012

HIGHEST CRITICALITY

ITEM: TANK ISOLATION VALVE (N.C.)
FAILURE MODE: FAILS TO REMAIN CLOSED, EXTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM (ABS)
3) CONTROLLER (A&B)
4) TANK ISOLATION VALVE (N.C.)
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LOCATION: AFT BODY-AREA 50
PART NUMBER: 50V63A1-LV1, LV2

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL STRESS

EFFECTS/RATIONALE:
DEPLETION OF AMMONIA FROM ONE OF TWO TANKS RESULTS IN LOSS OF ONE LEVEL OF REDUNDANCY DURING RTLS, TAL, AND AOA ABORTS. LOSS OF ALL REDUNDANCY TO COOL BOTH FREON LOOPS BY THE AMMONIA SYSTEM, LEADS TO LOSS OF CREW AND VEHICLE DURING ABORT PHASES (EXCEPT ATO). THE EFFECTS OF THE AMMONIA LEAKING INTO THE AFT BODY ARE UNKNOWN; HOWEVER, IT IS EXPECTED TO HAVE NO IMPACT ON ORBITER PERFORMANCE.

REFERENCES:

REPORT DATE 11/24/87  C-304
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87  HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 2/1R
MDAC ID: 4013  ABORT: 2/1R

ITEM: NH3 BOILER/HEAT EXCHANGER
FAILURE MODE: INTERNAL LEAKAGE (FREON 21 TO NH3), EXTERNAL LEAKAGE (FREON)

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM (ABS)
3) NH3 BOILER/HEAT EXCHANGER

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LOCATION: AFT BODY-AREA 50
PART NUMBER: 50V63A1LV1

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS

EFFECTS/RATIONALE:
DURING THE DEPLETION OF FREON FROM ONE COOLANT LOOP ENTRY IS REQUIRED AT THE NEXT PRIMARY LANDING SITE. A SECOND FAILURE TO THE REDUNDANT LOOP RESULTS IN LOSS OF CREW AND VEHICLE. HOWEVER, LEAKAGE OF FREON INTO THE AFT BODY DOES NOT EFFECT THE ORBITER.

REFERENCES:

REPORT DATE 11/24/87  C-305
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 4014

HIGHEST CRITICALITY

HDW/FUNC

FLIGHT: 3/3
ABORT: 1/1

ITEM: NH3 BOILER/HEAT EXCHANGER
FAILURE MODE: EXTERNAL LEAKAGE (NH3)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM (ABS)
3) NH3 BOILER/HEAT EXCHANGER
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ACTIVE THERMAL CONTROL SYSTEM
AMMONIA BOILER SYSTEM (ABS)
NH3 BOILER/HEAT EXCHANGER

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: AFT BODY-AREA 50

PART NUMBER:

CAUSES: MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS

EFFECTS/RATIONALE:
AN EXTERNAL LEAK THAT ELIMINATES FLOW THROUGH THE HEAT EXCHANGER RESULTS IN LOSS OF CREW AND VEHICLE DURING RTLS, TAL, AND AOA ABORTS. THE EFFECTS OF AMMONIA IN THE AFT BODY ARE UNKNOWN; HOWEVER, IT IS EXPECTED TO HAVE NO IMPACT ON ORBITER PERFORMANCE.

REFERENCES:

REPORT DATE 11/24/87  C-306
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 4015

ITEM: TANK DISCONNECTS, LINES AND FITTINGS (RELIEF VALVE TO ISOLATION VALVE)
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM (ABS)
3) LINES & FITTINGS (RELIEF VALVE TO ISOLATION VALVE)

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LOCATION: AFT BODY-AREA 50
PART NUMBER: 50V63A1

CAUSES: CORROSION, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL STRESS

EFFECTS/RATIONALE:
DEPLETION OF AMMONIA FROM ONE OF TWO TANKS RESULTS IN LOSS OF ONE LEVEL OF REDUNDANCY DURING RTLS, TAL, AND AOA ABORTS. LOSS OF ALL ABILITY TO COOL THE FREON LOOPS BY THE AMMONIA SYSTEM LEADS TO LOSS OF CREW AND VEHICLE DURING ABORT PHASES (EXCEPT ATO). THE EFFECTS OF AMMONIA IN THE AFT BODY ARE UNKNOWN; HOWEVER, IT IS EXPECTED TO HAVE NO IMPACT ON ORBITER PERFORMANCE.

REFERENCES:

REPORT DATE 11/24/87 C-307
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/3
MDAC ID: 4016  ABORT: 1/1

ITEM: LINES & FITTINGS (ISOLATION VALVE TO BOILER)
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM (ABS)
3) LINES & FITTINGS (ISOLATION VALVE TO BOILER)
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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: AFT BODY
PART NUMBER:

CAUSES: PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL STRESS, CORROSION

EFFECTS/RATIONALE:
AN EXTERNAL LEAK THAT ELIMINATES FLOW THROUGH THE HEAT EXCHANGER RESULTS IN LOSS OF CREW AND VEHICLE DURING RTLS, TAL, AND AOA ABORTS. THE EFFECTS OF AMMONIA IN THE AFT BODY ARE UNKNOWN; HOWEVER, IT IS EXPECTED TO HAVE NO IMPACT ON ORBITER PERFORMANCE.

REFERENCES:

REPORT DATE 11/24/87  C-308
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 4017

ITEM: LINES (BOILER TO DISCHARGE VENT)
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM (ABS)
3) LINES & FITTINGS (BOILER TO DISCHARGE VENT)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: AFT BODY
PART NUMBER:

CAUSES: CORROSION, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, THERMAL STRESS

EFFECTS/RATIONALE:
The AMMONIA SYSTEM CONTINUES TO FUNCTION PROPERLY. AMMONIA ENTERS THE AFT BODY DUE TO THIS FAILURE MODE, INSTEAD OF VENTING OVERBOARD. THE EFFECTS OF AMMONIA IN THE AFT BODY ARE UNKNOWN; HOWEVER, IT IS EXPECTED TO HAVE NO IMPACT ON ORBITER PERFORMANCE.

REFERENCES:

REPORT DATE 11/24/87 C-309
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/3
MDAC ID: 4018  ABORT: 3/3

ITEM: TEMPERATURE TRANSDUCER (NH3 EXHAUST)
FAILURE MODE: ERRONEOUS OUTPUT, FAILS OFF-SCALE (HIGH/LOW)

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM (ABS)
3) LINES
4) EXHAUST DUCT
5) TEMPERATURE TRANSDUCER

CRITICALITIES

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: AFT BODY
PART NUMBER:

CAUSES: MECHANICAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
FREON COOLANT LOOP SENSORS WHICH ARE DOWNSTREAM OF THE AMMONIA BOILER, PROVIDE SUFFICIENT PERFORMANCE DATA.

REFERENCES: VS70-960102

REPORT DATE 11/24/87  C-310
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87  HIGHEST CRITICALITY
SUBSYSTEM: ATCS                    HDW/FUNC: FLIGHT: 3/3
MDAC ID: 4019                     ABORT: 3/3

ITEM: RESISTOR (NH3 CONTROLLER)
FAILURE MODE: OPEN (ELECTRICAL)

LEAD ANALYST: W.E. PARKMAN        SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM
3) PANEL L1A2 (1.2K)
4) RESISTOR
5) 
6) 
7) 
8) 
9) 

REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-A4R13, A4R14, A4R15, A4R16, A4R17, A4R18

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL
FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
INABILITY TO CONTROL ONE AMMONIA SYSTEM BY THE GPC OR MANUALLY,
DEPENDING ON THE FAILED RESISTOR. THE REDUNDANT CIRCUIT
CONTINUES TO OPERATE THE CONTROL VALVES. FOR LOSS OF ALL
REDUNDANCY TO POSITION THE CONTROL VALVES IN ONE SYSTEM, FREON
LOOPS ARE COOLED USING THE STANDBY SYSTEM DURING RTLS, TAL, AND
AOA ABORTS.

REFERENCES:

REPORT DATE 11/24/87    C-311
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 4020

ITEM: RESISTOR (NH3 CONTROLLER)
FAILURE MODE: SHORTED

LEAD ANALYST: W. E. PARKMAN
SUBSYS LEAD: W. E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM
3) PANEL L1A2
4) RESISTOR (1.2K)

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REDUNDANCY SCREENS: A [ ]  B [ ]  C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-A4R13, A4R14, A4R15, A4R16, A4R17, A4R18

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
AN OVERCURRENT IN THE CIRCUIT ELIMINATES ONE METHOD OF POSITIONING CONTROL VALVES FOR ONE SYSTEM. THE REDUNDANT CIRCUIT CONTINUES TO OPERATE CONTROL VALVES. FOR LOSS OF ALL REDUNDANCY TO POSITION THE CONTROL VALVES IN ONE SYSTEM, THE FREON LOOPS ARE COOLED USING THE STANDBY SYSTEM.

REFERENCES:
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/3
MDAC ID: 4021  ABORT: 2/1R

ITEM: SWITCH 42 (NH3 CONTROLLER)
FAILURE MODE: FAILS TO SWITCH FROM PRI/GPC, FAILS TO SWITCH FROM SEC/ON

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM
3) PANEL L1A2
4) SWITCH 42
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LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2 -S42, S43

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
IF SWITCH FAILS IN THE GPC POSITION, SYSTEM OPERATES NOMINALLY. FOR A FAILURE IN THE MANUAL POSITION, ONE SYSTEM OPERATES UNTIL PRESSURE ON AMMONIA IS LOST. FOR LOSS OF ALL REDUNDANCY TO COOL FREON DURING RTLS, TAL, AND AOA ABORTS, CREW AND VEHICLE ARE LOST.

REFERENCES:

REPORT DATE 11/24/87  C-313
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87  HIGHEST CRITICALITY  HDW/FUNC
SUBSYSTEM: ATCS  FLIGHT: 3/3
MDAC ID: 4022  ABORT: 2/1R

ITEM: SWITCH 42 (NH3 CONTROLLER)  HIGHEST CRITICALITY
FAILURE MODE: FAILS TO SWITCH FROM OFF

LEAD ANALYST: W.E. PARKMAN  SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM
3) PANEL L1A2
4) SWITCH 42
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LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
SINCE ISOLATION AND CONTROL VALVES CANNOT BE POSITIONED, ONE AMMONIA SYSTEM IS LOST. THE LOSS OF ALL REDUNDANCY TO COOL FREON USING THE REDUNDANT AMMONIA SYSTEM LEADS TO LOSS OF CREW AND VEHICLE.

REFERENCES:

REPORT DATE 11/24/87  C-314
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 4023

ITEM: RESISTOR (NH3 FEEDBACK)
FAILURE MODE: OPEN (ELECTRICAL)

LEAD ANALYST: W. E. PARKMAN
SUBSYS LEAD: W. E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM
3) PANEL L1A2
4) RESISTOR (5.1K)

CRITICALITIES

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-A4R9, A4R10, A4R11, A4R12

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
TELEMETRY INDICATING THE POSITION OF NH3 BOILER SWITCH IS LOST. HOWEVER, THE SWITCH POSITION IS DETERMINED BY FEEDBACK FROM OTHER MEASUREMENTS (I.E.-SWITCH OR FREON LOOP).

REFERENCES:

REPORT DATE 11/24/87 C-315
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 4024

ITEM: RESISTOR (NH3 FEEDBACK)
FAILURE MODE: SHORTED

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM
3) PANEL L1A2
4) RESISTOR (5.1K)

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A1A2-A4R9, A4R10, A4R11, A4R12

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
TELEMETRY INDICATING THE POSITION OF NH3 BOILER SWITCH IS LOST.
HOWEVER, THE SWITCH POSITION IS DETERMINED BY FEEDBACK FROM OTHER MEASUREMENTS (I.E.-SWITCH OR FREON LOOP).

REFERENCES:

REPORT DATE 11/24/87 C-316
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 4025

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

ITEM: DIODES (GPC)
FAILURE MODE: OPEN (ELECTRICAL)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM
3) ALCA (PRI/GPC)
4) DIODE
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: AFT AVIONICS BAY 4 AREA 54
PART NUMBER: 54V76A121-CR, CR (ZONE 12, 12); 56V76A123-CR, CR (ZONE 7, 7)

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
THE LOSS OF A DIODE INHIBITS THE COMMAND OF ONE AMMONIA BOILER SYSTEM BY THE GPC. LOSS OF REDUNDANCY TO COMMAND AMMONIA SYSTEMS USING THE GPC REQUIRES CREW ACTION SWITCHING FROM GPC TO MANUAL.

REFERENCES:

REPORT DATE 11/24/87 C-317
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 4026

ITEM: DIODES (GPC)
FAILURE MODE: SHORTED

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM
3) ALCA (PRI/GPC)
4) DIODE

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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: AFT AVIONICS BAY 4 AREA 54
PART NUMBER: 54V76A121-CR, CR (ZONE 12, 12); 56V76A123-CR, CR (ZONE 7, 7)

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
Both ammonia systems operate simultaneously when switches 42 and 43 are in the GPC position. The ammonia system operates nominally, when the switch associated with the failed diode is in the off position. Loss of all redundancy to command ammonia system using the GPC requires crew action in switching from GPC to manual.

REFERENCES:

REPORT DATE 11/24/87 C-318
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 4027

ITEM: HYBRID DRIVER (POWER-PRI/GPC)
FAILURE MODE: FAILS "ON"

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM
3) ALCA
4) HYBRID DRIVER
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REDUNDANCY SCREENS: A [ ] B [ ] C [ ]

LOCATION: AFT AVIONICS BAY 4 AREA 54
PART NUMBER: 54V76A121-ZONE 6, 7; 55V76A122-ZONE 8, 8; 56V76A123-ZONE 11, 11, 12, 12

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
A HYBRID DRIVER THAT FAILS "ON" HAS NO EFFECT ON THE CIRCUIT, SINCE THE DRIVERS ARE IN SERIES. AN INPUT FROM THE SWITCH TO THE NON-FAILED DRIVER MUST OCCUR BEFORE THE CIRCUIT WILL OPERATE. IF ALL REDUNDANCY IN CIRCUIT IS LOST, HYBRID DRIVERS COULD OPEN AN ISOLATION VALVE, THEREBY DEPLETING AMMONIA FROM ONE OF TWO TANKS. CONTROL VALVES SHOULD REGULATE THE AMOUNT OF AMMONIA RELEASED AND PROTECT AGAINST UNDER COOLING THE FREON.

REFERENCES:

REPORT DATE 11/24/87 C-319
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 4028

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

ITEM: HYBRID DRIVER (NH3 CONTROLLER)
FAILURE MODE: FAILS "OFF", OPEN (ELECTRICAL)

LEAD ANALYST: W.E. PARKMAN
SUBSYS LEAD: W.E. PARKMAN

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) AMMONIA BOILER SYSTEM
3) ALCA
4) HYBRID DRIVER
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REDUNDANCY SCREENS:  A [ ]  B [ ]  C [ ]

LOCATION: AFT AVIONICS BAY 4 AREA 54
PART NUMBER: 54V76A121-ZONE 6, 7; 55V76A122-ZONE 9, 9;
56V76A123-ZONE 11, 11, 12, 12

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, THERMAL STRESS, VIBRATION

EFFECTS/RATIONALE:
THE INABILITY TO CONTROL AMMONIA SYSTEM BY THE GPC OR MANUALLY, DEPENDS ON THE FAILED DRIVER. THE REDUNDANT CIRCUIT CONTINUES TO OPERATE CONTROL VALVES. FOR LOSS OF ALL REDUNDANCY TO POSITION ISOLATION AND CONTROL VALVES FOR ONE SYSTEM, BOTH FREON LOOPS ARE COOLED USING THE STANDBY SYSTEM DURING RTLS, TAL, AND AOA ABORTS.

REFERENCES:

REPORT DATE 11/24/87  C-320
APPENDIX D

POTENTIAL CRITICAL ITEMS
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<th>MDAC-ID</th>
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