INDEPENDENT ORBITER ASSESSMENT

ANALYSIS OF THE ACTIVE THERMAL CONTROL SUBSYSTEM

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MCDONNELL DOUGLAS ASTRONAUTICS COMPANY
HOUSTON DIVISION

SPACE TRANSPORTATION SYSTEM ENGINEERING AND OPERATIONS SUPPORT

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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:

o Freon Coolant Loops

o Radiator and Flow Control Assembly

o Flash Evaporator System

o 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.

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Summary of ATCS Failure Modes By Criticality (HW/F)							
Criticality :	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
Number :	4	89	4	45	79	89	310

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:

Summary of ATCS Potential Critical Items (HW/F)						
Criticality :	1/1	2/1R	2/2	3/1R	3/2R	TOTAL
Number :	4	89	4	0	4	101

Of the 310 failure modes analyzed, 101 were determined to be PCIs.

ACTIVE THERMAL CONTROL SUBSYSTEM OVERVIEW ANALYSIS SUMMARY

ATCS ANALYSIS SUMMARY

CRIT.	#FM	#PCI	CRIT.	#FM	#PCI
1/1	4	4	3/1R	45	0
2/1R	89	89	3/2R	79	4
2/2	4	4	3/3	89	0

FREON COOLANT LOOP

CRIT.	#FM	#PCI
1/1	1	1
2/1R	55	55
2/2	0	0
3/1R	0	0
3/2R	17	3
3/3	35	0

RADIATOR AND FLOW CONTROL ASSEMBLY

CRIT.	#FM	#PCI
1/1	0	0
2/1R	7	7
2/2	0	0
3/1R	0	0
3/2R	22	0
3/3	11	0

FLASH EVAPORATOR SYSTEM

CRIT.	#FM	#PCI
1/1	1	1
2/1R	16	16
2/2	4	4
3/1R	45	0
3/2R	40	1
3/3	28	0

AMMONIA BOILER SYSTEM

CRIT.	#FM	#PCI
1/1	2	2
2/1R	11	11
2/2	0	0
3/1R	0	0
3/2R	0	0
3/3	15	0

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

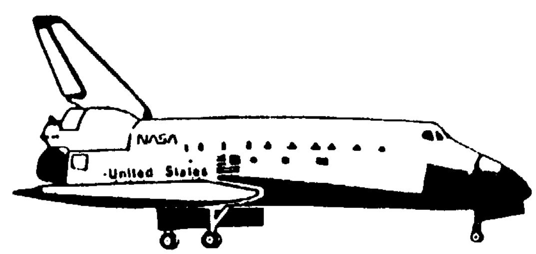


Figure 1 - ACTIVE THERMAL CONTROL SUBSYSTEM OVERVIEW ANALYSIS SUMMARY

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.

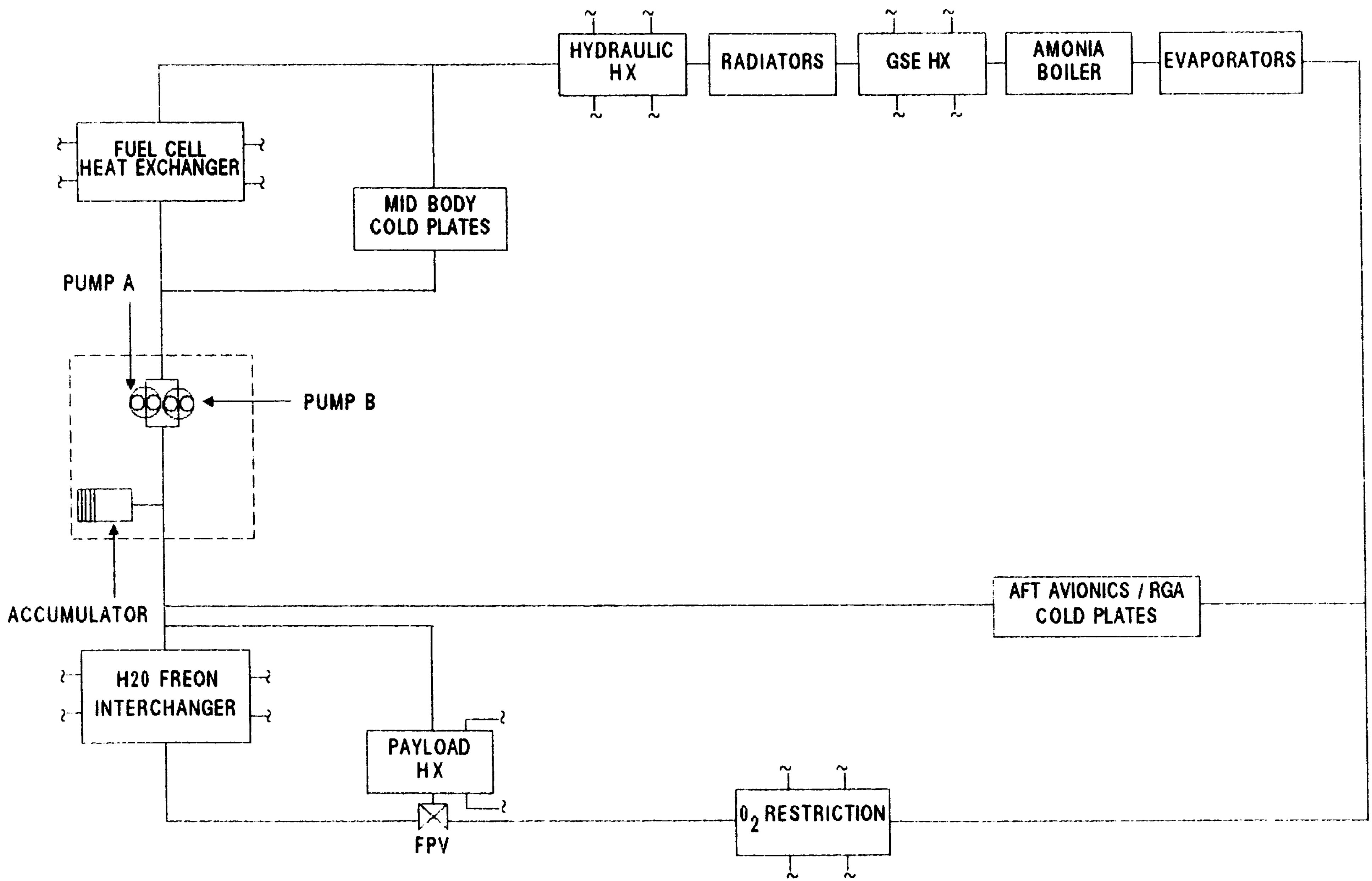


Figure 2 - ACTIVE THERMAL CONTROL SUBSYSTEM DIAGRAM

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 evaporater 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.

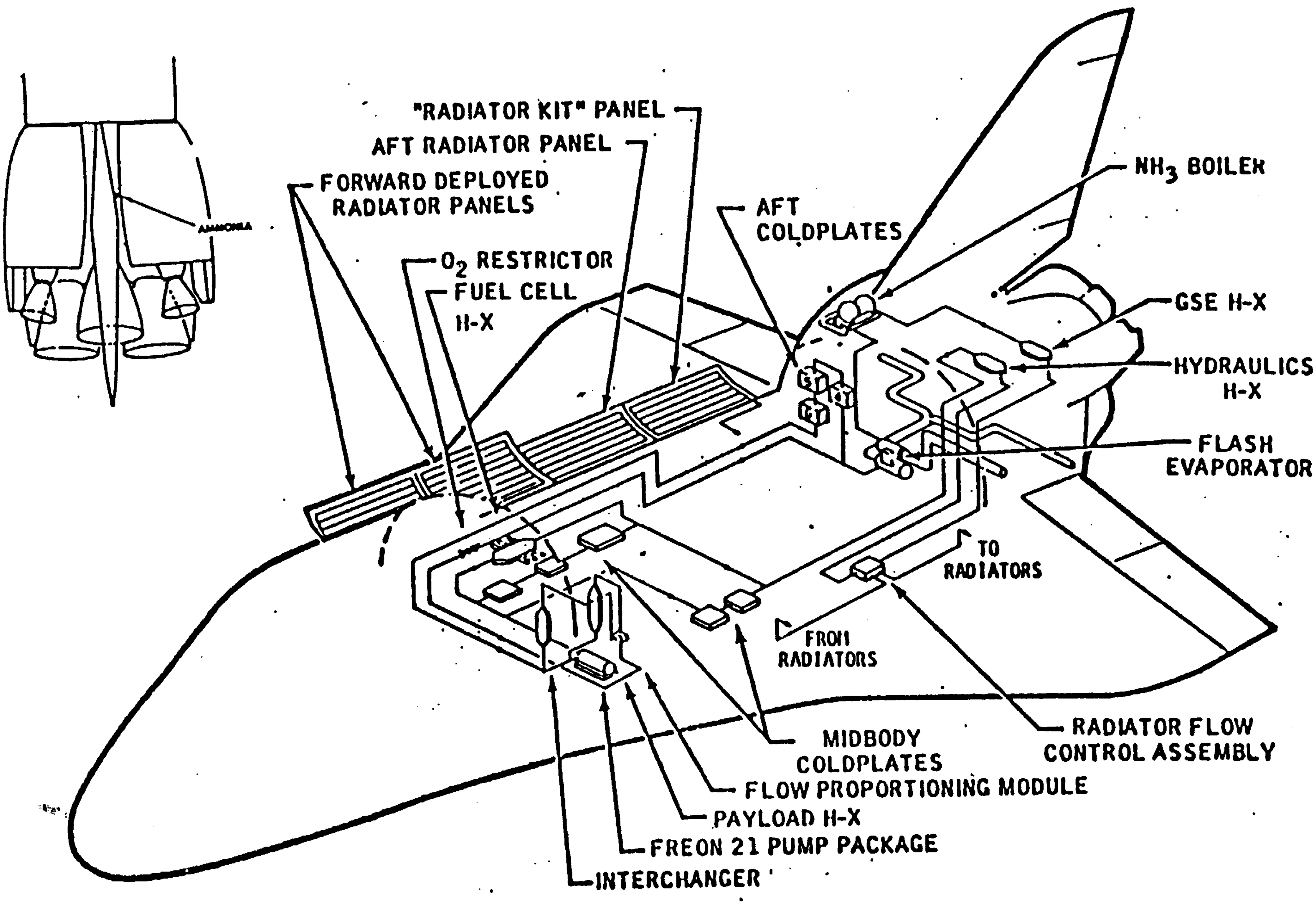


Figure 3 - ACTIVE THERMAL CONTROL SUBSYSTEM COMPONENT LOCATION

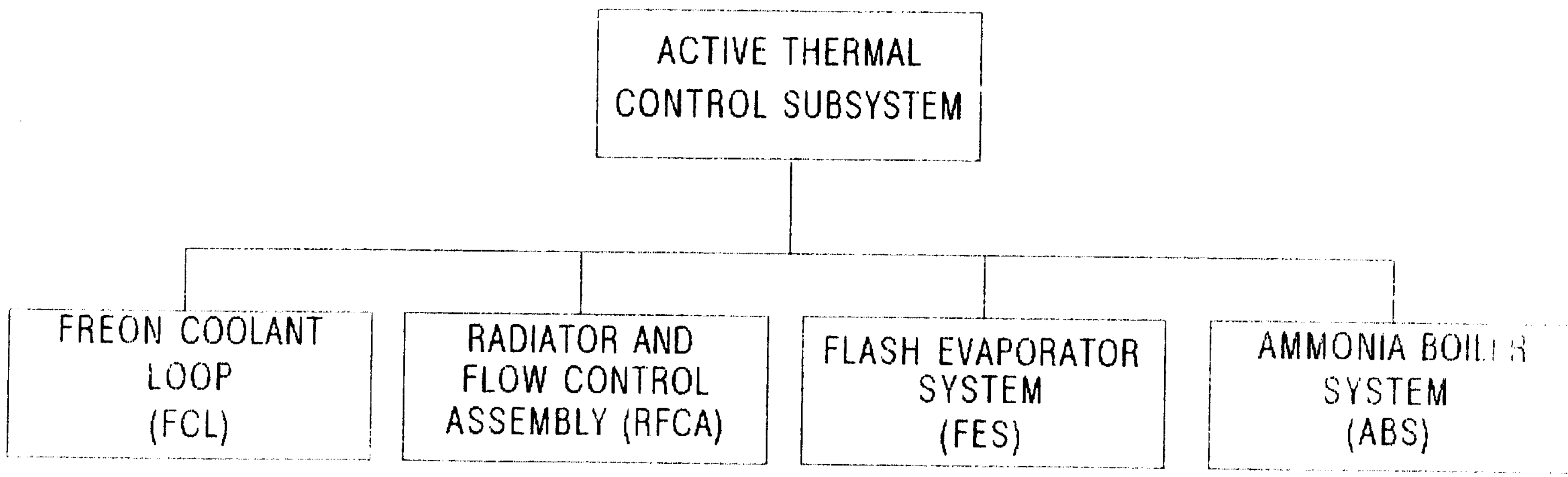


Figure 4 - ACTIVE THERMAL CONTROL SUBSYSTEM ANALYSIS HIERARCHY

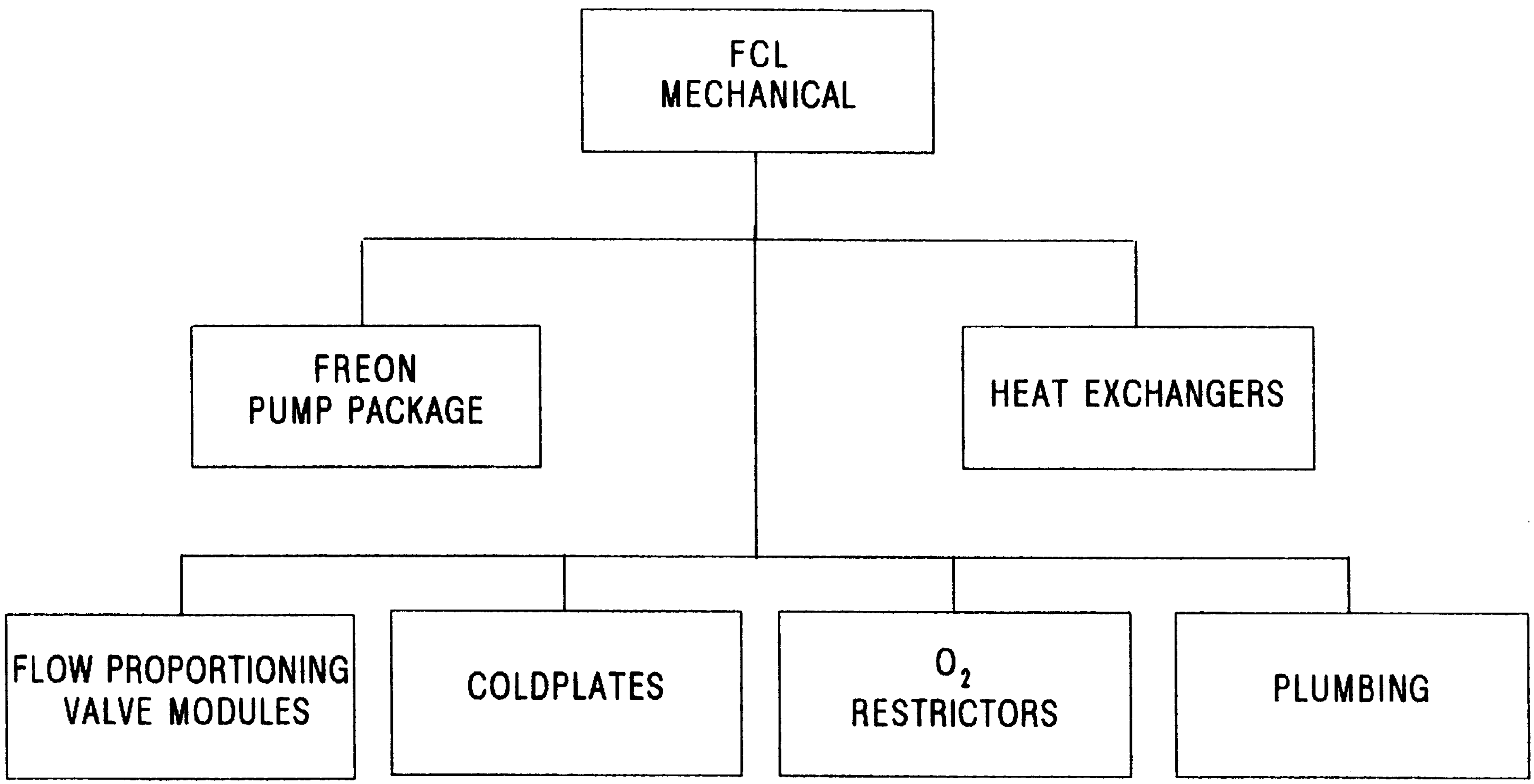


Figure 5 - FREON COOLANT LOOP MECHANICAL

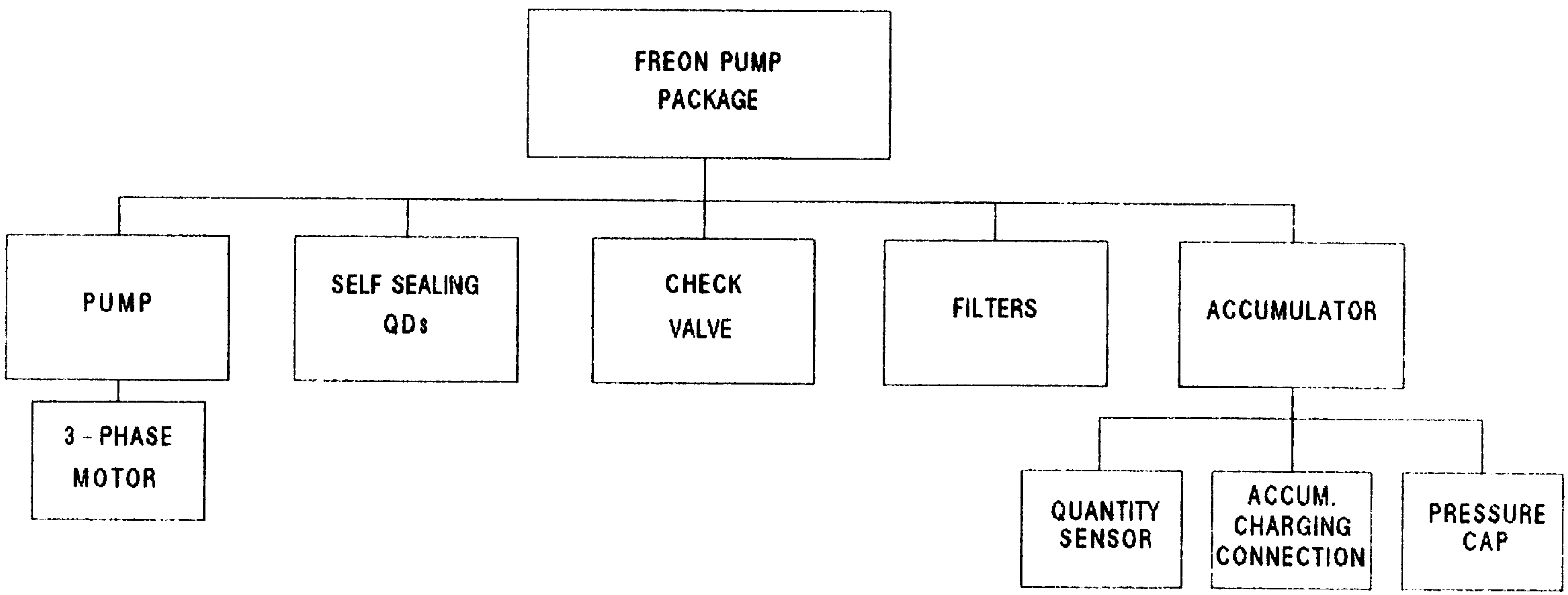


Figure 6 - FREON PUMP PACKAGE

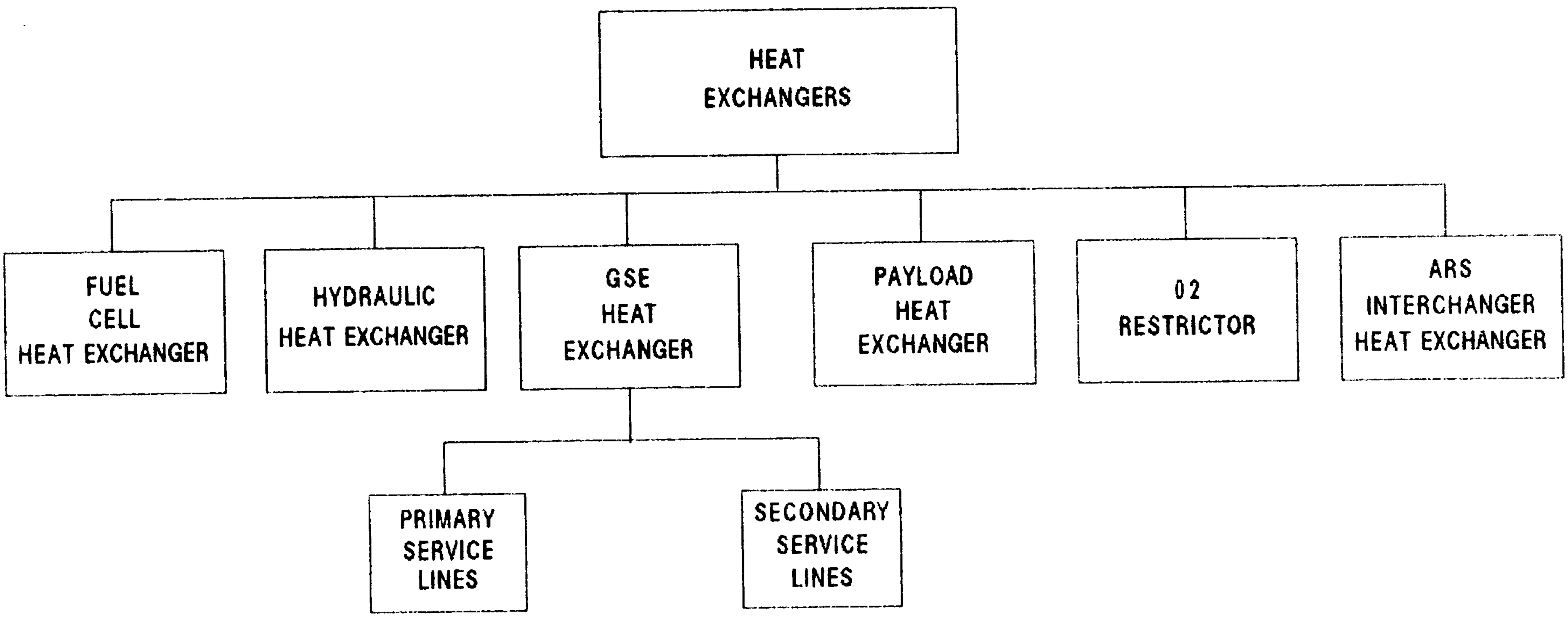


Figure 7 - HEAT EXCHANGERS

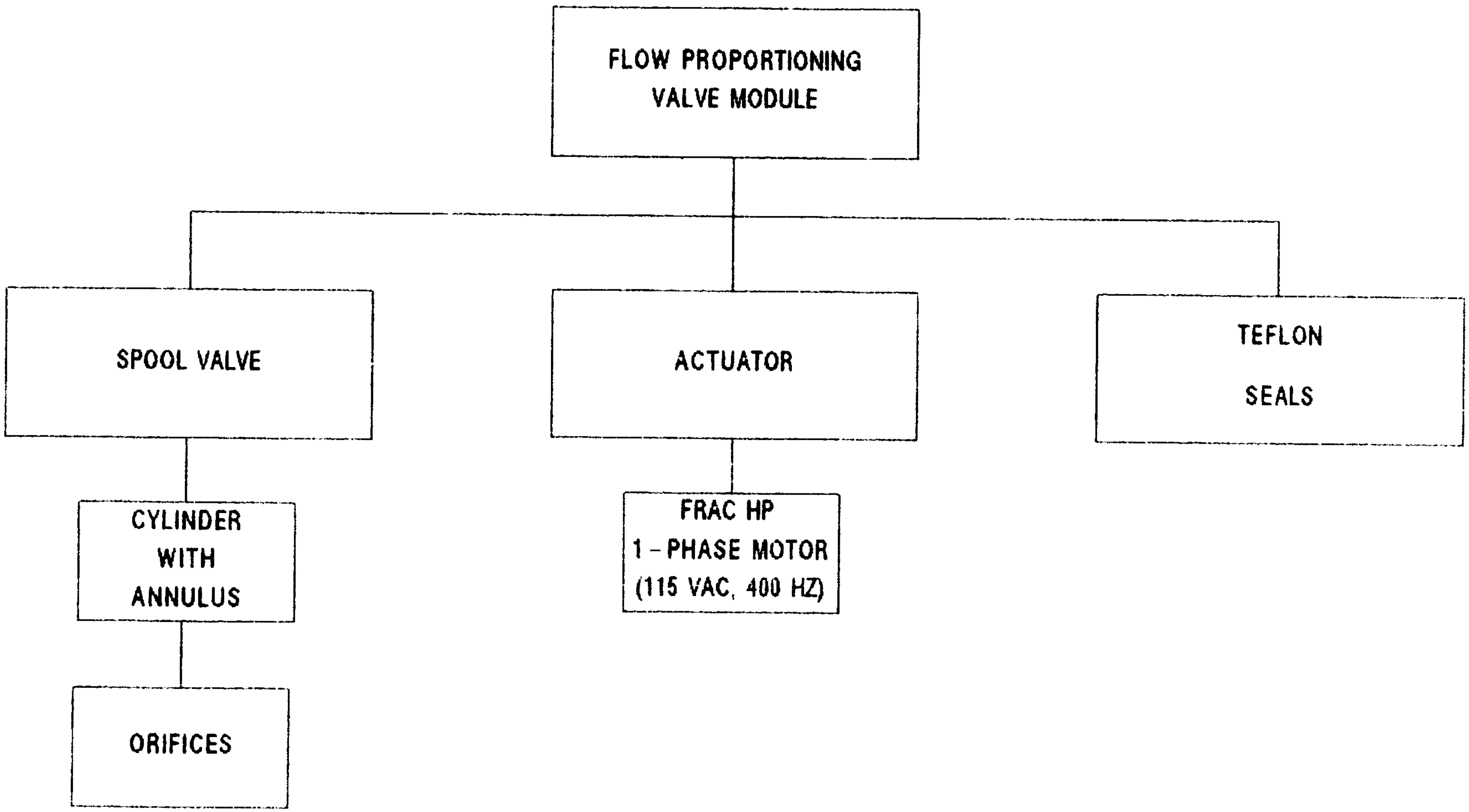


Figure 8 - FLOW PROPORTIONING VALVE MODULE

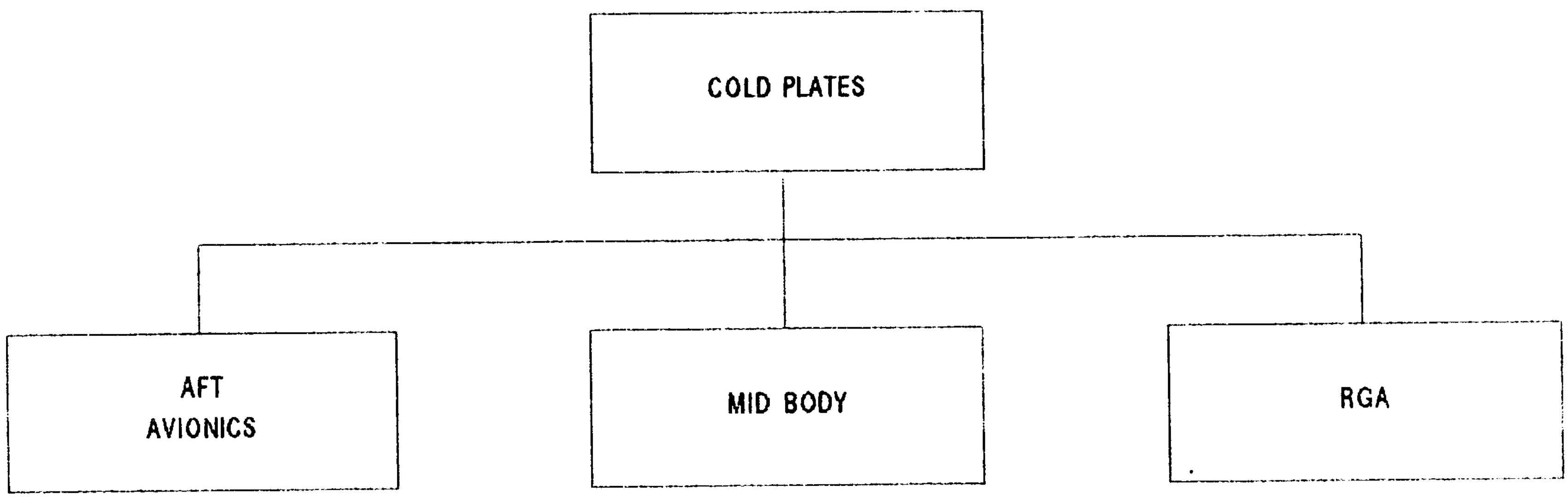


Figure 9 - COLD PLATES

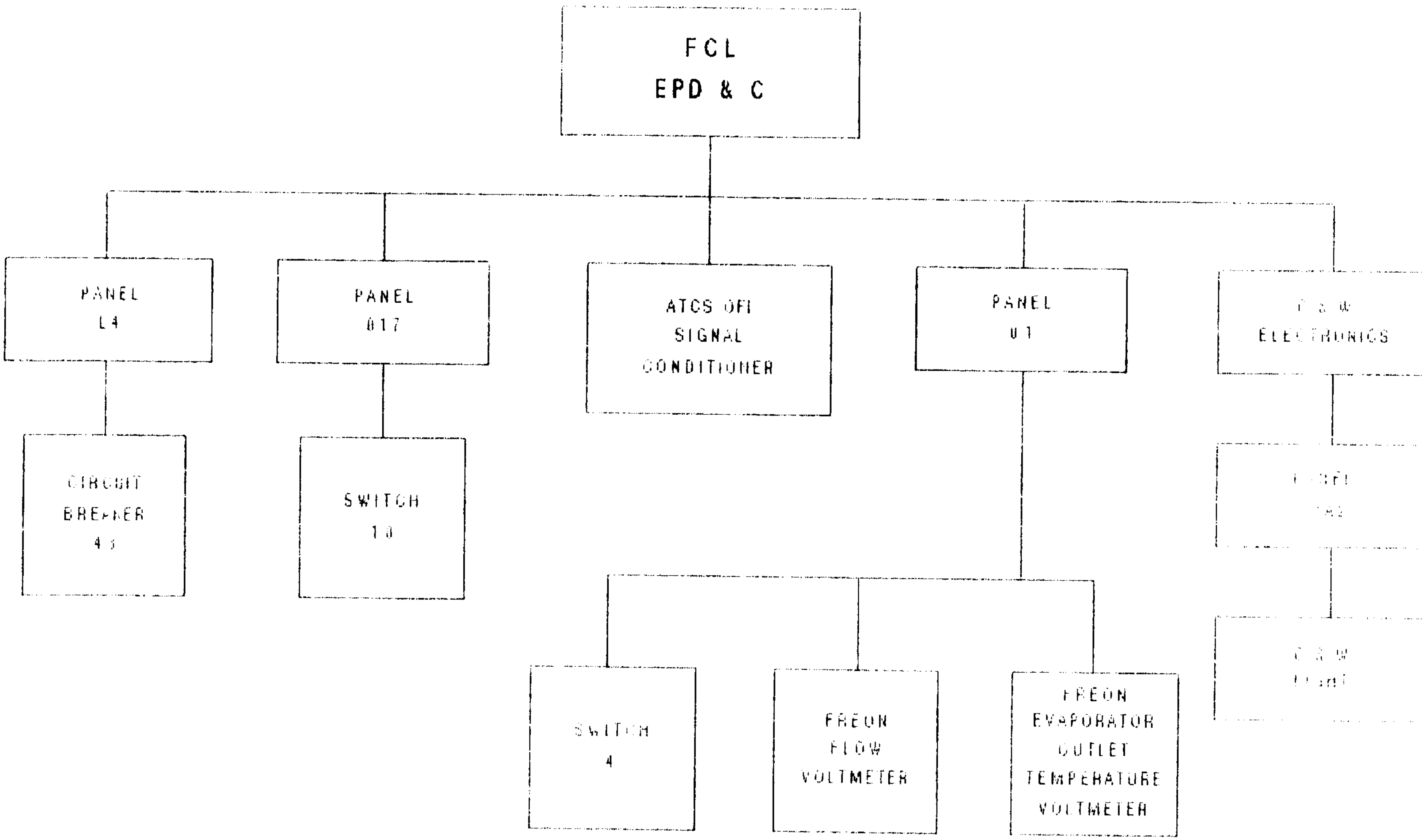
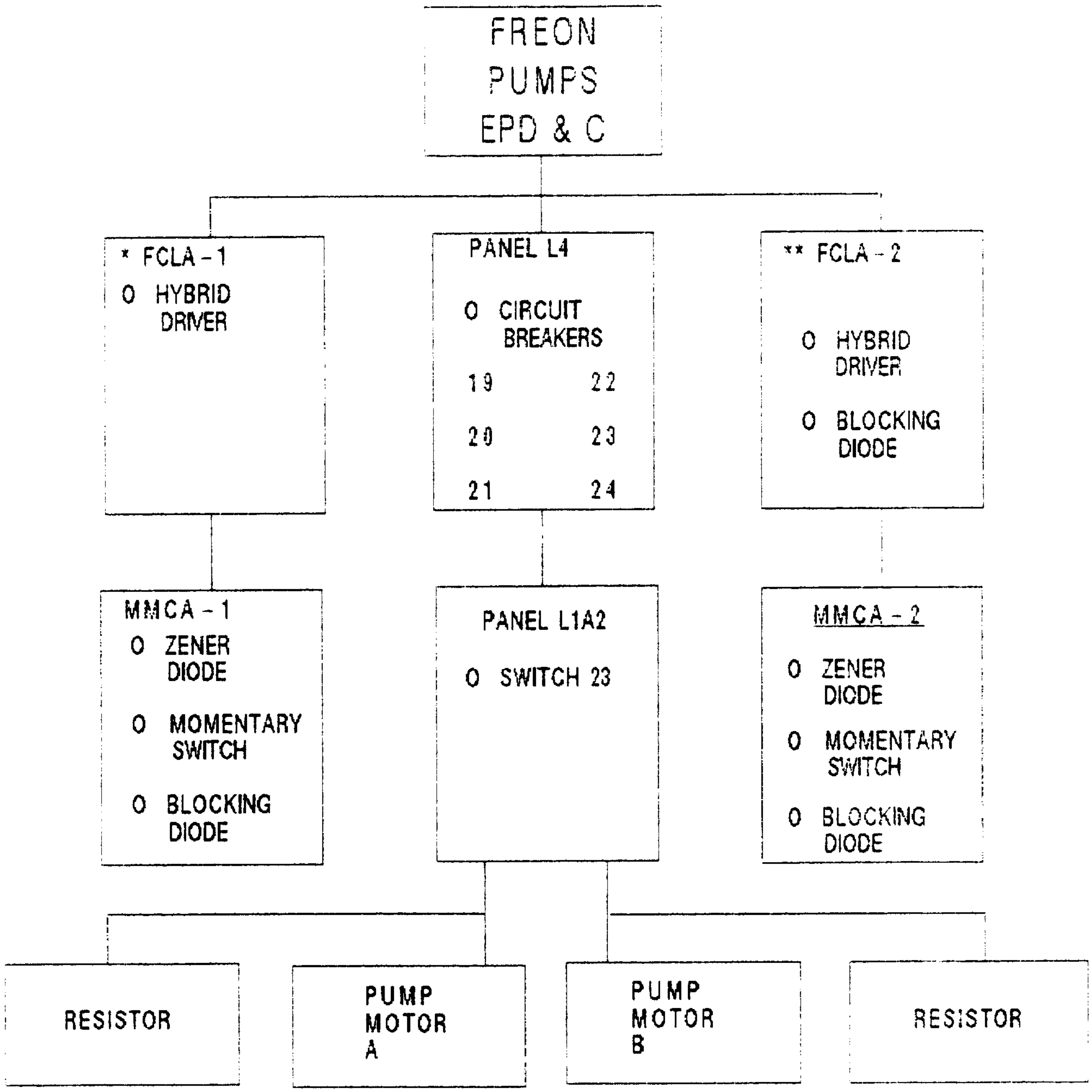


Figure 10 - FCL EPD&C



* 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

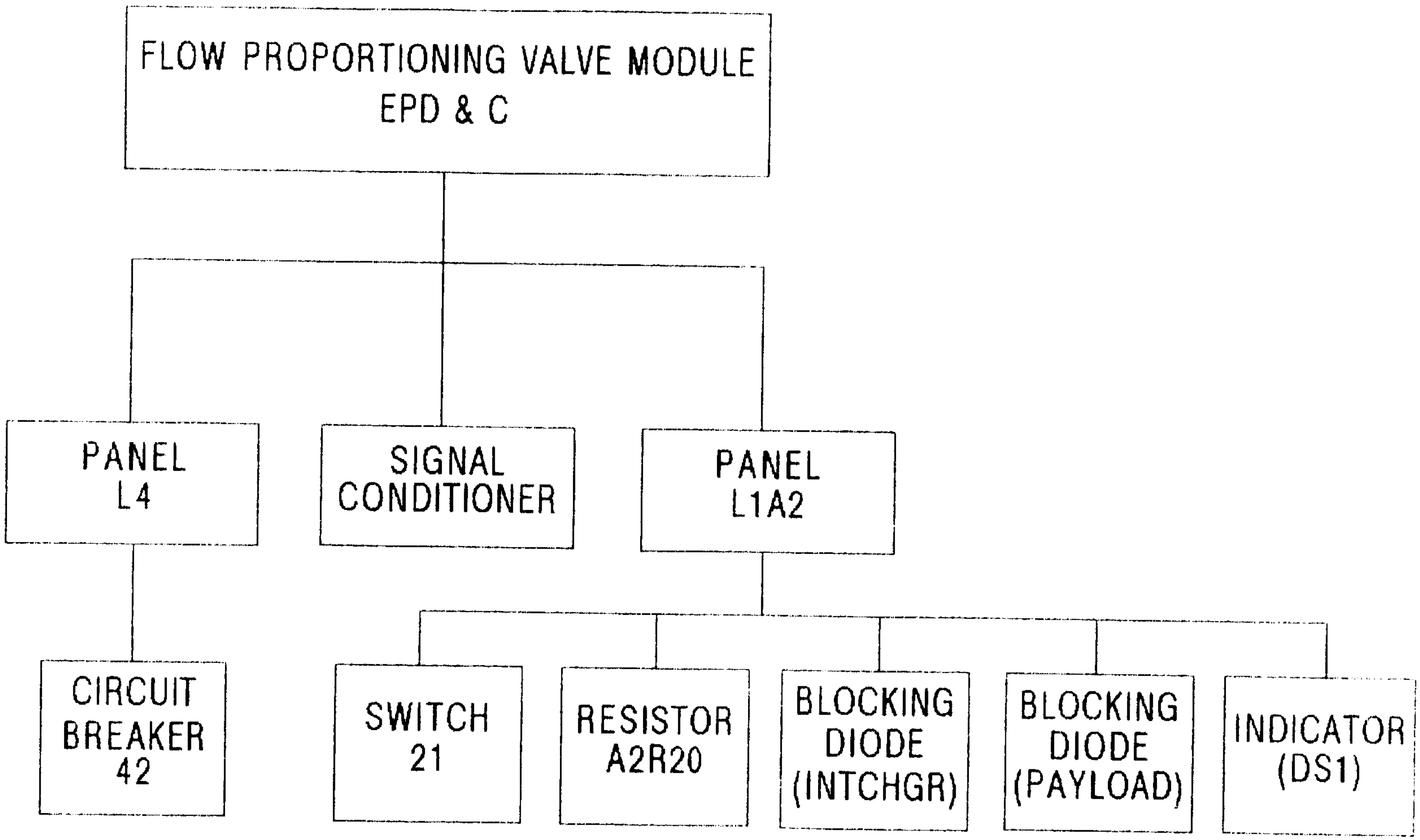


Figure 12 - FLOW PROPORTIONING VALVE MODULE EPD&C

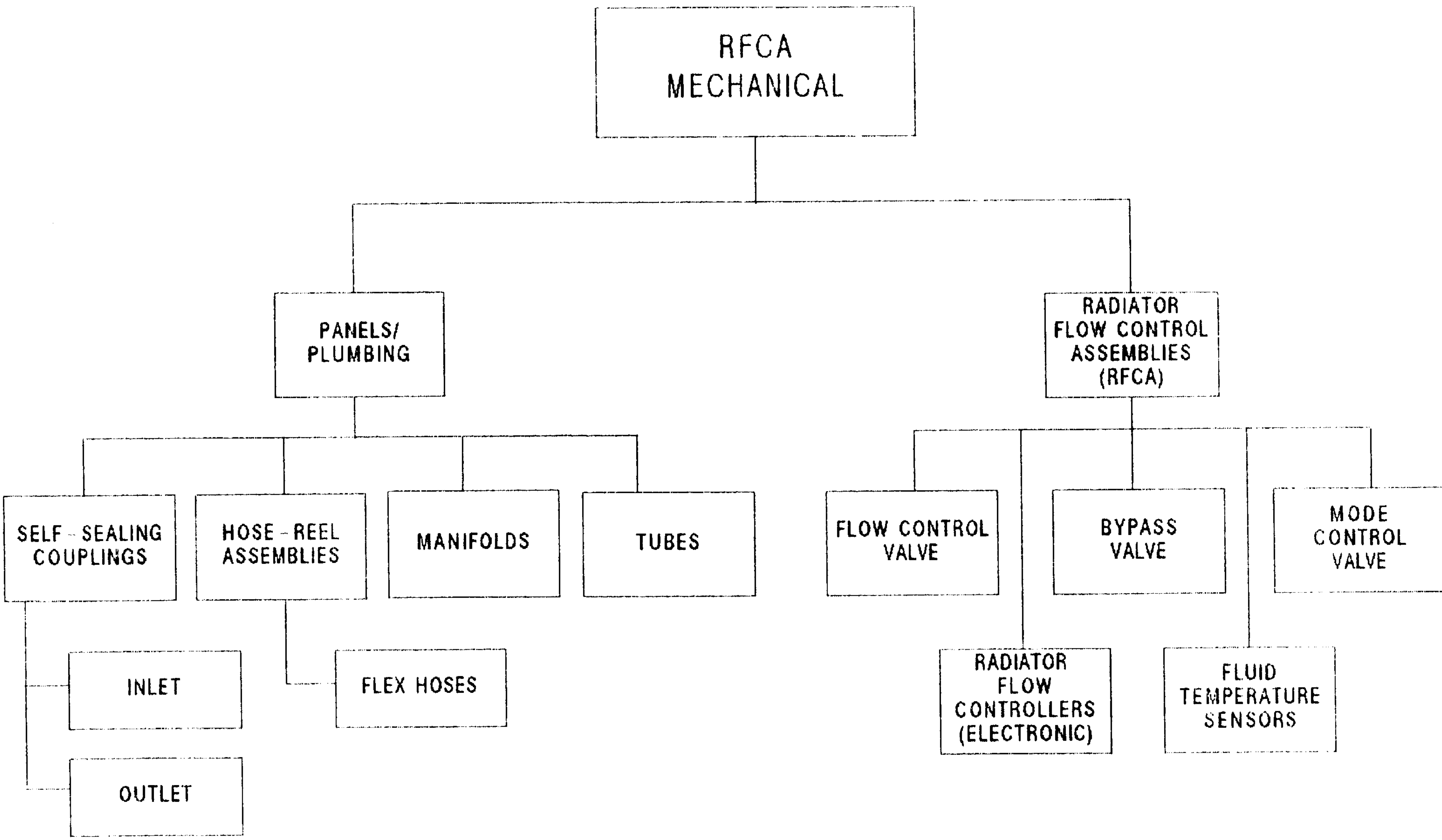


Figure 13 - RFCA MECHANICAL

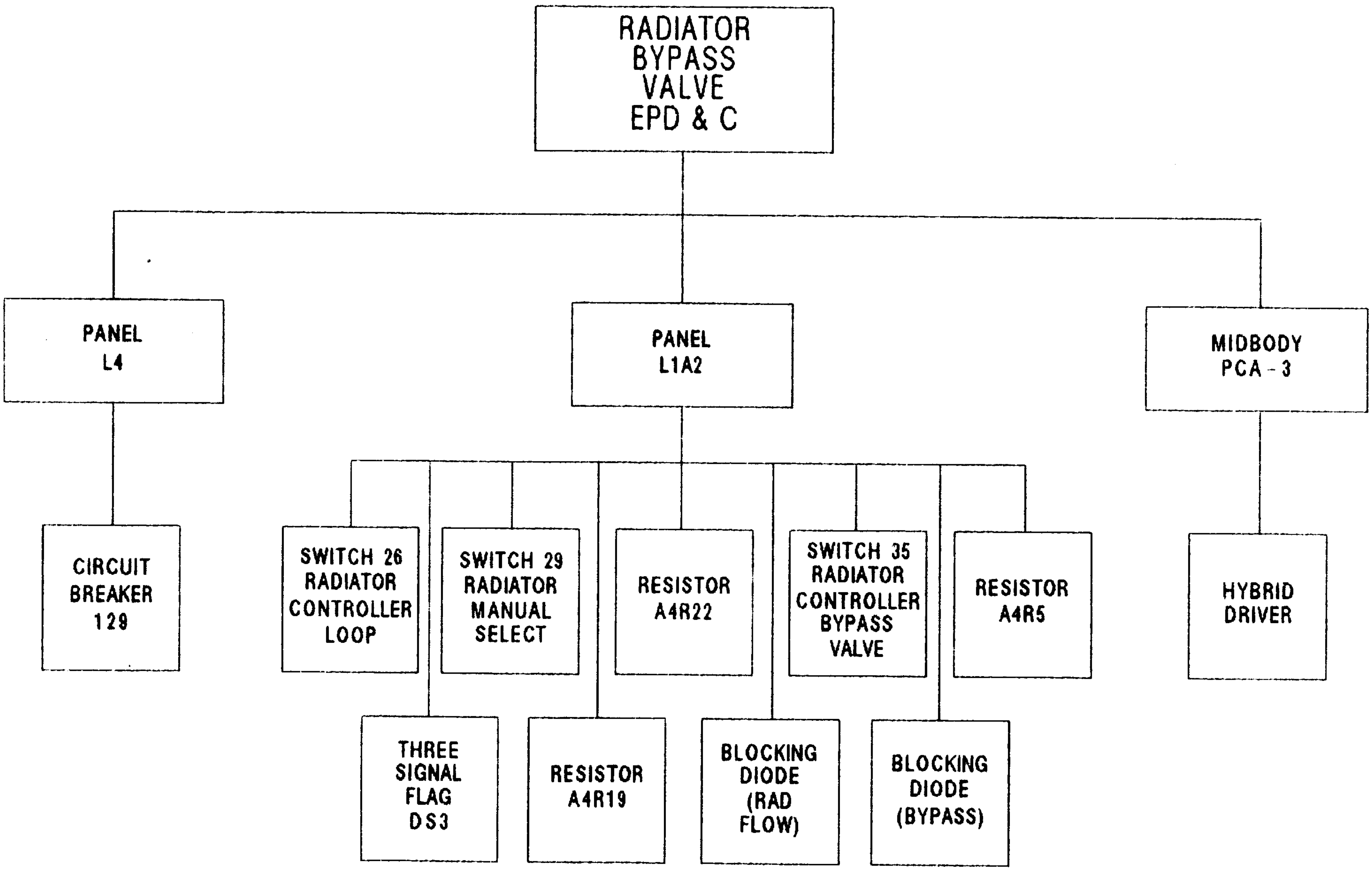


Figure 14 - RADIATOR BYPASS VALVE EPD&C

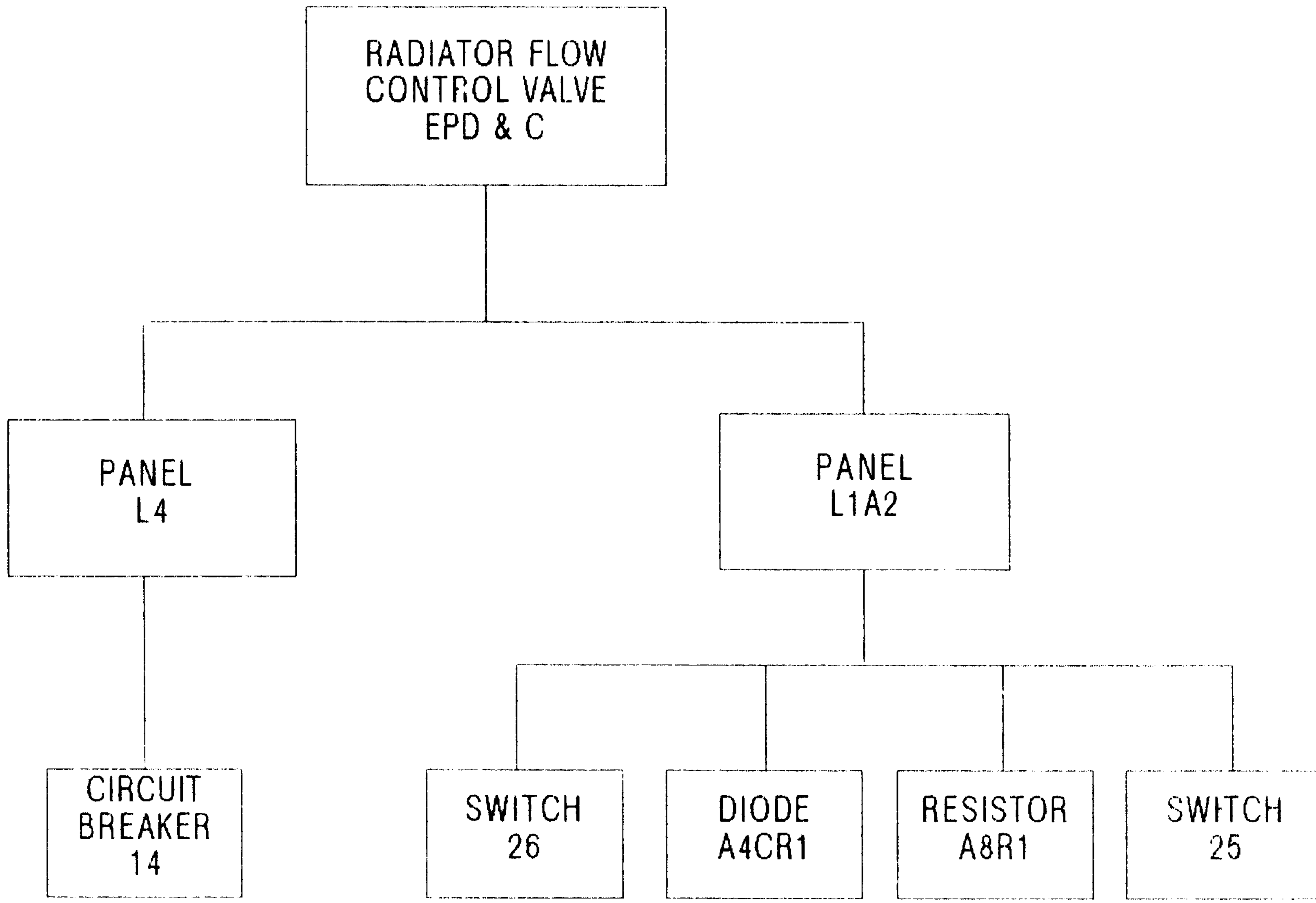


Figure 15 - RADIATOR FLOW VALVE CONTROL EPD&C

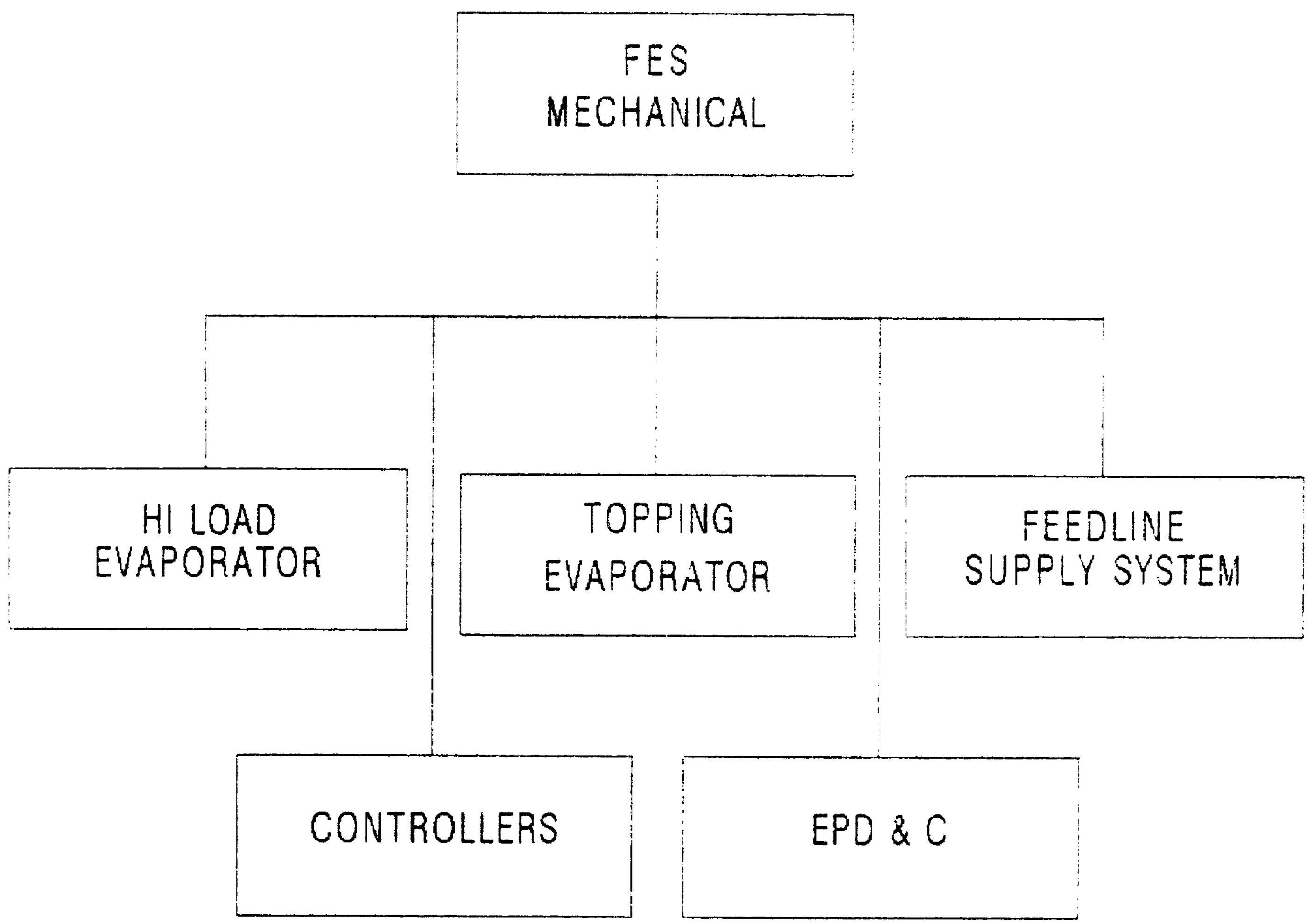


Figure 16 - FES MECHANICAL

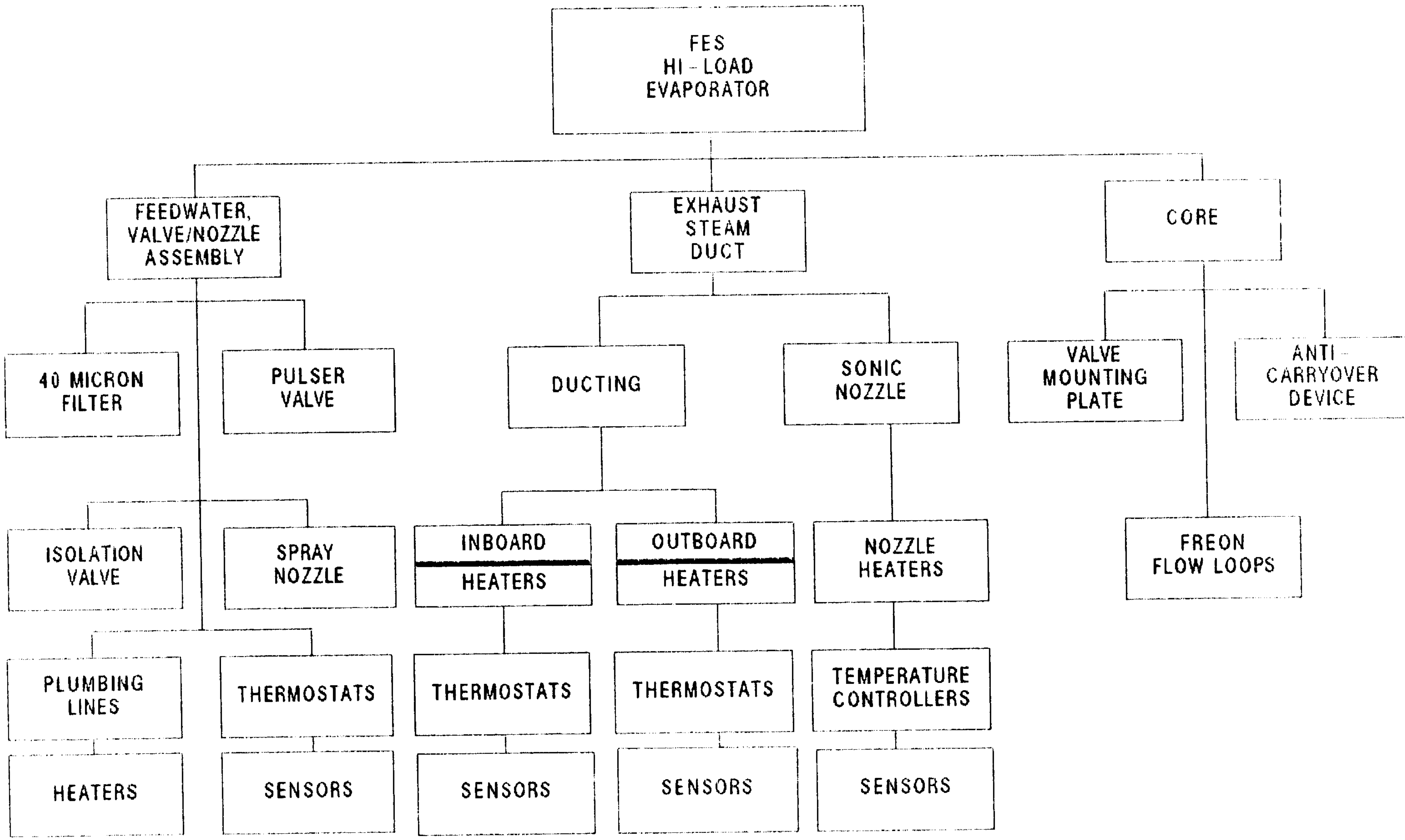


Figure 17 - FES HI-LOAD EVAPORATOR

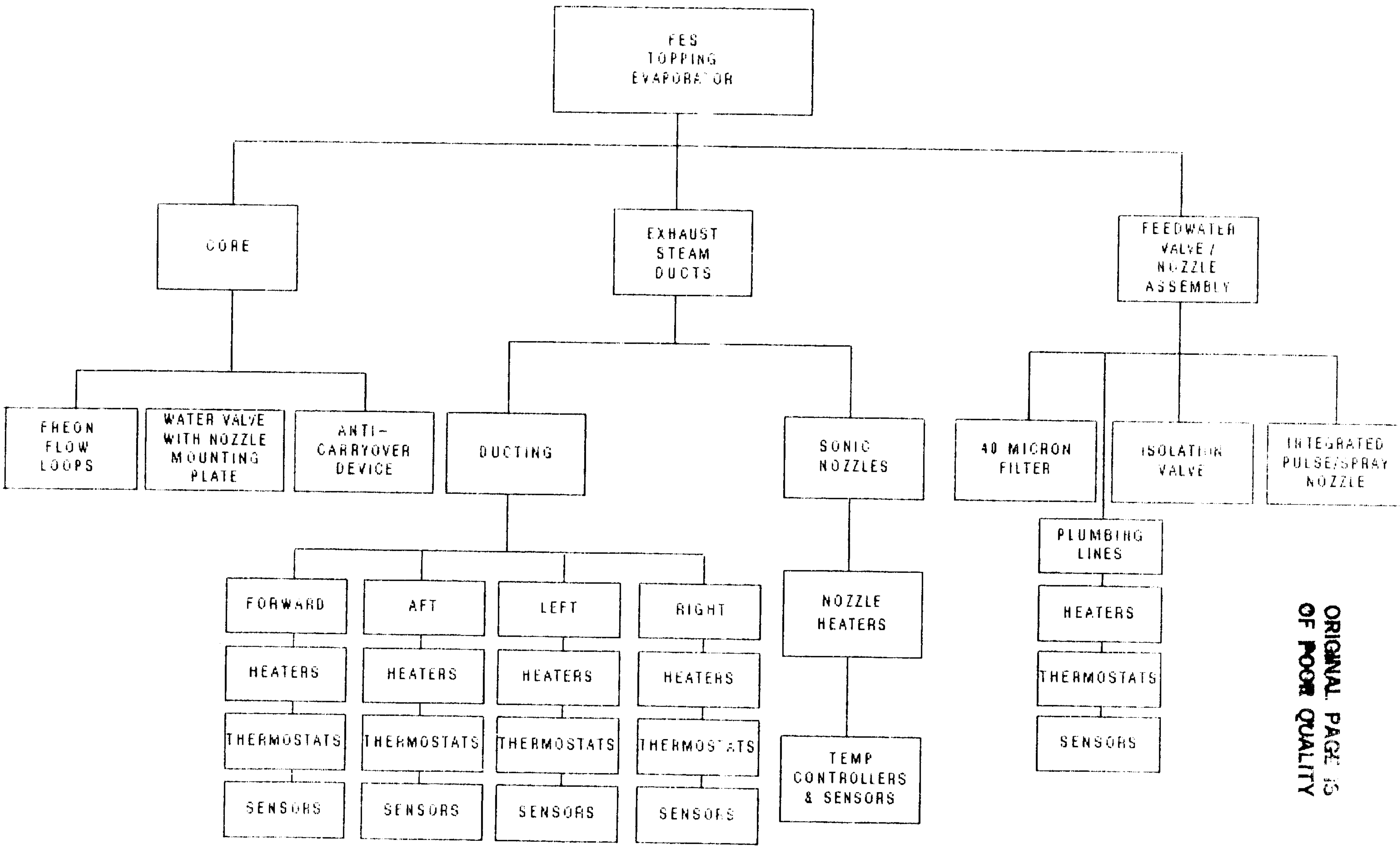


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Figure 18 - FES TOPPING EVAPORATOR

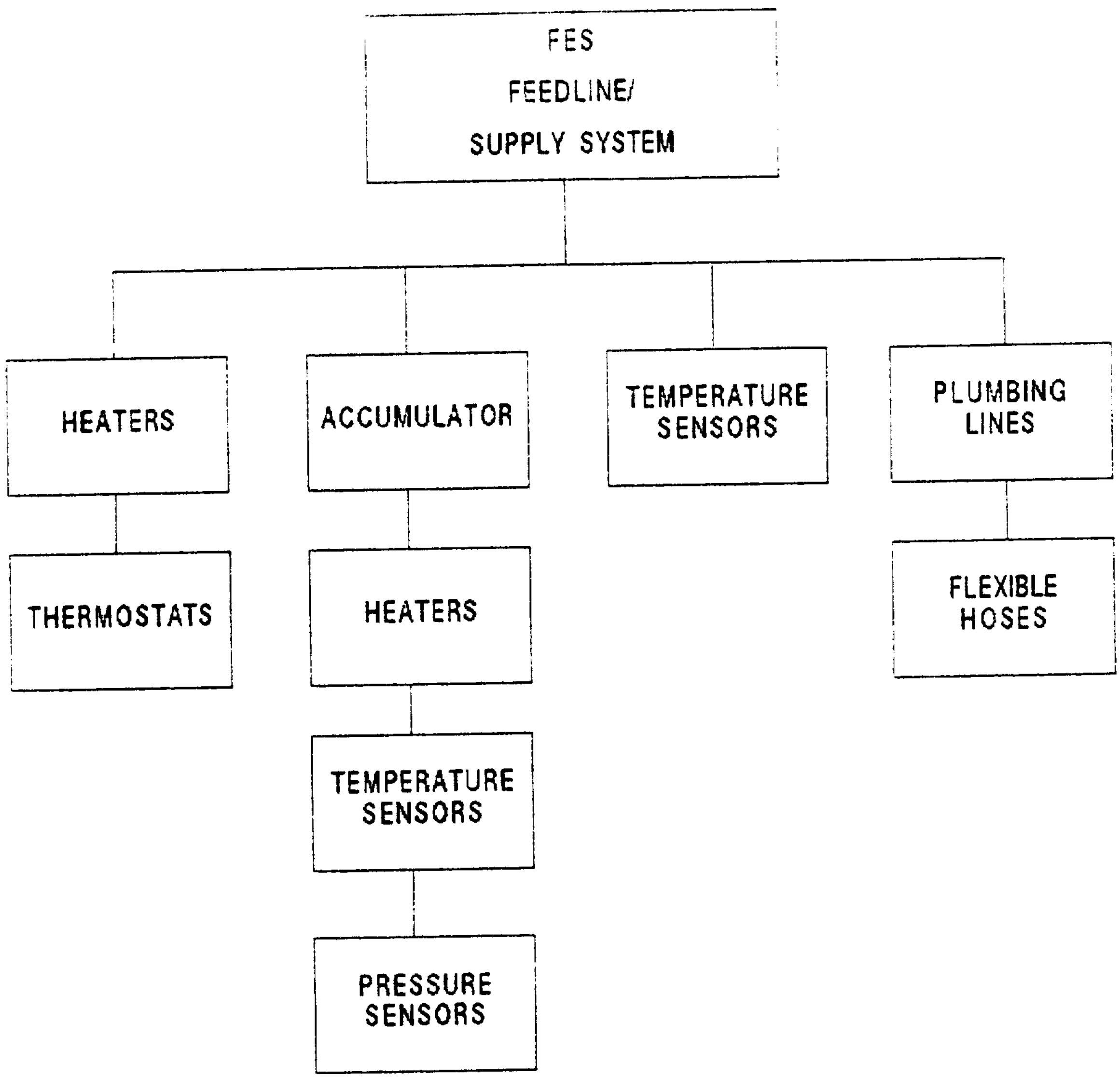

Figure 19 - FES FEEDLINE/SUPPLY SYSTEM

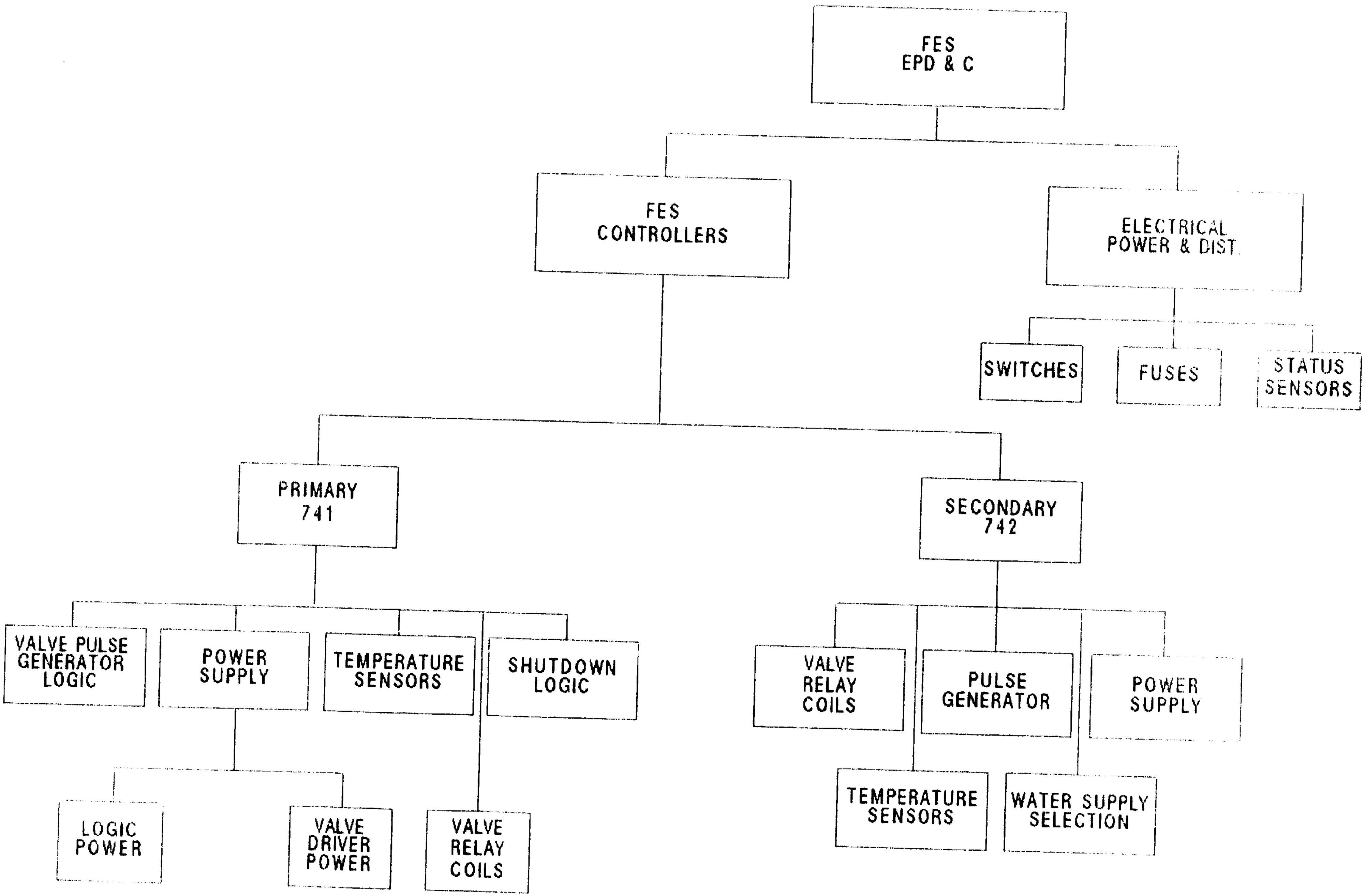

Figure 20 - FES EPD&C

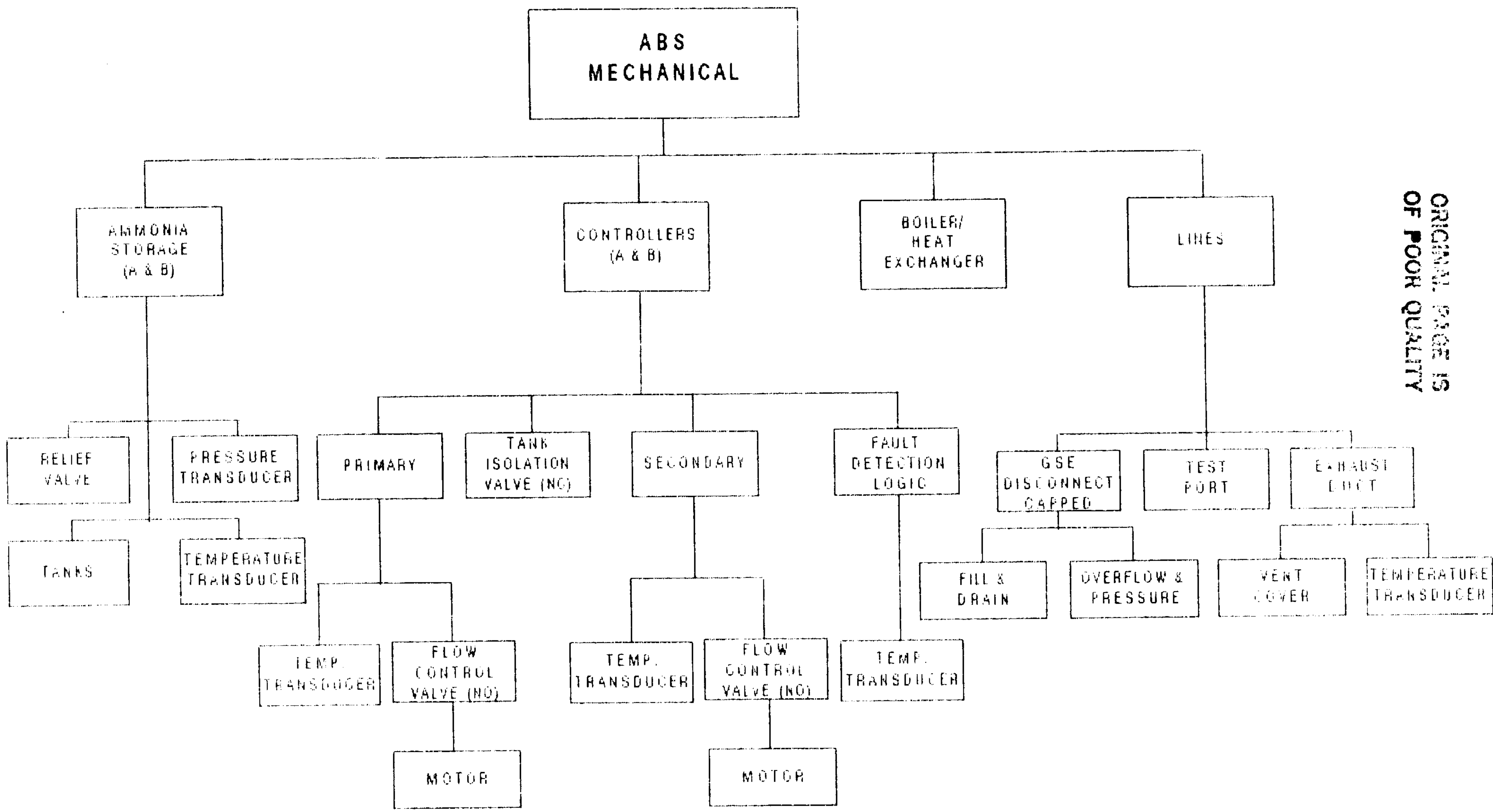

Figure 21 - AMMONIA BOILER SYSTEM MECHANICAL

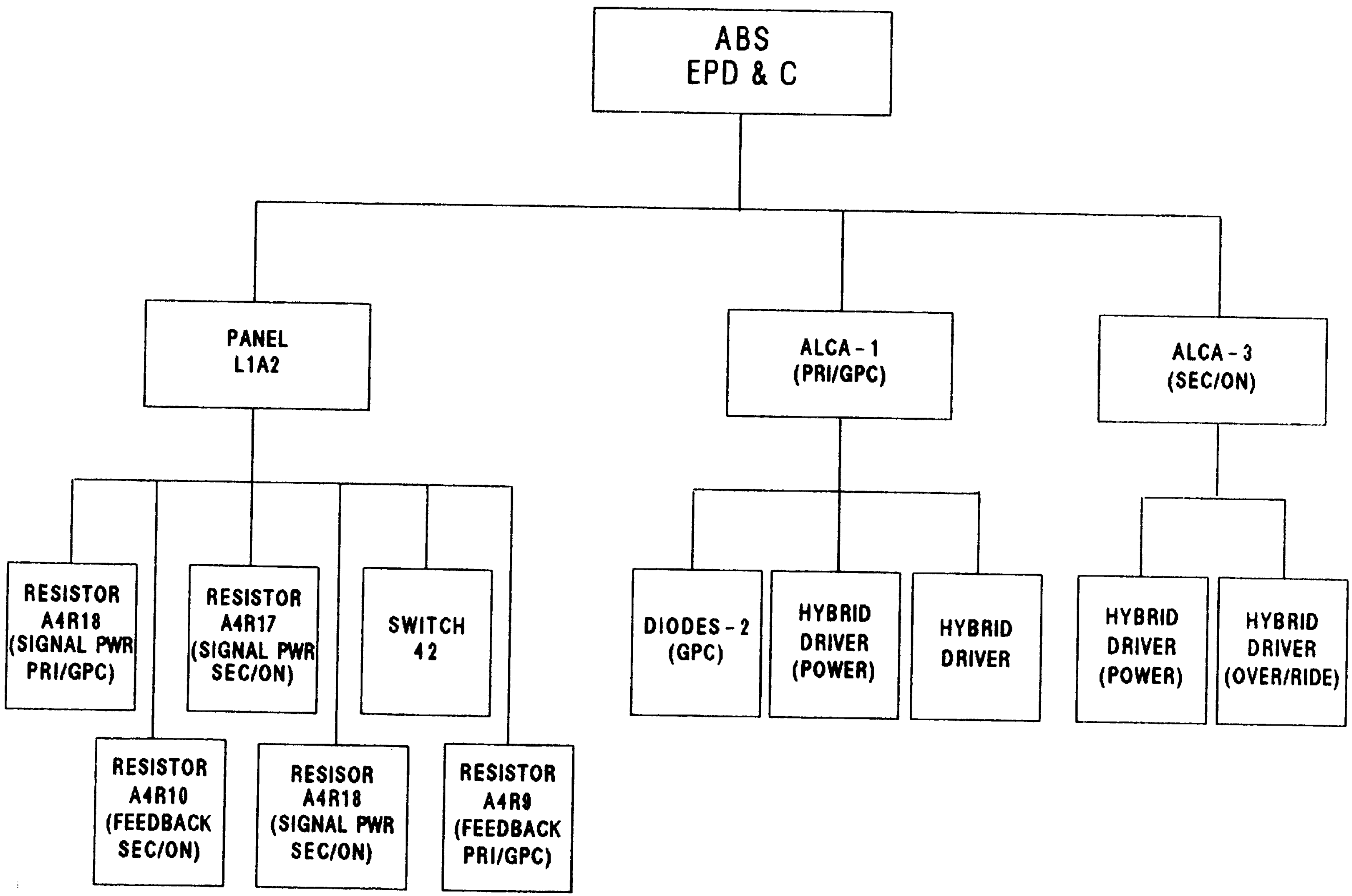

Figure 22 - ABS EPD&C

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.

TABLE I Summary of ATCS Failure Modes and Criticalities

Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
FCL	1	55	0	0	17	35	108
RFCA	0	7	0	0	22	11	40
FES	1	16	4	45	40	28	134
ABS	2	11	0	0	0	15	28
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.

TABLE II Summary of ATCS Potential Critical Items

Criticality:	1/1	2/1R	2/2	3/1R	3/2R	TOTAL
FCL :	1	55	0	0	3	59
RFCA :	0	7	0	0	0	7
FES :	1	16	4	0	1	22
ABS :	2	11	0	0	0	13

4.1 Freon Coolant Loop

The Freon Coolant (FCL) analysis identified 108 failure modes. The FCL anlaysis 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
2. Shuttle Flight Operations Manual Volume 3: Environment Control and Life Support Systems (ECLSS)
3. Space Shuttle Systems Handbook, JSC-11174
4. Shuttle Operational Data Book, JSC 08934
5. STS Operational Flight Rules, JSC 12820
6. Environmental Systems Console Handbook, JSC 19935
7. Instructions for Preparation of Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL), NSTS 22206

APPENDIX A
ACRONYMS

APPENDIX A
ACRONYMS

ABS	- Ammonia Boiler System
AC	- Alternating Current
ACOD	- Anti-Carryover Device
ALC	- Aft Load Controller
ALCA	- Aft Load Control Assembly
AOA	- Abort-Once-Around
AOS	- Acquisition of Signal
ARS	- Atmospheric Revitalization System
ASSY	- Assembly
ATCS	- Active Thermal Control Subsystem
ATO	- Abort-To-Orbit
BTU	- British Thermal Units
C&W	- Caution and Warning
CB	- Circuit Breaker
CIL	- Critical Items List
CNTLR	- Controller
CRIT	- Criticality
D&C	- Displays and Controls
DIST	- Distribution
DS	- Digital Signal
ECLSS	- Environmental Control and Life Support System (Subsystem
EMU	- Extravehicular Mobility Unit
EPDC	- Electrical Power, Distribution and Control
EPS	- Electrical Power System
F	- Fahrenheit
F	- Failed
F	- Functional
FCA	- Flow Control Assembly
FCL	- Freon Coolant Loop
FES	- Flash Evaporator System
FMEA	- Failure Modes and Effects Analysis
FRAC	- Fraction
ft	- Feet
GAS	- Get-Away Special
GFE	- Government Furnished Equipment
GPC	- General Purpose Computer
GSE	- Ground Support Equipment
H2O	- Water
HP	- Horsepower
hr	- Hour
HW	- Hardware
HX	- Heat Exchanger
HZ	- Hertz
ID	- Identifier
INTCHGR	- Interchanger
IOA	- Independent Orbiter Assessment

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

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 existent within NASA/Prime Contractor Orbiter FMEA/CILs, and will be permitted to go to greater hardware detail levels but not lesser.

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

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

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

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

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

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

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

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

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

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

    RATIONALE: Clarify definition of emergency systems to ensure consistency throughout IOA project.

B.3 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

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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 out lined, 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

Preceeding 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

MDAC-ID		CRITICALITY FLIGHT H/F	ABORT H/F	REDUNDANCY SCREENS A B C	ITEM NAME
1000	*	2/1R	2/1R	P P P	INLET SELF-SEALING COUPLING
1001	*	2/1R	2/1R	P P P	ORIFICE (INLET COUPLING)
1002		3/3	3/3		PUMP INLET PRESSURE SENSOR
1003	*	2/1R	2/1R	P P P	INLET FILTER (ACCUMULATOR)
1004	*	2/1R	2/1R	P F P	INLET FILTER (ACCUMULATOR)
1005	*	2/1R	2/1R	P P P	ACCUMULATOR
1006	*	3/2R	3/2R	F F P	SELF-SEALING DISCONNECT
1007		3/3	3/3		QUANTITY SENSOR
1008		3/2R	3/2R	P N P	INLET FILTER (FREON PUMP)
1009	*	3/2R	3/2R	P F P	INLET FILTER (FREON PUMP)
1010		3/2R	3/2R	P N P	FREON PUMP
1011	*	2/1R	2/1R	P P P	FREON PUMP
1012		3/2R	3/2R	P N P	3-PHASE MOTOR
1013		3/3	3/3		3-PHASE MOTOR
1014	*	2/1R	2/1R	P F P	OUTLET FILTER
1015		3/2R	3/2R	P N P	OUTLET FILTER
1016	*	2/1R	2/1R	P P P	CHECK VALVE
1017	*	2/1R	2/1R	P P P	OUTLET SELF-SEALING COUPLING
1018	*	2/1R	2/1R	P P P	ORIFICE (OUTLET COUPLING)
1019	*	2/1R	2/1R	P P P	FUEL CELL HEAT EXCHANGER
1020	*	2/1R	2/1R	P P P	FUEL CELL HEAT EXCHANGER
1021	*	2/1R	2/1R	P P P	FUEL CELL HEAT EXCHANGERS
1022	*	2/1R	2/1R	P P P	FUEL CELL HEAT EXCHANGER
1023	*	2/1R	2/1R	P P P	FUEL CELL HEAT EXCHANGER
1024	*	2/1R	2/1R	P P P	FUEL CELL HEAT EXCHANGER
1025	*	2/1R	2/1R	P P P	HYDRAULIC HEAT EXCHANGER
1026	*	2/1R	2/1R	P P P	HYDRAULIC HEAT EXCHANGERS
1027	*	2/1R	2/1R	P P P	HYDRAULIC HEAT EXCHANGERS
1028	*	2/1R	2/1R	P P P	HYDRAULIC HEAT EXCHANGER
1029	*	2/1R	1/1		HYDRAULIC HEAT EXCHANGER
1030	*	2/1R	2/1R	P P P	HYDRAULIC HEAT EXCHANGER
1031		3/2R	3/2R	P P P	HYDRAULIC HEAT EXCHANGER
1032	*	2/1R	2/1R	P P P	GSE HEAT EXCHANGER
1033	*	2/1R	2/1R	P P P	GSE HEAT EXCHANGER
1034	*	2/1R	2/1R	P P P	GSE HEAT EXCHANGERS
1035		3/3	3/3		GSE HEAT EXCHANGER
1036	*	2/1R	2/1R	P P P	GSE HEAT EXCHANGER
1037	*	2/1R	2/1R	P P P	O2 RESTRICTOR
1038	*	2/1R	2/1R	P P P	O2 RESTRICTOR

(*) Potential Critical Items.

TABLE C.1 FREON COOLANT LOOP ANALYSIS WORKSHEETS - CONT'D.

MDAC-ID		CRITICALITY FLIGHT H/F	ABORT H/F	REDUNDANCY SCREENS A B C	ITEM NAME
1039	*	2/1R	2/1R	P P P	ARS INTERCHANGER HEAT EXCHANGE
1040	*	2/1R	2/1R	P P P	ARS INTERCHANGER HEAT EXCHANGE
1041	*	2/1R	2/1R	P P P	ARS INTERCHANGER HEAT EXCHANGE
1042	*	2/1R	2/1R	P P P	ARS INTERCHANGER HEAT EXCHANGE
1043	*	2/1R	2/1R	P P P	ARS INTERCHANGER HEAT EXCHANGE
1044	*	2/1R	2/1R	P P P	ARS INTERCHANGER HEAT EXCHANGE
1045	*	2/1R	2/1R	F P P	ARS INTERCHANGER HEAT EXCHANGE
1046		3/3	3/3		INLET TEMPERATURE SENSOR
1047		3/3	3/3		FLOW RATE SENSOR INTERCHANGER
1048	*	2/1R	2/1R	P P P	PAYLOAD HEAT EXCHANGER
1049	*	2/1R	2/1R	P P P	PAYLOAD HEAT EXCHANGER
1050		3/3	3/3	P P P	PAYLOAD HEAT EXCHANGER
1051	*	2/1R	2/1R	P P P	PAYLOAD HEAT EXCHANGER
1052		3/3	3/3	P P P	PAYLOAD HEAT EXCHANGER
1053	*	2/1R	2/1R	P P P	PAYLOAD HEAT EXCHANGER
1054		3/3	3/3		FLOW RATE SENSOR PAYLOAD HX
1055	*	3/2R	3/2R	F F P	SERVICING QUICK DISCONNECT CAP
1056	*	2/1R	2/1R	P P P	FLOW PROPORTIONING VALVE
1057	*	2/1R	2/1R	P P P	FLOW PROPORTIONING VALVE
1058		3/2R	3/2R	P P P	FLOW PROPORTIONING VALVE
1059		3/3	3/3		ACTUATOR (FLOW PROP VLV)
1060	*	2/1R	2/1R	P P P	MIDBODY COLDPLATES
1061	*	2/1R	2/1R	P P P	MIDBODY COLDPLATES
1062	*	2/1R	2/1R	P P P	MIDBODY COLDPLATES
1063	*	2/1R	2/1R	P P P	ORIFICE (AFT AV COLDPLATES)
1064		3/3	3/3		AFT COLDPLATE FLOWRATE SENSOR
1065	*	2/1R	2/1R	P P P	AFT AVIONICS COLDPLATES
1066	*	2/1R	2/1R	P P P	AFT AVIONICS COLDPLATES
1067	*	2/1R	2/1R	P P P	AFT AVIONICS COLDPLATES
1068		3/3	3/3		ORIFICE (RGA COLDPLATES)
1069	*	2/1R	2/1R	P P P	RGA COLDPLATES
1070	*	2/1R	2/1R	P P P	RGA COLDPLATES
1071	*	2/1R	2/1R	P P P	RGA COLDPLATES
1072	*	2/1R	2/1R	P P P	FREON LOOP LINES AND FITTINGS
1073		3/3	3/3		CIRCUIT BREAKERS (FREON PUMP)
1074		3/2R	3/2R	P P P	SWITCH (FREON PUMPS)
1075		3/2R	3/2R	P P P	SWITCH (FREON PUMPS)
1076	*	2/1R	2/1R	P P P	SWITCH (FREON PUMPS)
1077		3/3	3/3		RESISTOR (FREON PUMPS)
1078		3/3	3/3		RESISTOR (FREON PUMPS)

(*) Potential Critical Items.

TABLE C.1 FREON COOLANT LOOP ANALYSIS WORKSHEETS - CONCLD.

MDAC-ID		CRITICALITY FLIGHT H/F	ABORT H/F	REDUNDANCY SCREENS A B C	ITEM NAME
1079		3/2R	3/2R	P P P	MDM BLOCKING DIODE-FREON PUMPS
1080		3/2R	3/2R	P P P	MDM BLOCKING DIODE-FREON PUMPS
1081		3/2R	3/2R	P P P	HYBRID DRIVER (FREON PUMPS)
1082		3/2R	3/2R	P P P	HYBRID DRIVER (FREON PUMPS)
1083		3/2R	3/2R	P P P	RELAY SOLENOID (FREON PUMPS)
1084		3/3	3/3		RELAY SOLENOID (FREON PUMPS)
1085	*	2/1R	2/1R	P P P	CB (FREON FLOW PROPORTIONING)
1086	*	2/1R	2/1R	P P P	SW (FLOW PROPORTIONING VLV)
1087		3/2R	3/2R	P P P	SW (FLOW PROPORTIONING VLV)
1088		3/3	3/3		SW 21 (FLOW PROP VLV)
1089	*	2/1R	2/1R	P P P	SIGNAL CONDITIONER (ATCS OF1)
1090		3/3	3/3		RESISTOR (FLOW PROP VLV)
1091		3/3	3/3		RESISTOR (FLOW PROP VLV)
1092		3/3	3/3		BLOCKING DIODE (INTERCHANGER)
1093		3/3	3/3		BLOCKING DIODE (INTERCHANGER)
1094		3/3	3/3		BLOCKING DIODE (PAYLOAD HX)
1095		3/3	3/3		BLOCKING DIODE (PAYLOAD HX)
1096		3/3	3/3		INDICATOR (FLOW PROP VLV)
1097		3/3	3/3		INDICATOR (FLOW PROP VLV)
1098		3/3	3/3		INDICATOR (FLOW PROP VLV)
1099		3/3	3/3		CB (FREON SIGNAL CONDITIONER)
1100		3/3	3/3		CB (FREON SIGNAL CONDITIONER)
1101		3/3	3/3		SW 10 (FREON SGNL COND)
1102		3/3	3/3		SW 10 (FREON SGNL COND)
1103		3/3	3/3		SW 10 (FREON SGNL COND)
1104		3/3	3/3		SWITCH 4 (FREON)
1105		3/3	3/3		FREON FLOW VOLTMETER
1106		3/3	3/3		FREON EVAP OUT TEMP VOLTMTR
1107		3/3	3/3		FREON C&W LIGHT

(*) Potential Critical Items.

TABLE C.2 RFCA ANALYSIS WORKSHEETS

MDAC-ID		CRITICALITY FLIGHT H/F	ABORT H/F	REDUNDANCY SCREENS A B C	ITEM NAME
2000	*	2/1R	2/1R	P P P	INLET SELF-SEALING COUPLING
2001	*	2/1R	2/1R	P P P	OUTLET SELF-SEALING COUPLING
2002	*	2/1R	2/1R	P P P	FLEX HOSES, MANIFOLDS, TUBES
2003		3/2R	3/2R	P P P	FLOW CONTROL VALVE
2004		3/2R	3/2R	P P P	FLOW CONTROL VALVE
2005	*	2/1R	2/1R	P P P	FLOW CONTROL VALVE
2006		3/2R	3/2R	P P P	STEPPING MTR (FLOW CNTRL VLV)
2007		3/2R	3/2R	P P P	BYPASS VALVE
2008		3/2R	3/2R	P P P	BYPASS VALVE
2009	*	2/1R	2/1R	P P P	BYPASS VALVE
2010	*	2/1R	2/1R	P P P	MOTOR (BYPASS VALVE)
2011	*	2/1R	2/1R	P P P	MODE CONTROL VALVE
2012		3/2R	3/2R	P P P	RADIATOR FLOW CONTROLLER
2013		3/3	3/3		INLET TEMPERATURE TRANSDUCER
2014		3/3	3/3		OUTLET TEMPERATURE TRANSDUCER
2015		3/2R	3/2R	P N P	TEMPERATURE SENSOR
2016		3/2R	3/2R	P N P	CB 14 (FREON RADIATOR CNTRLLR)
2017		3/2R	3/2R	P N P	SW 26 (RADIATOR CONTROL LOOP)
2018		3/2R	3/2R	P N P	SW 26 (RADIATOR CONTROL LOOP)
2019		3/2R	3/2R	P N P	DIODE (RADIATOR FLOW CNTRLLR)
2020		3/2R	3/2R	P P P	DIODE (RADIATOR FLOW CNTRLLR)
2021		3/3	3/3		RESISTOR (RAD FLOW CNTRLLR)
2022		3/3	3/3		RESISTOR (RAD FLOW CNTRLLR)
2023		3/2R	3/2R	P P P	SW 25 (RAD CONTROL OUT TEMP)
2024		3/2R	3/2R	P P P	SW 25 (RAD CONTROL OUT TEMP)
2025		3/2R	3/2R	P P P	CB (RADIATOR BYPASS VALVE)
2026		3/2R	3/2R	P N P	SW 29 (RADIATOR MANUAL SELECT)
2027		3/2R	3/2R	P N P	SW 29 (RADIATOR MANUAL SELECT)
2028		3/2R	3/2R	P N P	SW 29 (RADIATOR MANUAL SELECT)
2029		3/2R	3/2R	P N P	RESISTOR (PRECEDES S35)
2030		3/2R	3/2R	P N P	RESISTOR (PRECEDES S35)
2031		3/2R	3/2R	P N P	SW 35 (RAD CNTRLLR BYPASS VLV)
2032		3/2R	3/2R	P N P	SW 35 (RAD CNTRLLR BYPASS VLV)
2033		3/3	3/3		HYBRID DRIVER
2034		3/3	3/3		HYBRID DRIVER
2035		3/3	3/3		RESISTOR (BYPASS VLV INDICATOR)
2036		3/3	3/3		RESISTOR (BYPASS VLV INDICATOR)
2037		3/3	3/3		DIODE (BYPASS VALVE INDICATOR)
2038		3/3	3/3		DIODE (BYPASS VALVE INDICATOR)
2039		3/3	3/3		BYPASS VALVE INDICATOR

(*) Potential Critical Items.

TABLE C.3 FLASH EVAPORATOR SYSTEM ANALYSIS WORKSHEETS

MDAC-ID		CRITICALITY FLIGHT H/F	ABORT H/F	REDUNDANCY SCREENS A B C	ITEM NAME
3000		3/3	3/3		FES HI LOAD FEEDLINE TEMP SNSR
3001		3/1R	3/1R	P N P	HI LOAD FEEDLINE
3002		3/1R	3/1R	P N P	HI LOAD FEEDLINE
3003		3/1R	3/1R	P N P	HI LOAD FEEDLINE HEATER
3004		3/2R	3/2R	P N P	HI LOAD FEEDLINE HTR THERMOSTAT
3005		3/1R	3/1R	P N P	HI LOAD FEEDLINE HTR THERMOSTAT
3006		3/1R	3/1R	P N P	40 MCRN FILTER-HI LOAD WTR VLV
3007		3/1R	3/1R	P N P	HI LOAD ISOLATION VALVE
3008		3/1R	3/1R	P N P	HI LOAD ISOLATION VALVE
3009		3/1R	3/1R	P N P	HI LOAD PULSER VALVE
3010		3/1R	3/1R	P N P	HI LOAD PULSER VALVE
3011		3/1R	3/1R	P N P	HI LOAD SPRAY NOZZLES
3012	*	2/1R	2/1R	P N P	HI LOAD EVAPORATOR CORE
3013		3/1R	3/1R	P N P	HI LOAD VALVE MOUNTING PLATE
3014	*	2/1R	2/1R	P N P	HI LOAD VALVE MOUNTING PLATE
3015	*	2/1R	2/1R	P N P	HI LOAD VALVE MOUNTING PLATE
3016	*	2/1R	2/1R	P N P	HI LOAD EVAPORATOR ACOD
3017	*	2/1R	2/1R	P N P	HI LOAD EVAPORATOR ACOD
3018		3/3	3/3		HI LOAD ACOD
3019	*	2/1R	2/1R	P N P	HI LOAD EXIT DUCT
3020	*	2/1R	2/1R	P N P	HI LOAD EXIT DUCT
3021		3/1R	3/1R	P N P	HI LOAD HTRS - ZONE A
3022		3/3	3/3		HI LOAD TEMP MONITOR - ZONE A
3023		3/1R	3/1R	P N P	HI LOAD HTR THERMOSTAT-ZONE A
3024		3/2R	3/2R	P N P	HI LOAD HTR THERMOSTAT-ZONE A
3025		3/1R	3/1R	P N P	HI LOAD NOZZLE HEATER
3026		3/1R	3/1R	P N P	HI LOAD NZL TEMP SNSR/CNTRLLR
3027		3/2R	3/2R	P N P	HI LOAD NZL TEMP SNSR/CNTRLLR
3028		3/3	3/3		HI LOAD DUCT NZL TEMP MONITOR
3029	*	2/1R	2/1R	P N P	HI LOAD NOZZLE
3030	*	2/1R	2/1R	P N P	HI LOAD NOZZLE
3031		3/2R	3/2R	P N P	FES TOPPING FEEDLINE HEATER
3032		3/2R	3/2R	P N P	TOPPING FDLN HTR THERMOSTAT
3033		3/2R	3/2R	P N P	TOPPING FDLN HTR THERMOSTAT
3034		3/3	3/3		TOPPING FDLN HTR TEMP SNSR
3035		3/2R	3/2R	P N P	TOPPING EVAP WTR VLV FILTER
3036		3/3	3/3		TOPPING EVAPORATOR ISOL VLV
3037		3/2R	3/2R	P N P	TOPPING EVAPORATOR ISOL VLV
3038		3/2R	3/2R	P N P	TOPPING EVAP INTEGRAL PLSR VLV
3039		3/2R	3/2R	P N P	TOPPING EVAP INTEGRAL PLSR VLV
3040		3/2R	3/2R	P N P	TOPPING EVAP INTEGRAL PLSR VLV
3041		3/2R	3/2R	P N P	TOPPING EVAPORATOR FEEDLINE
3042		3/2R	3/2R	P N P	TOPPING EVAPORATOR FEEDLINE
3043		3/2R	3/2R	P N P	TOPPING EVAPORATOR ISOL VLV

(*) Potential Critical Items.

TABLE C.3 FLASH EVAPORATOR SYSTEM ANALYSIS WORKSHEETS - CONT'D.

MDAC-ID		CRITICALITY FLIGHT H/F	ABORT H/F	REDUNDANCY SCREENS A B C	ITEM NAME
3044		3/2R	3/2R	P N P	TOPPING EVAP INTEGRAL PLSR VLV
3045		3/2R	3/2R	P N P	TOPPING EVAP WTR VLV MTG PLATE
3046	*	2/1R	2/1R	P N P	TOPPING EVAP WTR VLV MTG PLATE
3047	*	1/1	1/1		TOPPING EVAP WTR VLV MTG PLATE
3048	*	2/1R	2/1R	P N P	TOPPING EVAPORATOR CORE
3049	*	2/2	2/2		TOPPING EVAPORATOR CORE
3050		3/3	3/3		TOPPING EVAPORATOR ACOD
3051	*	2/1R	2/1R	P N P	TOPPING EVAPORATOR ACOD
3052	*	2/1R	2/1R	P N P	TOPPING EVAPORATOR ACOD
3053	*	2/2	2/2		TOPPING EVAPORATOR EXIT DUCT
3054		3/2R	3/2R	P N P	TOPPING EVAPORATOR EXIT DUCT
3055		3/2R	3/2R	P N P	TPNG EVAP ZONE D,E,F,H HTRS
3056		3/2R	3/2R	P N P	TPNG EVAP ZONE D,E,F,H HTRS
3057		3/2R	3/2R	P N P	TPNG EVAP ZONE D,E,F,H HTRS
3058		3/3	3/3		TPNG EVAP ZONE D,E,F,H MON
3059		3/2R	3/2R	P N P	TPNG EVAP ZONE D,E,F,H THERM
3060		3/2R	3/2R	P N N	TPNG EVAP SONIC NOZZLES
3061		3/2R	3/2R	P N N	TPNG EVAP SONIC NOZZLES
3062		3/2R	3/2R	P N P	TPNG EVAP ZONE G,I HTRS
3063		3/2R	3/2R	P N P	TPNG EVAP ZONE G,I HTR CNTRLS
3064		3/2R	3/2R	P N P	TPNG EVAP ZONE G,I HTR CNTRLS
3065		3/3	3/3		TPNG EVAP ZONE G,I HTR MONTRS
3066		3/1R	3/1R	P N P	FES FEEDLINE A/B
3067	*	2/1R	2/1R	P N P	FES FEEDLINE A/B
3068		3/1R	3/1R	P N P	FES FEEDLINE HEATERS
3069		3/2R	3/2R	P N P	FES FEEDLINE HTR THERMOSTAT
3070		3/1R	3/1R	P N P	FES FEEDLINE HTR THERMOSTAT
3071		3/3	3/3		FES FEEDLINE TEMP SENSOR
3072		3/1R	3/1R	P N P	FES ACCUMULATOR HEATER
3073		3/1R	3/1R	P N P	FES ACCUMULATOR HTR THERMOSTAT
3074		3/2R	3/2R	P N P	FES ACCUMULATOR HTR THERMOSTAT
3075		3/3	3/3		FES ACCUMULATOR TEMP MONITOR
3076		3/3	3/3		FES FDLN ACCUM STATUS MONITOR
3077		3/1R	3/1R	P N P	FES FEEDLINE ACCUMULATOR
3078		3/1R	3/1R	P N P	FES FEEDLINE ACCUMULATOR
3079	*	2/2	2/2		FES CONTROLLER - SWITCH
3080		3/1R	3/1R	P N P	FES CONTROLLER - SWITCH
3081		3/1R	3/1R	P N P	FES CONTROLLER - SWITCH
3082		3/3	3/3		FES CONTROLLER SWITCH STATUS
3083		3/1R	3/1R	P N P	FES CONTROLLER INPUT DIODES
3084		3/3	3/3		FES CONTROLLER INPUT RESISTORS
3085		3/1R	3/1R	P N P	FES CONTROL SW INPUT RESISTORS
3086		3/3	3/3		FES CONTROL SW INPUT RESISTORS
3087		3/1R	3/1R	P N P	FES CONTROLLER POWER COMP

(*) Potential Critical Items.

TABLE C.3 FLASH EVAPORATOR SYSTEM ANALYSIS WORKSHEETS - CNCLD.

MDAC-ID	CRITICALITY FLIGHT H/F	ABORT H/F	REDUNDANCY SCREENS A B C	ITEM NAME
3088 *	2/1R	2/1R	P N F	HI-LOAD ENABLE SWITCH
3089 *	3/2R	3/2R	P N F	HI-LOAD ENABLE SWITCH
3090	3/3	3/3		HI-LOAD ENABLE SWITCH STATUS
3091	3/1R	3/1R	P N P	FES CONTROLLER POWER SUPPLY
3092	3/1R	3/1R	P N P	FES PRIMARY CNTRLLR MDPNT SNSR
3093	3/1R	3/1R	P N P	FES PRIMARY CNTRLLR MDPNT SNSR
3094	3/3	3/3		FES PRIMARY CNTRLLR MDPNT SNSR
3095	3/2R	3/2R	P N P	FES SEC CNTRLLR MIDPOINT SNSR
3096	3/2R	3/2R	P N P	FES SEC CNTRLLR MIDPOINT SNSR
3097	3/1R	3/1R	P N P	FES PRIMARY CNTRLLR EVAP SNSR
3098	3/1R	3/1R	P N P	FES PRIMARY CNTRLLR EVAP SNSR
3099	3/1R	3/1R	P N P	FES SEC CNTRLLR EVAP OUT SNSR
3100	3/1R	3/1R	P N P	FES SEC CNTRLLR EVAP OUT SNSR
3101	3/1R	3/1R	P N P	FES PRIM CNTRLLR SHUTDOWN SNSR
3102	3/2R	3/2R	P N P	FES PRIM CNTRLLR SHUTDOWN SNSR
3103	3/1R	3/1R	P N P	FES CONTROLLER SHUTDOWN LOGIC
3104	3/2R	3/2R	P N P	FES CONTROLLER SHUTDOWN LOGIC
3105	3/1R	3/1R	P N P	HI-LOAD VALVE PLSR ELECTRONICS
3106	3/1R	3/1R	P N P	HI-LOAD VALVE PLSR ELECTRONICS
3107	3/1R	3/1R	P N P	HI-LOAD ISOLATION VALVE RELAY
3108	3/1R	3/1R	P N P	HI-LOAD SPRAY VALVE RELAY
3109	3/2R	3/2R	P N P	TPPNG EVAP ISOLATION VLV RELAY
3110	3/2R	3/2R	P N P	TPPNG EVAP SPRAY VALVE RELAY
3111	3/3	3/3		GROUND OPS DIAG MEASUREMENTS
3112	3/3	3/3		FES SECONDARY SUPPLY SELECT SW
3113	3/3	3/3		FES SECONDARY SUPPLY SELECT SW
3114	3/1R	3/1R	P N P	FES FEEDLINE HEATER SELECT SW
3115	3/3	3/3		FES FEEDLINE HEATER SELECT SW
3116	3/3	3/3		FES FEEDLINE HTR SWITCH STATUS
3117	3/1R	3/1R	P N P	FES FEEDLINE HEATER FUSES
3118 *	2/2	2/2		TOPPING EVAP HEATER SELECT SW
3119	3/3	3/3		TOPPING EVAP HEATER SELECT SW
3120	3/3	3/3		TOPPING EVAP HEATER SELECT SW
3121	3/2R	3/2R	P N P	TPNG EVAP HTR SELECT SW FUSES
3122	3/2R	3/2R	P N P	TOPPING EVAP HTR FUSES/RPCS
3123	3/2R	3/2R	P N P	TOPPING EVAPORATOR HTR RELAY
3124	3/2R	3/2R	P N P	TPNG EVAP NOZZLE HTR SELECT SW
3125	3/3	3/3		TPNG EVAP NOZZLE HTR SELECT SW
3126	3/3	3/3		TPNG EVAP NOZZLE HTR SELECT SW
3127	3/2R	3/2R	P N P	TPNG EVAP NOZZLE HTR FUSES
3128 *	2/1R	2/1R	P N P	HI-LOAD HEATER SWITCH
3129	3/3	3/3		HI-LOAD HEATER SELECT SWITCH
3130	3/3	3/3		HI-LOAD DUCT HTR SWITCH STATUS
3131	3/1R	3/1R	P N P	HI-LOAD DUCT HTR SWITCH FUSES
3132	3/1R	3/1R	P N P	HI-LOAD DUCT HEATER FUSES/RPCS
3133	3/1R	3/1R	P N P	HI-LOAD DUCT HEATER RELAYS

(*) Potential Critical Items.

TABLE C.4 AMMONIA BOILER SYSTEM ANALYSIS WORKSHEETS

MDAC-ID	CRITICALITY FLIGHT H/F	ABORT H/F	REDUNDANCY SCREENS A B C	ITEM NAME
4001 *	3/3	2/1R	P N P	RELIEF VALVE (NH3)
4002 *	3/3	2/1R	P N P	RELIEF VALVE
4003	3/3	3/3		PRESSURE TRANSDUCER (NH3 TANK)
4004	3/3	3/3		TEMP TRANSDUCER (NH3 TANK)
4005 *	3/3	2/1R	P N P	AMMONIA CONTROLLER A
4006 *	3/3	2/1R	P N P	AMMONIA CONTROLLER A
4007 *	3/3	2/1R	P N P	FLOW CONTROL VALVE (N.O.)
4008	3/3	3/3		FLOW CONTROL VALVE (N.O.)
4009	3/3	3/3		FLOW CONTROL VALVE (N.O.)
4010	3/3	3/3		TEMP SENSOR (NH3 CONTROLLER)
4011 *	3/3	2/1R	P N P	TANK ISOLATION VALVE (N.C.)
4012 *	3/3	2/1R	P N P	TANK ISOLATION VALVE (N.C.)
4013 *	2/1R	2/1R	P P P	NH3 BOILER/HEAT EXCHANGER
4014 *	3/3	1/1		NH3 BOILER/HEAT EXCHANGER
4015 *	3/3	2/1R	P N P	TANK, LINES & FITTINGS
4016 *	3/3	1/1		LINES & FITTINGS
4017	3/3	3/3		LINES
4018	3/3	3/3		TEMP TRANSDUCER (NH3 EXHAUST)
4019	3/3	3/3		RESISTOR (NH3 CONTROLLER)
4020	3/3	3/3		RESISTOR (NH3 CONTROLLER)
4021 *	3/3	2/1R	P N P	SWITCH 42 (NH3 CONTROLLER)
4022 *	3/3	2/1R	P N P	SWITCH 42 (NH3 CONTROLLER)
4023	3/3	3/3		RESISTOR (NH3 FEEDBACK)
4024	3/3	3/3		RESISTOR (NH3 FEEDBACK)
4025	3/3	3/3		DIODES (GPC)
4026	3/3	3/3		DIODES (GPC)
4027	3/3	3/3		HYBRID DRIVER (POWER-PRI/GPC)
4028	3/3	3/3		HYBRID DRIVER (NH3 CONTROLLER)

(*) Potential Critical Items.

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/26/87
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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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:

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
5)
6)
7)
8)
9)

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: 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

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

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/26/87
SUBSYSTEM: ATCS
MDAC ID: 1004

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	2/1R
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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/26/87
SUBSYSTEM: ATCS
MDAC ID: 1005

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	2/1R
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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

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

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
6)
7)
8)
9)

CRITICALITIES

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

REDUNDANCY SCREENS: A [3] B [F] C [P]

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:

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
6)
7)
8)
9)

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: 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

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

ITEM: INLET FILTER (FREON PUMP)
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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

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

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

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

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
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

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

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

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
6)
7)
8)
9)

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: 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	5/12/87	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	ATCS	FLIGHT:	2/1R
MDAC ID:	1014	ABORT:	2/1R

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

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

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/26/87
SUBSYSTEM: ATCS
MDAC ID: 1016

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

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/17/87
SUBSYSTEM: ATCS
MDAC ID: 1018

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 2/1R
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
5) ORIFICE
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

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

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

HIGHEST CRITICALITY	HDW/FUNC
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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	6/12/87	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	ATCS	FLIGHT:	2/1R
MDAC ID:	1022	ABORT:	2/1R

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1023

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	2/1R
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
5)
6)
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CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

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

ITEM: FUEL CELL HEAT EXCHANGER
FAILURE MODE: RESTRICTED FLOW (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
5)
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CRITICALITIES

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

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

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:

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
5)
6)
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CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1026

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

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1027

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 2/1R
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
5)
6)
7)
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CRITICALITIES

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

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

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:

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
5)
6)
7)
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9)

CRITICALITIES

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

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

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:

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

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

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

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

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
4) GSE HEAT EXCHANGER
5)
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7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1033

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	2/1R
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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1034

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	2/1R
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)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	6/12/87	HIGHEST CRITICALITY		HDW/FUNC
SUBSYSTEM:	ATCS		FLIGHT:	3/3
MDAC ID:	1035		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
5)
6)
7)
8)
9)

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: 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:

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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 (O2)

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

BREAKDOWN HIERARCHY:
1) ACTIVE THERMAL CONTROL SYSTEM
2) FREON COOLANT LOOP
3) O2 RESTRICTOR
4)
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6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: MIDBODY-AREA 40
PART NUMBER:

CAUSES:

EFFECTS/RATIONALE:
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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

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

ITEM: O2 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) O2 RESTRICTOR
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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 DISSIMILIAR 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	6/12/87	HIGHEST CRITICALITY		HDW/FUNC
SUBSYSTEM:	ATCS		FLIGHT:	2/1R
MDAC ID:	1040		ABORT:	2/1R

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	6/12/87	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	ATCS	FLIGHT:	2/1R
MDAC ID:	1042	ABORT:	2/1R

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1043

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	2/1R
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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1044

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	2/1R
ABORT:	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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
5)
6)
7)
8)
9)

CRITICALITIES

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

REDUNDANCY SCREENS: A [3] B [P] C [P]

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

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

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
6)
7)
8)
9)

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: 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	6/12/87	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	ATCS	FLIGHT:	3/3
MDAC ID:	1047	ABORT:	3/3

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
6)
7)
8)
9)

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: 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	6/12/87	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	ATCS	FLIGHT:	2/1R
MDAC ID:	1048	ABORT:	2/1R

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

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

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1050

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

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1051

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

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1052

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/3
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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87
SUBSYSTEM: ATCS
MDAC ID: 1053

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

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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
6)
7)
8)
9)

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: 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

HIGHEST CRITICALITY	HDW/FUNC
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
5)
6)
7)
8)
9)

CRITICALITIES

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

REDUNDANCY SCREENS: A [3] B [F] C [P]

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:

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/16/87
SUBSYSTEM: ATCS
MDAC ID: 1057

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/16/87
SUBSYSTEM: ATCS
MDAC ID: 1058

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

HIGHEST CRITICALITY HDW/FUNC
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
5)
6)
7)
8)
9)

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: 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:

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/16/87
SUBSYSTEM: ATCS
MDAC ID: 1062

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 2/1R
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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
5)
6)
7)
8)
9)

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: 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:

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/16/87
SUBSYSTEM: ATCS
MDAC ID: 1068

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/3
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
5)
6)
7)
8)
9)

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: MIDBODY
PART NUMBER:

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:

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	8/31/87	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	ATCS	FLIGHT:	2/1R
MDAC ID:	1072	ABORT:	2/1R

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
3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
6)
7)
8)
9)

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: 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/26/87
SUBSYSTEM: ATCS
MDAC ID: 1074

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
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 EPD&C
3) FREON PUMPS A (B)
4) PANEL L4
5) PANEL L1A2 (SWITCH)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

HIGHEST CRITICALITY	HDW/FUNC
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)
6)
7)
8)
9)

CRITICALITIES

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

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

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)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	6/26/87	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	ATCS	FLIGHT:	3/3
MDAC ID:	1077	ABORT:	3/3

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
7)
8)
9)

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
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
7)
8)
9)

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
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:

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)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/26/87
SUBSYSTEM: ATCS
MDAC ID: 1080

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
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)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/26/87
SUBSYSTEM: ATCS
MDAC ID: 1082

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/2R
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
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

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

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
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/26/87
SUBSYSTEM: ATCS
MDAC ID: 1084

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 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
6)
7)
8)
9)

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: 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

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

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
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: FLIGHT DECK-AREA 30
PART NUMBER: 31V73A4-CB42, 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:

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

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

ITEM: SWITCH (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) SWITCH
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	7/08/87	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	ATCS	FLIGHT:	3/3
MDAC ID:	1088	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
5)
6)
7)
8)
9)

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-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:

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)
FAILURE 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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

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

ITEM: RESISTOR (FLOW PROPORTIONING VALVE)
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) RESISTOR
5)
6)
7)
8)
9)

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-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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

HIGHEST CRITICALITY HDW/FUNC
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
5)
6)
7)
8)
9)

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-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:

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)
5)
6)
7)
8)
9)

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-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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87
SUBSYSTEM: ATCS
MDAC ID: 1093

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/3
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 EPD&C
3) FLOW PROPORTIONING MODULE
4) BLOCKING DIODE (INTERCHANGER)
5)
6)
7)
8)
9)

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-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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87
SUBSYSTEM: ATCS
MDAC ID: 1094

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/3
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)
5)
6)
7)
8)
9)

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-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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

HIGHEST CRITICALITY	HDW/FUNC
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)
5)
6)
7)
8)
9)

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-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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87
SUBSYSTEM: ATCS
MDAC ID: 1096

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/3
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
5)
6)
7)
8)
9)

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-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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	7/08/87	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	ATCS	FLIGHT:	3/3
MDAC ID:	1097	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
5)
6)
7)
8)
9)

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-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:

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)
6)
7)
8)
9)

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-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:

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)
6)
7)
8)
9)

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: 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

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

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)

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: 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 1101

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

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)
6)
7)
8)
9)

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: 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:

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)
6)
7)
8)
9)

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: 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 1103

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

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)
6)
7)
8)
9)

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: 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/19/87
SUBSYSTEM: ATCS
MDAC ID: 1104

HIGHEST CRITICALITY HDW/FUNC
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)
6)
7)
8)
9)

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:
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 TRANSDUCER SIGNALS TO LOOP 2 (1) SIGNALS. HOWEVER, SYSTEM SENSORS PROVIDE DATA WHICH COMPENSATES FOR THE FAILED SWITCH.

REFERENCES:

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
6)
7)
8)
9)

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: 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 VOLMETER.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 1106

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
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
6)
7)
8)
9)

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: 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 1107

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

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
7)
8)
9)

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
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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	6/05/87	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	ATCS	FLIGHT:	2/1R
MDAC ID:	2000	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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 2003

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

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: MIDBODY-AREA 30
PART NUMBER: 40V63-A20, A23

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

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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 MINUMUM 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 2008

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/2R
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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 2009

HIGHEST CRITICALITY	HDW/FUNC
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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: MIDBODY-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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	6/05/87	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	ATCS	FLIGHT:	2/1R
MDAC ID:	2010	ABORT:	2/1R

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
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
4)
5)
6)
7)
8)
9)

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: 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 2014

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

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)
4)
5)
6)
7)
8)
9)

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: 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:

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87
SUBSYSTEM: ATCS
MDAC ID: 2016

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/2R
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 (PNL 014)
5) CIRCUIT BREAKER 14 (CB15)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	7/08/87	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	ATCS	FLIGHT:	3/2R
MDAC ID:	2020	ABORT:	3/2R

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
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	7/08/87	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	ATCS	FLIGHT:	3/3
MDAC ID:	2021	ABORT:	3/3

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 L1A2
5) RESISTOR
6)
7)
8)
9)

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-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:

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 (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) RESISTOR
6)
7)
8)
9)

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-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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/08/87
SUBSYSTEM: ATCS
MDAC ID: 2023

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

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
6)
7)
8)
9)

CRITICALITIES

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

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

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

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

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
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	7/15/87	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	ATCS	FLIGHT:	3/2R
MDAC ID:	2025	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
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 2026

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

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)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 2027

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

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)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 2028

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

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)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 2029

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
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)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 2030

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

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 L1A2
5) RESISTOR (PRECEDES S35)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 2032

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

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)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 2033

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

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)

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: 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:

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)

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: 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/10/87
SUBSYSTEM: ATCS
MDAC ID: 2035

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

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

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-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 MDM FEEDBACKS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/10/87
SUBSYSTEM: ATCS
MDAC ID: 2036

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

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)
6)
7)
8)
9)

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-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:

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)
6)
7)
8)
9)

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:
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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/10/87
SUBSYSTEM: ATCS
MDAC ID: 2038

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

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)
6)
7)
8)
9)

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/10/87
SUBSYSTEM: ATCS
MDAC ID: 2039

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
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
6)
7)
8)
9)

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-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:

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	/NA
LIFTOFF:	/NA	TAL:	/NA
ONORBIT:	3/3	AOA:	/NA
DEORBIT:	/NA	ATO:	3/3
LANDING/SAFING:	/NA		

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

LOCATION: AFT BODY - HI LOAD FEEDLINE
PART NUMBER: PRIMARY: V63T1895A (50V63MT44). SECONDARY: V63T1896A (50V63MT45).

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/27/87
SUBSYSTEM: ATCS
MDAC ID: 3001

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:
A HEATER FAILED OFF IN THE VICINITY OF THE HI LOAD VALVES COULD AFFECT THE OPERATION OF THE VALVES/NOZZLES. THEREFORE, A HEATER FAILURE WILL, IN ALL LIKELIHOOD, REQUIRE THE USE OF THE ALTERNATE SET OF HEATERS. LOSS OF BOTH SETS OF HEATERS MAY MEAN LOSS OF THE HIGH LOAD EVAPORATOR AND ENTRY TO NEXT PRIMARY LANDING SITE. LOSS OF THE HIGH LOAD COMBINED WITH LOSS OF ONE FREON LOOP CAN RESULT IN LOSS OF THE CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH, 60FJ, 60FL); SSSH 7.3 SHEET 1 OF 2

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/27/87
SUBSYSTEM: ATCS
MDAC ID: 3004

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

ITEM: FES HI LOAD 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) HI LOAD EVAPORATOR
4)
5)
6)
7)
8)
9)

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		

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

LOCATION:
PART NUMBER: FDLN A: HTR 1-50V63S45, HTR 2-50V63S47. FLDN B: HTR 1-50V63S42, HTR 2-50V63S50.

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT FUSELAGE
PART NUMBER: FDLN A: HTR 1-50V63S45, HTR 2-50V63S47. FLDN 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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/11/87
SUBSYSTEM: ATCS
MDAC ID: 3006

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT FUSELAGE - HI LOAD FEEDWATER SYSTEM
PART NUMBER:

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/28/87
SUBSYSTEM: ATCS
MDAC ID: 3007

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/1R
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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/28/87
SUBSYSTEM: ATCS
MDAC ID: 3010

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/1R
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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/15/87
SUBSYSTEM: ATCS
MDAC ID: 3012

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE

EFFECTS/RATIONALE:
A LEAK IN THE EVAPORATOR CORE WOULD RESULT IN A MIXING OF THE FREON 21 AND WATER. WORST CASE WOULD RESULT IN A LOSS OF THE EVAPORATOR AND THE LEAKING FREON LOOP. FLIGHT RULES CALL FOR A PRIORITY FLIGHT FOR LEAKS BETWEEN DISSIMILAR FLUIDS. THE SIZE OF THE LEAK MUST BE CONSIDERED SINCE A LEAK COULD MEAN THE LOSS OF THE ASSOCIATED FREON LOOP. A LOSS OF A FREON LOOP MEANS AN ENTRY AT THE NEXT PRIMARY LANDING SITE - NOT SIMPLY A MINIMUM DURATION FLIGHT. LOSS OF THE FREON LOOP AND LOSS OF THE HIGH LOAD CAN MEAN LOSS OF CREW/VEHICLE.

REFERENCES: CSD-SH-126; JSC-19935

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/28/87
SUBSYSTEM: ATCS
MDAC ID: 3013

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/1R
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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	2/1R
LIFTOFF:	2/1R	TAL:	2/1R
ONORBIT:	2/1R	AOA:	2/1R
DEORBIT:	2/1R	ATO:	2/1R
LANDING/SAFING:	/NA		

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

LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
A LEAK IN THE VALVE MOUNTING PLATE ALLOWS MIXING OF WATER AND FREON 21. A LEAK, IN A HEAT EXCHANGER, BETWEEN DISSIMILAR FLUIDS CAUSES A PRIORITY FLIGHT BY FLIGHT RULES. THE SIZE OF THE LEAK MUST BE TAKEN INTO CONSIDERATION, HOWEVER, SINCE A LARGE ENOUGH LEAK COULD MEAN THE LOSS OF THE ASSOCIATED FREON LOOP. LOSS OF ONE FREON LOOP CHANGES THE FLIGHT RULE FROM INVOKING A MINIMUM DURATION FLIGHT TO ENTERING AT THE NEXT PRIMARY LANDING SITE. LOSS OF THE HIGH LOAD EVAPORATOR COMBINED WITH LOSS OF ONE FREON LOOP CAN RESULT IN LOSS OF CREW/VEHICLE.

REFERENCES: JSC-19935

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	2/1R
LIFTOFF:	2/1R	TAL:	2/1R
ONORBIT:	2/1R	AOA:	2/1R
DEORBIT:	2/1R	ATO:	2/1R
LANDING/SAFING:	/NA		

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

LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
LOSS OF HI-LOAD EVAPORATOR DUE TO A STRUCTURAL FAILURE OF THE VALVE MOUNTING PLATE. LOSS OF THE HIGH LOAD EVAPORATOR COMBINED WITH THE LOSS OF ONE FREON LOOP CAN RESULT IN THE LOSS OF THE CREW/VEHICLE.

REFERENCES: VS70-960102; JSC-19935; SSSH 7.3

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/28/87
SUBSYSTEM: ATCS
MDAC ID: 3016

HIGHEST CRITICALITY	HDW/FUNC
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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: MECHANICAL SHOCK, MISHANDLING/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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/01/87
SUBSYSTEM: ATCS
MDAC ID: 3018

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
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
4)
5)
6)
7)
8)
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: 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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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)

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/01/87
SUBSYSTEM: ATCS
MDAC ID: 3020

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

ITEM: HI LOAD EXIT DUCT
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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	2/1R
LIFTOFF:	2/2	TAL:	2/1R
ONORBIT:	2/1R	AOA:	2/1R
DEORBIT:	2/1R	ATO:	2/1R
LANDING/SAFING:	/NA		

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

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 AVAIALBLE. 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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/01/87
SUBSYSTEM: ATCS
MDAC ID: 3021

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/26/87
SUBSYSTEM: ATCS
MDAC ID: 3022

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
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
3) HI LOAD EVAPORATOR
4)
5)
6)
7)
8)
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: 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
2) FLASH EVAPORATOR SYSTEM
3) HI LOAD EVAPORATOR
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:
A THERMOSTAT FAILED REFLECTING A HIGH TEMPERATURE IS EQUIVALENT TO A HEATER FAILED OFF. A SINGLE THERMOSTAT FAILURE WILL RESULT IN A "LOCAL" UNDERTEMP SITUATION. A FAILURE OF ALL THERMOSTATS WILL RESULT IN THE LOSS OF THE HI LOAD DUCT, THE LOSS OF THE HI 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 THE CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH, 60FM); SSSH 7.3 SHEET 1 OF 2

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 THERMOSTATS
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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/2R	TAL:	3/3
ONORBIT:	3/2R	AOA:	3/3
DEORBIT:	3/2R	ATO:	3/2R
LANDING/SAFING:	/NA		

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/01/87
SUBSYSTEM: ATCS
MDAC ID: 3025

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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 MAY ICE UP RESULTING IN THE LOSS OF THE NOZZLE, THE LOSS OF THE 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

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 CONTROLLER ASSEMBLY
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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	/NA
LIFTOFF:	/NA	TAL:	/NA
ONORBIT:	3/2R	AOA:	/NA
DEORBIT:	3/2R	ATO:	3/2R
LANDING/SAFING:	/NA		

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/27/87
SUBSYSTEM: ATCS
MDAC ID: 3028

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	/NA
LIFTOFF:	/NA	TAL:	/NA
ONORBIT:	3/3	AOA:	/NA
DEORBIT:	/NA	ATO:	3/3
LANDING/SAFING:	/NA		

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	2/1R
LIFTOFF:	2/2	TAL:	2/1R
ONORBIT:	2/1R	AOA:	2/1R
DEORBIT:	2/1R	ATO:	2/1R
LANDING/SAFING:	/NA		

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

LOCATION: HI LOAD NOZZLE - AFT FUSELAGE
PART NUMBER: 50V63TP268

CAUSES: ICING

EFFECTS/RATIONALE:
A BLOCKAGE OF THE HIGH LOAD NOZZLE MEANS NO FLOW THRU THE NOZZLE, LOSS OF THE HIGH LOAD EVAPORATOR AND ENTRY AT NEXT PLS. LOSS OF THE HIGH LOAD EVAPORATOR COMBINED WITH THE LOSS OF ONE FREON LOOP CAN RESULT IN THE LOSS OF THE CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH)

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/09/87
SUBSYSTEM: ATCS
MDAC ID: 3030

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 2/1R
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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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 SESALED. 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)

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/2R	TAL:	3/3
ONORBIT:	3/2R	AOA:	3/3
DEORBIT:	3/2R	ATO:	3/2R
LANDING/SAFING:	/NA		

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

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/2R	TAL:	3/3
ONORBIT:	3/2R	AOA:	3/3
DEORBIT:	3/2R	ATO:	3/2R
LANDING/SAFING:	/NA		

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

LOCATION: AFT FUSELAGE
PART NUMBER: FDLN A: HTR 1-50V63S44, HTR2-50V63S46; FLDN 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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/2R	TAL:	3/3
ONORBIT:	3/2R	AOA:	3/3
DEORBIT:	3/2R	ATO:	3/2R
LANDING/SAFING:	/NA		

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

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 UNDERTEMP 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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/02/87
SUBSYSTEM: ATCS
MDAC ID: 3034

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	/NA
LIFTOFF:	/NA	TAL:	/NA
ONORBIT:	3/3	AOA:	/NA
DEORBIT:	/NA	ATO:	3/3
LANDING/SAFING:	/NA		

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

LOCATION: AFT FUSELAGE
PART NUMBER: FDLN A: 50V63MT40 (V63T1891A). FLDN B: 50V63MT42 (V63T1893A).

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/03/87
SUBSYSTEM: ATCS
MDAC ID: 3035

HIGHEST CRITICALITY	HDW/FUNC
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)
5)
6)
7)
8)
9)

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		

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

LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
BLOCKAGE IN THE FILTER WILL RESTRICT THE FLOW THRU THE WATER VALVES/NOZZLES AND INTO THE TOPPING EVAPORATOR. LOSS OF BOTH FILTERS, MEANS LOSS OF BOTH TOPPING EVAPORATOR FEEDLINES LOSS OF THE TOPPING EVAPORATOR, AND A MINIMUM DURATION FLIGHT.

REFERENCES: JSC-19935

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
4)
5)
6)
7)
8)
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: 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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/03/87
SUBSYSTEM: ATCS
MDAC ID: 3037

HIGHEST CRITICALITY HDW/FUNC
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
4)
5)
6)
7)
8)
9)

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		

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

LOCATION: AFT FUSELAGE
PART NUMBER:

CAUSES: LOSS OF INPUT, MECHANICAL SHOCK, MISHANDLING/ABUSE, VIBRATION

EFFECTS/RATIONALE:
THE TOPPING EVAPORATOR ISOLATION VALVE NORMALLY REMAINS OPEN DURING ALL TOPPING EVAPORATOR OPERATIONS. THE VALVE FAILING CLOSED MEANS THE FEEDLINE PATH INTO THE TOPPING EVAPORATOR IS NO LONGER AVAILABLE. LOSS OF BOTH TOPPING EVAPORATOR ISOLATION VALVES MEANS THE LOSS OF THE TOPPING EVAPORATOR AND A MINIMUM DURATION FLIGHT.

REFERENCES: VS70-960102 (60FH, 60FJ), JSC-19935

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/03/87
SUBSYSTEM: ATCS
MDAC ID: 3038

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

ITEM: TOPPING EVAPORATOR INTEGRAL PULSER/SHUTOFF VALVE/NOZZLE
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
4)
5)
6)
7)
8)
9)

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		

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

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

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
4)
5)
6)
7)
8)
9)

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		

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

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

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
4)
5)
6)
7)
8)
9)

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		

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

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

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
4)
5)
6)
7)
8)
9)

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		

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	6/09/87	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	ATCS	FLIGHT:	3/2R
MDAC ID:	3042	ABORT:	3/2R

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
4)
5)
6)
7)
8)
9)

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		

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

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

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
4)
5)
6)
7)
8)
9)

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		

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

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

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
4)
5)
6)
7)
8)
9)

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		

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

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

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
4)
5)
6)
7)
8)
9)

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		

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

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	2/1R
LIFTOFF:	2/1R	TAL:	2/1R
ONORBIT:	2/1R	AOA:	2/1R
DEORBIT:	2/1R	ATO:	2/1R
LANDING/SAFING:	/NA		

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

LOCATION: AFT FUSELAGE
PART NUMBER:

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 3047

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	1/1
LIFTOFF:	1/1	TAL:	1/1
ONORBIT:	1/1	AOA:	1/1
DEORBIT:	1/1	ATO:	1/1
LANDING/SAFING:	/NA		

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 3048

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	2/1R
LIFTOFF:	2/1R	TAL:	2/1R
ONORBIT:	2/1R	AOA:	2/1R
DEORBIT:	2/1R	ATO:	2/1R
LANDING/SAFING:	/NA		

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/05/87
SUBSYSTEM: ATCS
MDAC ID: 3049

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	2/2
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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	2/2
LIFTOFF:	2/2	TAL:	2/2
ONORBIT:	2/2	AOA:	2/2
DEORBIT:	3/3	ATO:	2/2
LANDING/SAFING:	/NA		

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/08/87
SUBSYSTEM: ATCS
MDAC ID: 3050

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
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
4)
5)
6)
7)
8)
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: 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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	6/08/87	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	ATCS	FLIGHT:	2/1R
MDAC ID:	3051	ABORT:	2/1R

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	2/1R
LIFTOFF:	2/1R	TAL:	2/1R
ONORBIT:	2/1R	AOA:	2/1R
DEORBIT:	2/1R	ATO:	2/1R
LANDING/SAFING:	/NA		

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	6/08/87	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	ATCS	FLIGHT:	2/1R
MDAC ID:	3052	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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	2/1R
LIFTOFF:	2/1R	TAL:	2/1R
ONORBIT:	2/1R	AOA:	2/1R
DEORBIT:	2/1R	ATO:	2/1R
LANDING/SAFING:	/NA		

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

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
SUBSYSTEM: ATCS
MDAC ID: 3053

HIGHEST CRITICALITY	HDW/FUNC
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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	3/3
LIFTOFF:	3/2R	TAL:	3/3
ONORBIT:	2/2	AOA:	3/3
DEORBIT:	3/3	ATO:	2/2
LANDING/SAFING:	/NA		

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/08/87
SUBSYSTEM: ATCS
MDAC ID: 3054

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

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
4)
5)
6)
7)
8)
9)

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		

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/08/87
SUBSYSTEM: ATCS
MDAC ID: 3055

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

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
6)
7)
8)
9)

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		

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/08/87
SUBSYSTEM: ATCS
MDAC ID: 3056

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

ITEM: TOPPING EVAPORATOR - EXIT DUCT - ZONE D, E, F, AND H THERMOSTATS
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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/2R	TAL:	3/3
ONORBIT:	3/2R	AOA:	3/3
DEORBIT:	3/2R	ATO:	3/2R
LANDING/SAFING:	/NA		

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/08/87
SUBSYSTEM: ATCS
MDAC ID: 3057

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/2R	TAL:	3/3
ONORBIT:	3/2R	AOA:	3/3
DEORBIT:	3/2R	ATO:	3/2R
LANDING/SAFING:	/NA		

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/08/87
SUBSYSTEM: ATCS
MDAC ID: 3058

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	/NA
LIFTOFF:	/NA	TAL:	/NA
ONORBIT:	3/3	AOA:	/NA
DEORBIT:	/NA	ATO:	3/3
LANDING/SAFING:	/NA		

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/09/87
SUBSYSTEM: ATCS
MDAC ID: 3059

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

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
4)
5)
6)
7)
8)
9)

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		

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/09/87
SUBSYSTEM: ATCS
MDAC ID: 3060

HIGHEST CRITICALITY HDW/FUNC
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
4)
5)
6)
7)
8)
9)

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		

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

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 PROPULSIVE 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

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

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
4)
5)
6)
7)
8)
9)

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		

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

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

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
4)
5)
6)
7)
8)
9)

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		

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/09/87
SUBSYSTEM: ATCS
MDAC ID: 3063

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/2R
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
4)
5)
6)
7)
8)
9)

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		

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

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 OFF. A HEATER FAILED OFF MEANS POSSIBLE ICING OF THE NOZZLE AND IF ALL REDUNDANCY IS LOST, LOSS OF THE NOZZLE AND LOSS OF THE TOPPING EVAPORATOR. LOSS OF THE TOPPING EVAPORATOR MEANS A MINIMUM DURATION FLIGHT.

REFERENCES: VS70-960102 (60FH, 60FN), SSSH 7.3 SHEET 1 OF 2

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/09/87
SUBSYSTEM: ATCS
MDAC ID: 3064

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

ITEM: TOPPING EVAPORATOR - RH AND LH NOZZLE ZONE G AND I HEATER CONTROLLERS
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
4)
5)
6)
7)
8)
9)

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		

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/09/87
SUBSYSTEM: ATCS
MDAC ID: 3065

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/3
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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	/NA
LIFTOFF:	/NA	TAL:	/NA
ONORBIT:	3/3	AOA:	/NA
DEORBIT:	/NA	ATO:	3/3
LANDING/SAFING:	/NA		

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/01/87
SUBSYSTEM: ATCS
MDAC ID: 3066

HIGHEST CRITICALITY HDW/FUNC
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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/01/87
SUBSYSTEM: ATCS
MDAC ID: 3067

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

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)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	2/1R
LIFTOFF:	2/1R	TAL:	2/1R
ONORBIT:	2/1R	AOA:	2/1R
DEORBIT:	2/1R	ATO:	2/1R
LANDING/SAFING:	/NA		

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

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/2R	TAL:	3/3
ONORBIT:	3/2R	AOA:	3/3
DEORBIT:	3/2R	ATO:	3/2R
LANDING/SAFING:	/NA		

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

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 TN 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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/12/87
SUBSYSTEM: ATCS
MDAC ID: 3070

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/1R
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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/12/87
SUBSYSTEM: ATCS
MDAC ID: 3071

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	/NA
LIFTOFF:	/NA	TAL:	/NA
ONORBIT:	3/3	AOA:	/NA
DEORBIT:	/NA	ATO:	3/3
LANDING/SAFING:	/NA		

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/13/87
SUBSYSTEM: ATCS
MDAC ID: 3072

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

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

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
5)
6)
7)
8)
9)

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		

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

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 OVERTEMPERATURE 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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/05/87
SUBSYSTEM: ATCS
MDAC ID: 3075

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

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
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	/NA
LIFTOFF:	/NA	TAL:	/NA
ONORBIT:	3/3	AOA:	/NA
DEORBIT:	/NA	ATO:	3/3
LANDING/SAFING:	/NA		

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 5/13/87
SUBSYSTEM: ATCS
MDAC ID: 3076

HIGHEST CRITICALITY HDW/FUNC
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
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	/NA
LIFTOFF:	/NA	TAL:	/NA
ONORBIT:	3/3	AOA:	/NA
DEORBIT:	/NA	ATO:	3/3
LANDING/SAFING:	/NA		

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/26/87
SUBSYSTEM: ATCS
MDAC ID: 3077

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

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/22/87
SUBSYSTEM: ATCS
MDAC ID: 3079

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	3/3
LIFTOFF:	2/2	TAL:	3/3
ONORBIT:	3/2R	AOA:	3/3
DEORBIT:	2/2	ATO:	2/2
LANDING/SAFING:	/NA		

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

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	3/3
LIFTOFF:	3/1R	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/1R
DEORBIT:	3/1R	ATO:	3/1R
LANDING/SAFING:	/NA		

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/22/87
SUBSYSTEM: ATCS
MDAC ID: 3081

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/1R
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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	3/3
LIFTOFF:	3/1R	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/1R
DEORBIT:	3/1R	ATO:	3/1R
LANDING/SAFING:	/NA		

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/22/87
SUBSYSTEM: ATCS
MDAC ID: 3082

HIGHEST CRITICALITY HDW/FUNC
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
4)
5)
6)
7)
8)
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: 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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/22/87
SUBSYSTEM: ATCS
MDAC ID: 3083

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

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
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	3/3
LIFTOFF:	3/1R	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/1R
DEORBIT:	3/1R	ATO:	3/1R
LANDING/SAFING:	/NA		

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

LOCATION: FLIGHT DECK
PART NUMBER: PRIMARY A: A3CR1, A3CR10; PRIMARY B: A3CR2, A3CR9; SECONDARY: A3CR3, A3CR8

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, PIECE-PART STRUCTURAL, THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:
FAILURE OF THE DIODE IN AN OPEN CIRCUIT CONDITION MEANS THE CORRECT SIGNAL WILL NOT GET TO THE FES ELECTRONICS. LOSS OF ANY ONE DIODE MEANS THE LOSS OF ONE SWITCH/COMMAND OPTION (ON/GPC) ON ONE FES SYSTEM (PRIMARY A, PRIMARY B, SECONDARY). LOSS OF ALL DIODES MEANS THE LOSS OF ALL FES. LOSS OF ONE FREON LOOP FOLLOWING THE LOSS OF ALL FES CAN RESULT IN THE LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FG), SSSH 7.3 SHEET 2 OF 2

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/22/87
SUBSYSTEM: ATCS
MDAC ID: 3084

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

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
POWER 4) CONTROL RESISTORS
5)
6)
7)
8)
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: 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

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
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	3/3
LIFTOFF:	3/1R	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/1R
DEORBIT:	3/1R	ATO:	3/1R
LANDING/SAFING:	/NA		

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

LOCATION: PANEL L1A2
PART NUMBER: PRIMARY A: ON-A3R24, GPC-A2R8; PRIMARY B: ON-A3R25, GPC-A3R9; SECONDARY: ON-A3R26; GPC-A2R11

CAUSES: MECHANICAL SHOCK, MISHANDLING/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)

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/22/87
SUBSYSTEM: ATCS
MDAC ID: 3086

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

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
5)
6)
7)
8)
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: FLIGHT DECK -PANEL L1A2
PART NUMBER: PRIMARY A: ON-A3R24; GPC-A2R8; PRIMARY B: ON-A3R25, GPC-A3R9; SECONDARY: ON-A3R26, GPC-A2R11

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)

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
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	3/3
LIFTOFF:	3/1R	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/1R
DEORBIT:	3/1R	ATO:	3/1R
LANDING/SAFING:	/NA		

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

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:
THE "BLACK BOX" DELIVERS POWER TO THE REMAINDER OF THE FES CONTROL CIRCUIT. FAILURE OF THE BLACK BOX MEANS FAILURE OF THE ASSOCIATED FES. LOSS OF ALL BLACK BOXES MEANS LOSS OF ALL FES. LOSS OF ALL FES COMBINED WITH THE LOSS OF ONE FREON LOOP CAN RESULT IN THE LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FG), SSSH 7.3 SHEET 2 OF 2

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87
SUBSYSTEM: ATCS
MDAC ID: 3088

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

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)
7)
8)
9)

CRITICALITIES

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

REDUNDANCY SCREENS: A [2] B [NA] C [F]

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 BEAUSE, 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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87
SUBSYSTEM: ATCS
MDAC ID: 3089

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

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
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	3/3
LIFTOFF:	3/3	TAL:	3/3
ONORBIT:	3/2R	AOA:	3/3
DEORBIT:	3/3	ATO:	3/2R
LANDING/SAFING:	/NA		

REDUNDANCY SCREENS: A [2] B [NA] C [F]

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-LOD WILL PRESENST 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)

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87
SUBSYSTEM: ATCS
MDAC ID: 3090

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
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
5)
6)
7)
8)
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: 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)

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	3/3
LIFTOFF:	3/1R	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/1R
DEORBIT:	3/1R	ATO:	3/1R
LANDING/SAFING:	/NA		

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

LOCATION: AFT FUSELAGE
PART NUMBER: POWER SUPPLIES FOR 50V63A14, 50V63A15, 50V63A16.
(COMPONENTS INCLUDE: TRANSFORMER, ZENER DIODE, VOLTAGE REGULATOR).

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)

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87
SUBSYSTEM: ATCS
MDAC ID: 3092

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/1R
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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

INDEPNDENT 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
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	3/3
LIFTOFF:	3/1R	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/1R
DEORBIT:	3/1R	ATO:	3/1R
LANDING/SAFING:	/NA		

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

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

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
5)
6)
7)
8)
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: 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

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
5)
6)
7)
8)
9)

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		

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

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

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
5)
6)
7)
8)
9)

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		

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87
SUBSYSTEM: ATCS
MDAC ID: 3097

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

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
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	3/3
LIFTOFF:	3/1R	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/1R
DEORBIT:	3/1R	ATO:	3/1R
LANDING/SAFING:	/NA		

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

LOCATION: AFT FUSELAGE
PART NUMBER: CONTROLLER A: 807-4; CONTROLLER B: 807-5

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
IF ALL OTHER TEMPERATURE SENSORS ARE OPERATING CORRECTLY, THE FAILURE OF THIS SENSOR, MEANS THERE WILL BE NO PULSES GENERATED TO ACTIVATE THE EVAPORATOR PULSAR VALVES - NO OPERATION OF THE EVAPORATOR REGARDLESS OF THE INPUT TEMPERATURES. THE FAILURE OF ONE SENSOR IN THIS CONDITION MEANS THE LOSS OF ONE CONTROLLER, FAILURE OF BOTH MEANS THE LOSS OF BOTH CONTROLLERS WITH ONLY THE SECONDARY CONTROLLER REMAINING. LOSS OF ALL CONTROLLERS MEANS THE LOSS OF ALL FES COOLING WHICH COMBINED WITH THE LOSS OF ONE FREON LOOP CAN RESULT IN THE LOSS OF THE CREW/VEHICLE.

REFERENCES: VS70-960102 (60FH, 60FJ), SSSH 7.3 SHEET 2 OF 2

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87
SUBSYSTEM: ATCS
MDAC ID: 3098

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

CRITICALITIES

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

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

LOCATION: AFT FUSELAGE
PART NUMBER: CONTROLLER A: 807-4; CONTROLLER: 807-5

CAUSES: CONTAMINATION, MISHANDLING/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 CORRECTIONFACTOR 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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87
SUBSYSTEM: ATCS
MDAC ID: 3099

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

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
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	3/3
LIFTOFF:	3/1R	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/1R
DEORBIT:	3/1R	ATO:	3/1R
LANDING/SAFING:	/NA		

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87
SUBSYSTEM: ATCS
MDAC ID: 3100

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

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87
SUBSYSTEM: ATCS
MDAC ID: 3101

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

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT FUSELAGE
PART NUMBER: CONTROLLER A: 807-7; 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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87
SUBSYSTEM: ATCS
MDAC ID: 3102

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
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
5)
6)
7)
8)
9)

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		

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	6/23/87	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	ATCS	FLIGHT:	3/1R
MDAC ID:	3103	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
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	3/3
LIFTOFF:	3/1R	TAL:	3/3
ONORBIT:	3/1R	AOA:	3/1R
DEORBIT:	3/1R	ATO:	3/1R
LANDING/SAFING:	/NA		

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

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 SCONDARY SHUTDOWN LOGIC PROVIDES BACKUP SHUTDOWN LOGIC TO THE A CONTROLLER.

REFERENCES: VS70-960102 (60FH, 60FJ), SSSH 7.3 SHEET 2 OF 2

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/23/87
SUBSYSTEM: ATCS
MDAC ID: 3104

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

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
5)
6)
7)
8)
9)

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		

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 3105

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

ITEM: HI-LOAD VALVE PULSER ELECTRONICS (PRIMARY A, B, AND SECONDARY)
FAILURE MODE: GENERATES INCORRECT REQUENCY (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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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 INSUFFIENT 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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 3106

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

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 3107

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

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 3108

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/1R
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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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 (60FH, 60FJ, 60FK)

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
5)
6)
7)
8)
9)

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		

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

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

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
5)
6)
7)
8)
9)

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		

REDUNDANC SCREENS: A [2] B [NA] C [P]

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 3111

HIGHEST CRITICALITY	HDW/FUNC
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
3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	/NA
LIFTOFF:	/NA	TAL:	/NA
ONORBIT:	/NA	AOA:	/NA
DEORBIT:	/NA	ATO:	/NA
LANDING/SAFING:	3/3		

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)

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 3112

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

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
5)
6)
7)
8)
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: 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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87
SUBSYSTEM: ATCS
MDAC ID: 3113

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

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
5)
6)
7)
8)
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: 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

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	6/25/87	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	ATCS	FLIGHT:	3/3
MDAC ID:	3115	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
5)
6)
7)
8)
9)

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:	/NA		

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 CANNOT 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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87
SUBSYSTEM: ATCS
MDAC ID: 3116

HIGHEST CRITICALITY HDW/FUNC
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
5)
6)
7)
8)
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: 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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87
SUBSYSTEM: ATCS
MDAC ID: 3117

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/1R
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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:
A FUSE BLOWING MEANS THE REQUIRED POWER WILL NOT REACH THE HEATERS AND THE HEATERS WILL NOT OPERATE. LOSS OF ONE FUSE RESULTS IN THE LOSS OF ONE HEATER SYSTEM. LOSS OF ALL FUSES RESULTS IN THE LOSS OF ALL FEEDLINE HEATERS. LOSS OF ALL FEEDLINE HEATERS WILL RESULT IN THE LOSS OF BOTH FEEDLINES, TOTAL LOSS OF THE FES, AND LANDING AT NEXT PLS. TOTAL LOSS OF THE FES COMBINED WITH LOSS OF ONE FREON LOOP CAN RESULT IN THE LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FL), SSSH 7.3 SHEET 1 OF 2

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

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	/NA	RTLS:	3/3
LIFTOFF:	2/2	TAL:	3/3
ONORBIT:	2/2	AOA:	3/3
DEORBIT:	2/2	ATO:	2/2
LANDING/SAFING:	/NA		

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87
SUBSYSTEM: ATCS
MDAC ID: 3119

HIGHEST CRITICALITY	HDW/FUNC
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)
6)
7)
8)
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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87
SUBSYSTEM: ATCS
MDAC ID: 3120

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

ITEM: TOPPING EVAPORATOR HEATER SELECT SWITCH STATUS
FAILURE MODE: ERONEOUS 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
5)
6)
7)
8)
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:
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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	6/25/87	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	ATCS	FLIGHT:	3/2R
MDAC ID:	3121	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
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/2R	TAL:	3/3
ONORBIT:	3/2R	AOA:	3/3
DEORBIT:	3/2R	ATO:	3/2R
LANDING/SAFING:	/NA		

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

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:
BLOWING OF THE FUSE MEANS THE CONTROL BUS POWER WILL NOT REACH THE SWITCH AND THE HEATERS WILL NOT BE OPERATIONAL. LOSS OF ONE FUSE MEANS LOSS OF ONE HEATER SYSTEM; LOSS OF ALL FUSES MEANS LOSS OF ALL HEATERS AND LOSS OF THE TOPPING EVAPORATOR. LOSS OF THE TOPPING EVAPORATOR REQUIRES 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: 3122

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
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
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/2R	TAL:	3/3
ONORBIT:	3/2R	AOA:	3/3
DEORBIT:	3/2R	ATO:	3/2R
LANDING/SAFING:	/NA		

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

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:
OPENING OF THE FUSES OR RPCS BETWEEN THE INPUT POWER AND THE TOPPING EVAPORATOR EXIT DUCT HEATERS REMOVES ONE HEATER SYSTEM FROM FURTHER USE. LOSS OF ALL FUSES MEAN LOSS OF ALL HEATERS AND SUBSEQUENT LOSS OF THE TOPPING EVAPORATOR. LOSS OF THE TOPPING EVAPORATOR REQUIRES 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	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	ATCS	FLIGHT:	3/2R
MDAC ID:	3123	ABORT:	3/2R

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
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/2R	TAL:	3/3
ONORBIT:	3/2R	AOA:	3/3
DEORBIT:	3/2R	ATO:	3/2R
LANDING/SAFING:	/NA		

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	6/25/87	HIGHEST CRITICALITY		HDW/FUNC
SUBSYSTEM:	ATCS		FLIGHT:	3/2R
MDAC ID:	3124		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
5)
6)
7)
8)
9)

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		

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

LOCATION: PANEL L1A2
PART NUMBER: LEFT- S37; RIGHT - S38

CAUSES: MECHANICAL SHOCK, MISHANDLING/ABUSE, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
FAILURE OF THE SWITCH IN THE "OFF" POSITION FAILS ALL HEATERS ON THE AFFECTED NOZZLE. REMOVAL OF HEAT WILL RESULT IN ICING AND LOSS OF THE ONE NOZZLE. LOSS OF THE NOZZLE WILL MEAN EFFECTIVE 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: 3125

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/3
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
5)
6)
7)
8)
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:
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

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
5)
6)
7)
8)
9)

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:	/NA		

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87
SUBSYSTEM: ATCS
MDAC ID: 3127

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/2R
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
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	3/3
LIFTOFF:	3/2R	TAL:	3/3
ONORBIT:	3/2R	AOA:	3/3
DEORBIT:	3/2R	ATO:	3/2R
LANDING/SAFING:	/NA		

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

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

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
5)
6)
7)
8)
9)

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:	/NA		

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87
SUBSYSTEM: ATCS
MDAC ID: 3130

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/3
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
5)
6)
7)
8)
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 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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	6/25/87	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	ATCS	FLIGHT:	3/1R
MDAC ID:	3131	ABORT:	3/1R

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL L1A2
PART NUMBER: 1 AMP FUSES BETWEEN CONTROL BUS AND SWITCH

CAUSES: OVERLOAD, PIECE-PART STRUCTURAL

EFFECTS/RATIONALE:
AN OPEN FUSE INTERRUPTS THE CIRCUIT AND DOES NOT ALLOW ANY POWER TO THE HEATERS. LOSS OF ONE FUSE MEANS LOSS OF ONE HEATER SYSTEM; LOSS OF ALL FUSES MEANS LOSS OF ALL HEATERS AND LOSS OF THE HIGH LOAD EVAPORATOR. LOSS OF THE HIGH LOAD EVAPORATOR MEANS LOSS OF MISSION AND ENTRY TO NEXT PLS. IF COMBINED WITH THE LOSS OF ONE FREON LOOP, THE LOSS OF THE HIGH LOAD EVAPORATOR CAN RESULT IN LOSS OF CREW/VEHICLE.

REFERENCES: VS70-960102 (60FM), SSSH 7.3 SHEET 1 OF 2

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87
SUBSYSTEM: ATCS
MDAC ID: 3132

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/1R
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
6)
7)
8)
9)

CRITICALITIES

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

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

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:
AN OPEN FUSE INTERRUPTS THE CIRCUIT AND DOES NOT ALLOW ANY POWER TO THE HEATERS. LOSS OF ONE FUSE MEANS LOSS OF ONE HEATER SYSTEM; LOSS OF ALL FUSES MEANS LOSS OF ALL HEATERS AND LOSS OF THE HIGH LOAD EVAPORATOR. THE LOSS OF THE HIGH LOAD EVAPORATOR COMBINED WITH THE LOSS OF ONE FREON LOOP CAN RESULT IN THE LOSS OF CREW/VEHICLE. THE LOSS OF THE HIGH LOAD ALONE MEANS ENTRY TO NEXT PLS.

REFERENCES: VS70-960102 (60FH), SSSH 7.3 SHEET 1 OF 2

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/25/87
SUBSYSTEM: ATCS
MDAC ID: 3133

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

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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 4001

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
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)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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 ELIMATE COOLING OF THE FREON LOOPS BY THE AMMONIA SYSTEM AND RESULT IN LOSS OF CREW AND VEHICLE DURING RTLS, TAL, AND AOA ABORTS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 4002

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/3
ABORT:	2/1R

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)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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)
5)
6)
7)
8)
9)

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: 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 4004

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

ITEM: TEMPERATURE 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) TEMPERATURE TRANSDUCER (NH3 TANK)
5)
6)
7)
8)
9)

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: 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/17/87
SUBSYSTEM: ATCS
MDAC ID: 4005

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/3
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)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/17/87
SUBSYSTEM: ATCS
MDAC ID: 4006

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/3
ABORT:	2/1R

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)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 4007

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
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.)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 4008

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/3
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.)
6)
7)
8)
9)

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: 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 4009

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

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.)
6)
7)
8)
9)

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: 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 4010

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

ITEM: TEMERATURE 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
6)
7)
8)
9)

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: AFT BODY-AREA 50
PART NUMBER: 50V63A1-MT1, 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 4011

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 2/1R

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.)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 4012

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/3
ABORT:	2/1R

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.)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 4013

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	2/1R
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
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

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
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	1/1
LIFTOFF:	3/3	TAL:	1/1
ONORBIT:	3/3	AOA:	1/1
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING:	3/3		

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 4015

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
ABORT: 2/1R

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)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 4016

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/3
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)
4)
5)
6)
7)
8)
9)

CRITICALITIES

FLIGHT PHASE	HDW/FUNC	ABORT	HDW/FUNC
PRELAUNCH:	3/3	RTLS:	1/1
LIFTOFF:	3/3	TAL:	1/1
ONORBIT:	3/3	AOA:	1/1
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING:	3/3		

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 4017

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

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

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: 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87
SUBSYSTEM: ATCS
MDAC ID: 4018

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/3
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
6)
7)
8)
9)

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: 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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 4019

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
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)

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-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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 4020

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

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)
5)
6)
7)
8)
9)

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-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
SUBSYSTEM: ATCS
MDAC ID: 4021

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/3
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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 4022

HIGHEST CRITICALITY	HDW/FUNC
FLIGHT:	3/3
ABORT:	2/1R

ITEM: SWITCH 42 (NH3 CONTROLLER)
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
5)
6)
7)
8)
9)

CRITICALITIES

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

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

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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 4023

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

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)
5)
6)
7)
8)
9)

CRITICALITIES

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-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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 4024

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

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)
5)
6)
7)
8)
9)

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-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:

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
5)
6)
7)
8)
9)

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: 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 4026

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

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
5)
6)
7)
8)
9)

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: 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:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/15/87
SUBSYSTEM: ATCS
MDAC ID: 4027

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

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
5)
6)
7)
8)
9)

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: 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:

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
5)
6)
7)
8)
9)

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: 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:

APPENDIX D
POTENTIAL CRITICAL ITEMS

ATCS POTENTIAL CRITICAL ITEMS

MDAC-ID	FLIGHT	ITEM NAME	FAILURE MODE
1000	2/1R	INLET SELF-SEALING COUPLING	EXTERNAL LEAKAGE
1001	2/1R	ORIFICE INLET COUPLING	RESTRICTED FLOW
1003	2/1R	INLET FILTER - ACCUMULATOR	RESTRICTED FLOW
1004	2/1R	INLET FILTER - ACCUMULATOR	STRUCTURAL FAILURE (RUPTURE)
1005	2/1R	ACCUMULATOR	INTERNAL LEAKAGE
1006	3/2R	SELF-SEALING DISCONNECT	EXTERNAL LEAKAGE
1009	3/2R	INLET FILTER FREON PUMP	STRUCTURAL FAILURE (RUPTURE)
1011	2/1R	FREON PUMP	EXTERNAL LEAKAGE
1014	2/1R	OUTLET FILTER	STRUCTURAL FAILURE (RUPTURE)
1016	2/1R	CHECK VALVE	FAILS TO CLOSE
1017	2/1R	OUTLET SELF-SEALING COUPLING	EXTERNAL LEAKAGE
1018	2/1R	ORIFICE (OUTLET COUPLING)	RESTRICTED FLOW
1019	2/1R	FUEL CELL HEAT EXCHANGER	INTERNAL LEAKAGE (F21 TO FC40)
1020	2/1R	FUEL CELL HEAT EXCHANGER	INTERNAL LEAKAGE (F21 TO F21)
1021	2/1R	FUEL CELL HEAT EXCHANGERS	INTERNAL LEAKAGE (FC40 TO FC40)
1022	2/1R	FUEL CELL HEAT EXCHANGER	EXTERNAL LEAKAGE (FREON)
1023	2/1R	FUEL CELL HEAT EXCHANGER	EXTERNAL LEAKAGE (FC40)
1024	2/1R	FUEL CELL HEAT EXCHANGER	RESTRICTED FLOW (F21)
1025	2/1R	HYDRAULIC HEAT EXCHANGER	INTERNAL LEAKAGE (F21 TO HYDRAULIC FLUID)
1026	2/1R	HYDRAULIC HEAT EXCHANGERS	INTERNAL LEAKAGE (FREON TO FREON)
1027	2/1R	HYDRAULIC HEAT EXCHANGERS	INTERNAL LEAKAGE (HYDRAULIC TO HYD)
1028	2/1R	HYDRAULIC HEAT EXCHANGERS	EXTERNAL LEAKAGE (FREON 21)
1029	2/1R	HYDRAULIC HEAT EXCHANGER	EXTERNAL LEAKAGE (HYDRAULIC FLUID)
1030	2/1R	HYDRAULIC HEAT EXCHANGER	RESTRICTED FLOW (FREON 21)
1032	2/1R	GSE HEAT EXCHANGER	INTERNAL LEAKAGE (F21 TO GSE LINES)
1033	2/1R	GSE HEAT EXCHANGER	INTERNAL LEAKAGE (F21 TO F21)

ATCS POTENTIAL CRITICAL ITEMS - CONT'D.

MDAC-ID	FLIGHT	ITEM NAME	FAILURE MODE
1034	2/1R	GSE HEAT EXCHANGERS	EXTERNAL LEAKAGE (FREON 21)
1036	2/1R	GSE HEAT EXCHANGER	RESTRICTED FLOW (FREON 21)
1037	2/1R	O2 RESTRICTOR	EXTERNAL LEAKAGE (O2)
1038	2/1R	O2 RESTRICTOR	EXTERNAL LEAKAGE (FREON 21)
1039	2/1R	ARS INTERCHANGER HEAT EXCHANGER	INTERNAL LEAKAGE (FREON TO WATER)
1040	2/1R	ARS INTERCHANGER HEAT EXCHANGER	INTERNAL LEAKAGE (FREON TO FREON)
1041	2/1R	ARS INTERCHANGER HEAT EXCHANGER	INTERNAL LEAKAGE (WATER TO WATER)
1042	2/1R	ARS INTERCHANGER HEAT EXCHANGER	EXTERNAL LEAKAGE (FREON 21)
1043	2/1R	ARS INTERCHANGER HEAT EXCHANGER	EXTERNAL LEAKAGE (WATER)
1044	2/1R	ARS INTERCHANGER HEAT EXCHANGER	RESTRICTED FLOW (FREON 21)
1045	2/1R	ARS INTERCHANGER HEAT EXCHANGER	RESTRICTED FLOW (WATER)
1048	2/1R	PAYLOAD HEAT EXCHANGER	INTERNAL LEAKAGE (F21 TO P/L EXCHANGER FLUID)
1049	2/1R	PAYLOAD HEAT EXCHANGER	INTERNAL LEAKAGE (FREON TO FREON)
1051	2/1R	PAYLOAD HEAT EXCHANGER	EXTERNAL LEAKAGE (FREON 21)
1053	2/1R	PAYLOAD HEAT EXCHANGER	RESTRICTED FLOW (F21)
1055	3/2R	SERVICING QUICK DISCONNECT CAP	FAILS TO REMAIN CLOSED
1056	2/1R	FLOW PROPORTIONING VLV	EXTERNAL LEAKAGE
1057	2/1R	FLOW PROPORTIONING VLV	FAILS IN INTERMEDIATE POSIT, RESTRICTED FLOW
1060	2/1R	MIDBODY COLDPLATES	EXTERNAL LEAKAGE
1061	2/1R	MIDBODY COLDPLATES	INTERNAL LEAKAGE
1062	2/1R	MIDBODY COLDPLATES	RESTRICTED FLOW
1063	2/1R	ORIFICE (AFT AVIONICS COLDPLATES)	RESTRICTED FLOW
1065	2/1R	AFT AVIONICS COLDPLATES	EXTERNAL LEAKAGE
1066	2/1R	AFT AVIONICS COLDPLATES	INTERNAL LEAKAGE
1067	2/1R	AFT AVIONICS COLDPLATES	RESTRICTED FLOW
1069	2/1R	RGA COLDPLATES	INTERNAL LEAKAGE
1070	2/1R	RGA COLDPLATES	EXTERNAL LEAKAGE
1071	2/1R	RGA COLDPLATES	RESTRICTED FLOW
1072	2/1R	FREON LOOP LINES AND FITTINGS	EXTERNAL LEAKAGE
1076	2/1R	SWITCH (FREON PUMPS)	FAILS IN PUMP "OFF" POSITION

ATCS POTENTIAL CRITICAL ITEMS - CONT'D.

MDAC-ID	FLIGHT	ITEM NAME	FAILURE MODE
1085	2/1R	CB (FREON FLOW PROPORTIONING VALVE)	OPEN (ELECTRICAL)
1086	2/1R	SWITCH (FLOW PROPORTIONING VALVE)	FAILS WITH VALVE IN MID-TRAVEL POSITION
1089	2/1R	SIGNAL CONDITIONER (ATCS OF1)	ERRONEOUS OUTPUT, LOSS OF OUTPUT
2000	2/1R	INLET SELF-SEALING COUPLING	EXTERNAL LEAKAGE
2001	2/1R	OUTLET SELF-SEALING COUPLING	EXTERNAL LEAKAGE
2002	2/1R	FLEX HOSES, MANIFOLDS, TUBES	EXTERNAL LEAKAGE
2005	2/1R	FLOW CONTROL VALVE	EXTERNAL LEAKAGE
2009	2/1R	BYPASS VALVE	EXTERNAL LEAKAGE
2010	2/1R	MOTOR (BYPASS VALVE)	FAILS TO START
2011	2/1R	MODE CONTROL VALVE	EXTERNAL LEAKAGE
3012	2/1R	HI LOAD EVAPORATOR CORE	INTERNAL LEAKAGE (FREON)
3014	2/1R	HI LOAD/VALVE MOUNTING PLATE	INTERNAL/EXTERNAL LEAKAGE (FREON)
3015	2/1R	HI LOAD VALVE MOUNTING PLATE	EXTERNAL LEAKAGE, STRUCTURAL FAILURE
3016	2/1R	HI LOAD EVAPORATOR ACOD	INTERNAL LEAKAGE (FREON TO WATER)
3017	2/1R	HI LOAD EVAPORATOR ACOD	EXTERNAL LEAKAGE (FREON)
3019	2/1R	HI LOAD EXIT DUCT	EXTERNAL LEAKAGE
3020	2/1R	HI LOAD EXIT DUCT	NO FLOW
3029	2/1R	HI LOAD NOZZLE	RESTRICTED FLOW
3030	2/1R	HI LOAD NOZZLE	EXTERNAL LEAKAGE
3046	2/1R	TOPPING EVAPORATOR WATER VLV/NOZZLE	LEAK BETWEEN WATER AND FREON
3047	1/1	TOPPING EVAPORATOR WATER VLV NOZZLE	STRUCTURAL FAILURE (RUPTURE)
3048	2/1R	TOPPING EVAPORATOR CORE	INTERNAL LEAKAGE - FREON
3049	2/2	TOPPING EVAPORATOR CORE	RESTRICTED FLOW - WATER
3051	2/1R	TOPPING EVAPORATOR ACOD	INTERNAL LEAKAGE - FREON
3052	2/1R	TOPPING EVAPORATOR ACOD	STRUCTURAL FAILURE (RUPTURE)
3053	2/2	TOPPING EVAPORATOR EXIT DUCT	RESTRICTED FLOW - WATER
3067	2/1R	FES FEEDLINE A/B	LEAKAGE
3079	2/2	FES CONTROLLER-SWITCH	FAILS IN "ON"
3088	2/1R	HI-LOAD ENABLE SWITCH	ONE OR MORE CONTACTS STUCK IN OFF POSITION
3089	3/2R	HI-LOAD ENABLE SWITCH	ONE OR MORE CONTACTS NOT MAKING IN OFF

ATCS POTENTIAL CRITICAL ITEMS - CNCLD.

MDAC-ID	FLIGHT	ITEM NAME	FAILURE MODE
3118	2/2	TOPPING EVAPORATOR HEATER SELECT SWITCH	FAILS IN OFF POSITION
3128	2/1R	HI-LOAD HEATER SWITCH	FAILED TO "OFF"
4001	(A)2/1R	NH3 RELIEF VALVE	FAILS TO OPEN
4002	(A)2/1R	RELIEF VALVE	FAILS TO CLOSE
4005	(A)2/1R	AMMONIA CONTROLLER A	LOSS OF OUTPUT
4006	(A)2/1R	AMMONIA CONTROLLER A	PREMATURE OPERATION
4007	(A)2/1R	FLOW CONTROL VALVE	FAILS TO OPEN
4011	(A)2/1R	TANK ISOLATION VALVE	FAILS TO OPEN
4012	(A)2/1R	TANK ISOLATION VALVE	FAILS TO REMAIN CLOSED, EXT LEAKAGE
4013	2/1R	NH3 BOILER/HEAT EXCHANGER	INT/EXTERNAL LEAKAGE (FREON 21 TO NH3)
4014	(A)1/1	NH3 BOILER/HEAT EXCHANGER	EXTERNAL LEAKAGE (NH3)
4015	(A)2/1R	TANKS, LINES, & FITTINGS	EXTERNAL LEAKAGE
4016	(A)1/1	LINES & FITTINGS	EXTERNAL LEAKAGE
4021	(A)2/1R	SW 42 (NH3 CONTROLLER)	FAILS TO SW FROM PRI/ GPC OR SEC/ON
4022	(A)2/1R	SW 42 (NH3 CONTROLLER)	FAILS TO SWITCH FROM OFF