INDEPENDENT ORBITER ASSESSMENT

ANALYSIS OF THE PURGE, VENT AND DRAIN SUBSYSTEM

18 NOVEMBER 1987

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, 10 October 1986. The IOA approach features a top-down analysis of the hardware to determine failure modes, criticality, and potential critical items. To preserve independence, this analysis was accomplished without reliance upon the results contained within the NASA FMEA/CIL documentation. This report documents (Appendix C) the independent analysis results corresponding to the Orbiter PV&D (Purge, Vent and Drain) Subsystem hardware.

The Purge, Vent and Drain (PV&D) Subsystem controls the environment of unpressurized compartments and window cavities, senses hazardous gases, and purges Orbiter/ET Disconnect. The subsystem is divided into six systems. The systems and hardware components which were analyzed are described below:

- Purge System - Controls the environment of unpressurized structural compartments
  - Ducts
  - Flexible Joints
  - Check Valves
    - In-line
    - Bulkhead
  - Umbilical Disconnects

- Vent System - Controls the pressure of unpressurized compartments
  - Vent Ports - Doors/Hinges
  - Filters
    - EMI Filters
    - Contamination Filters

- Drain System - Removes water from unpressurized compartments
  - Tubing/Couplings
  - Quick Disconnects

- Hazardous Gas Detection System (HGDS) - Monitors hazardous gas concentrations
  - Tubing/Couplings
  - Quick Disconnects

- Window Cavity Conditioning System (WCCS) - Maintains clear windows and provides pressure control of the window cavities
  - Tubing/Debris Screen
  - Desiccant/Filter Canisters
  - Check Valves
  - Quick Disconnects

- External Tank/Orbiter Disconnect Purge System - Prevents cryo-pumping/icing of disconnect hardware
  - Quick Disconnects
  - Tubing
  - Hoses/Orifices/Fittings/Seals

The IOA analysis process utilized available PV&D 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 six systems of the PV&D. A summary of the number of failure modes, by criticality, is also presented below with Hardware (HW) criticality first and Functional (F) criticality second.

Summary of IOA Failure Modes By Criticality (HW/F)							
Criticality :	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
Number :	4	10	2	-	-	46	62

PV&D ANALYSIS SUMMARY		
CRIT.	#FM	#PCI
1 / 1	4	4
2 / 2	2	2
2 / 1R	10	10
3 / 1R	0	0
3 / 3	46	0
TOTAL	62	16

PURGE SYSTEM

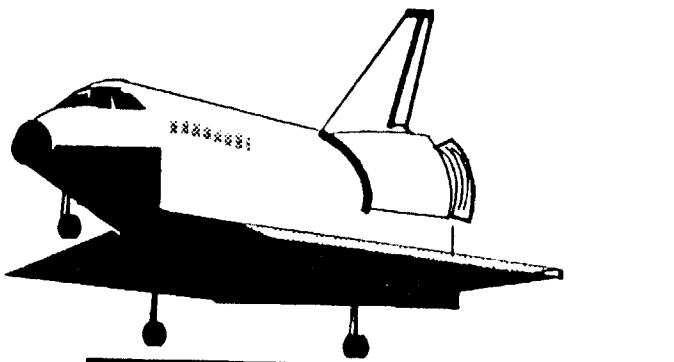
CRIT.	#FM	#PCI
3 / 3	14	0

VENT SYSTEM

CRIT.	#FM	#PCI
2 / 1R	6	6
3 / 1R	0	0
3 / 3	8	0

DRAIN SYSTEM

CRIT.	#FM	#PCI
3 / 3	5	0



WCCS

CRIT.	#FM	#PCI
1 / 1	2	2
2 / 2	2	2
2/ 1R	4	4
3 / 3	12	0

HGDS

CRIT.	#FM	#PCI
3 / 3	4	0

ET/ORB DISCN. NET

CRIT.	#FM	#PCI
1 / 1	2	2
3/ 3	3	0

Figure 1 - PV&D OVERVIEW ANALYSIS SUMMARY

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 IOA Potential Critical Items (HW/F)						
Criticality :	1/1	2/1R	2/2	3/1R	3/2R	TOTAL
Number :	4	10	2	—	—	16

Four (4) of the sixty-two (62) failure modes analyzed were determined as single failures which could result in the loss of crew or vehicle. A possible loss of mission could result if any of twelve (12) single failures occurred. Two (2) of the criticality 1/1 failures are in the Window Cavity Conditioning System (WCCS) outer window cavity, where leakage and/or restricted flow will cause failure to depressurize/repressurize the window cavity. Two (2) criticality 1/1 failures represent leakage and/or restricted flow in the Orbiter/ET disconnect purge network which prevent cryopumping/icing of disconnect hardware.

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 re-evaluating the FMEA/CIL for the Space Shuttle design. The MDAC is providing an independent assessment of the Orbiter FMEA/CIL revaluation 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 revaluation 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 PV&D Ground Rules and Assumptions

The PV&D ground rules and assumptions used in the IOA are consistent with the project level ground rules and assumptions contained in Appendix B.

3.0 SUBSYSTEM DESCRIPTION

3.1 Design and Function

The PV&D subsystem consists of six (6) basic systems, the primary function of which is the environment control of the Orbiter unpressurized structural cavities. The six systems are described in the following paragraphs.

3.2 System Description

3.2.1 Purge System

The Orbiter Purge System services vehicle unpressurized compartments, including the payload bay. The system is made up of three circuits of on-board ducting that distributes purge gases to and within the various compartments of the vehicle. Each circuit has a separate interface at the starboard T-0 umbilical panel and functions during prelaunch and postlanding operations for thermal, hazardous gas, moisture, and contamination control. The three circuits are described below.

3.2.1.1 Circuit One - services the Orbital Maneuvering System (OMS) Pods, vertical stabilizer, wings, cabin annulus, forward Reaction Control System (RCS) and Star Tracker. It is equipped with check valves to prevent cross flow of gases during ascent and descent.

3.2.1.2 Circuit Two - services the lower midbody equipment bay and the payload bay. Three special capped outlets are incorporated in the system and are available for internal purging or conditioning of payloads.

3.2.1.3 Circuit Three - services the aft body engine compartment. This circuit provides a dedicated flow to the three main engine controllers and a bulk area dedicated conditioning flow. Additional bulk area conditioning flow is provided by flow from the "Circuit Two" system. This flow enters the aft body through 14 check valves.

3.2.2 Vent System

The Orbiter Vent System provides ascent venting and descent repressurization of unpressurized Orbiter compartments to maintain differential pressures within Orbiter structural limits. The vent ports provide outlets for ground purging and on-orbit molecular venting of compartments containing thermal insulation. The vent ports also minimize the effects of entry heating and repressurization on the vehicle structure either by maintaining the vent doors closed during the high heating phase of the flight or by using heat sinks. To accomplish these tasks the Orbiter uses the following three designs.

- o Electronically actuated vent doors (forward RCS, forward fuselage plenum, mid fuselage, wings, aft fuselage/vertical fin and OMS pods)

- o Passive vents (open holes) with heat sinks for thermal protection (rudders/speed break, elevons/elevon cavity)

- o Self-vented compartments which freely vent (nose cap, wing leading edge, body flap)

The active vent system consists of eighteen electromagnetically actuated doors. The actuators are designed to meet fail-safe requirements through the use of dual 3-phase AC motors, independently powered, connected through a differential and slip clutch to bell cranks, linkages and torque shafts. Vent door positions are monitored by redundant limit switches which indicate open, closed, and purge positions.

The sequence of the active vent system is controlled automatically by the launch processing system for prelaunch sequencing and the Orbiter general purpose computers during ascent and descent phases. Manual sequencing capability via CRT is required for de-orbit and post-landing operations.

3.2.3 Drain System

The Drain System consists of passive "through-hole" and active "vacuum line" systems. The two systems are described below.

3.2.3.1 Passive System - consists of dedicated drain holes and flow paths in selected structures which provide vertical or vertical and horizontal gravity drainage.

3.2.3.2 Active System - consists of three separate circuits which service the forward fuselage plenum and forward RCS nose wheel well compartments. The forward fuselage plenum drain line is used in the horizontal mode, while the forward RCS and nose wheel well drain lines are used primarily in the vertical mode.

The active drain system consists of 3/8-inch-diameter brazed stainless steel lines that extend from the low point within the compartment serviced to a disconnect located for easy servicability during ground operations.

3.2.4 Hazardous Gas Detection System (HGDS)

The HGDS monitors hazardous gas concentrations (hydrogen, oxygen, monomethylhydrazine, nitrogen tetroxide, and hydrazine) in selected vehicle compartments (forward RCS fuselage, payload bay, lower mid fuselage, aft fuselage, and OMS pods) during prelaunch, landing and safing operations. GSE hypergolic measurement probes are mounted external to the vehicle to monitor purge effluent from the FWD RCS, OMS/RCS Pods, and aft fuselage vents. The

cryogenic system consist of 1/5 inch diameter stainless steel tubing vacuum lines connected to a GSE mass spectrometer. The interface between the on-board tubing and GSE is thru the T-O disconnect, therefore, the aft fuselage, payload bay, Lower Mid Fuselage (LMF), and ET intertank area are monitored to lift-off.

3.2.5 Window Cavity Conditioning System (WCCS)

The WCCS prevents contamination (e.g. fog, frost, Volatile Condensable Material (VCM)) and window glass overpressurization and provides necessary fail-safe redundancy. The system is divided into eight smaller systems each with its own purge and vent circuits. The systems are as follows:

- Port front and middle outer windshields
- Starboard front and middle outer windshields
- Port outer windshield and overhead window
- Starboard outer windshield and overhead window
- Port inner window cavities
- Starboard inner window cavities
- Side hatch outer cavity
- Side hatch inner cavity

The vent circuit of each system is equipped with a desiccant/filter canister. The canister removes moisture, particulates, and VCM contamination from pressurization gases. If the outer canisters fail to flow properly, check valves, working in parallel, provide redundancy. The WCCS is connected by 1/4 to 1 inch brazed stainless steel tubing. WCCS LRUs are joined to the tubing with Dynatube-fittings.

3.2.6 External Tank/Orbiter Disconnect Purge System

The External Tank/Orbiter Disconnect Purge System provides helium to the LH_2 side and gaseous nitrogen to the LO_2 side of the disconnects to prevent cryo-pumping (liquefaction of air) and icing within the:

- frangible nut canisters
- gap between the disconnect plates
- electrical feed-through cavity, including the ET wire shrouds

The purge gas maintains a positive pressure (P is greater than or equal to 0.10 PSID) in the above volumes during prelaunch operations under cryogenic conditions to prevent back diffusion of air and the resulting cryo-pumping and/or ice formation.

The purge gas is introduced to the circuit by GSE through a T-O umbilical disconnect and is ducted to the ET/Orbiter disconnect compartment via an on-board tubing circuit.

3.3 Hierarchy

Figure 2 illustrates the hierarchy of the PV&D subsystem. Figures 3 thru 8 illustrate the system and corresponding subassemblies of the PV&D system.

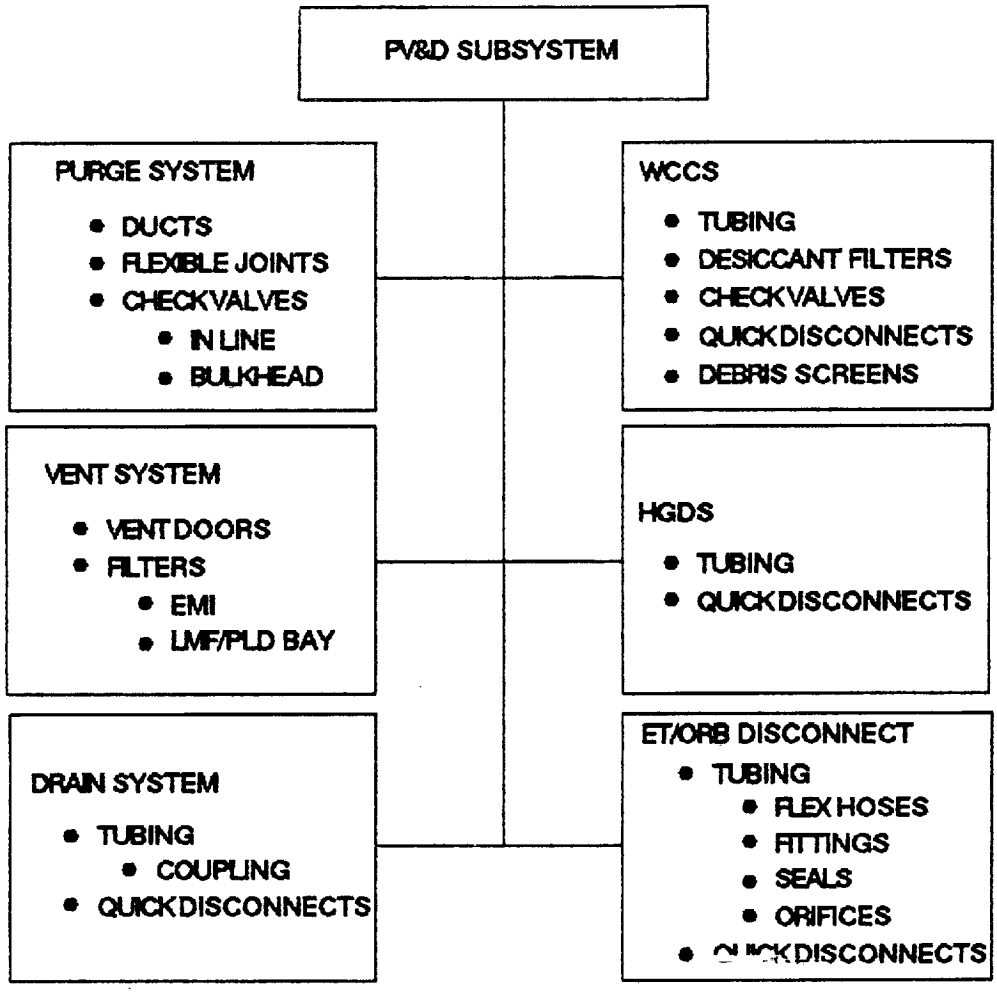
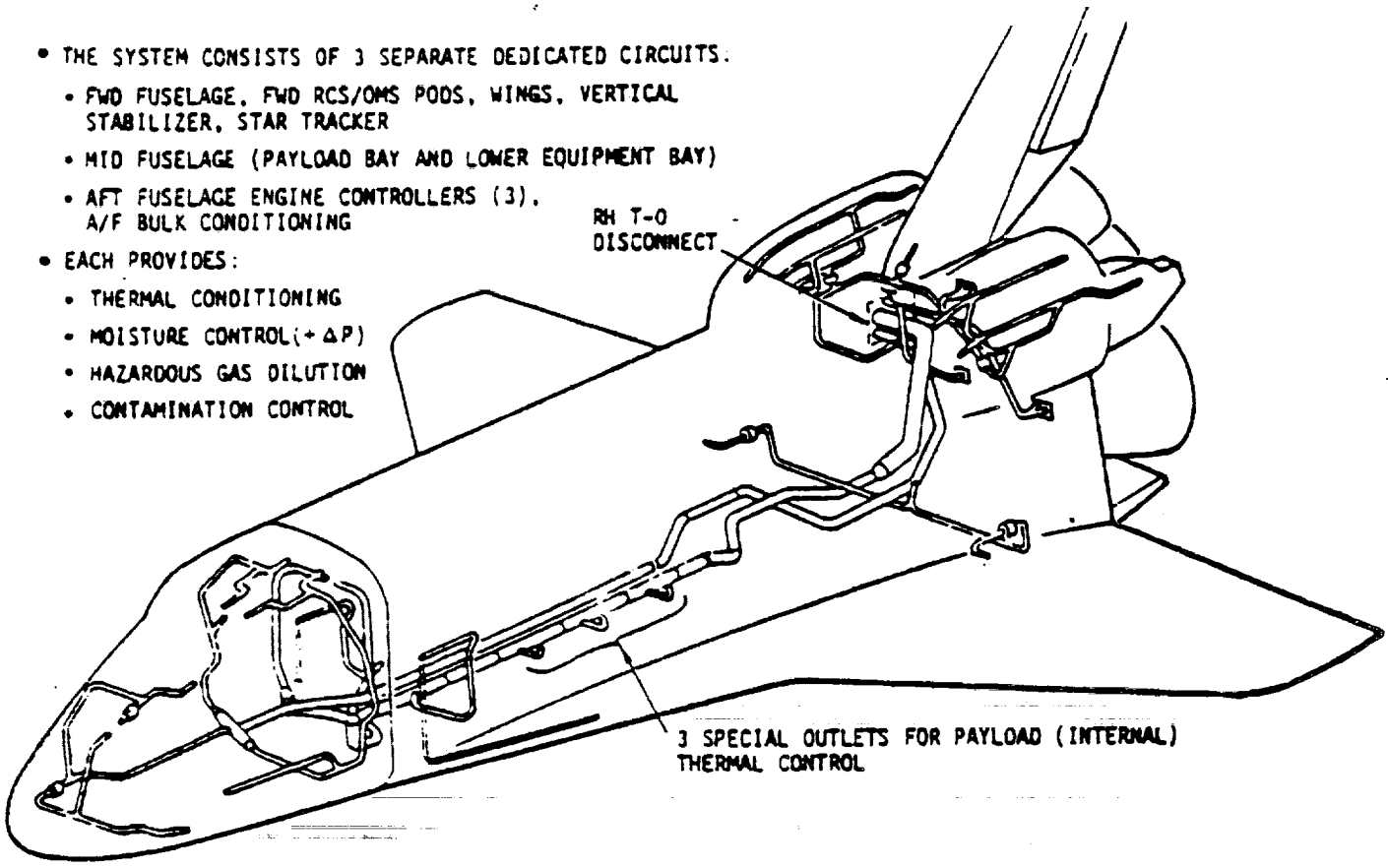


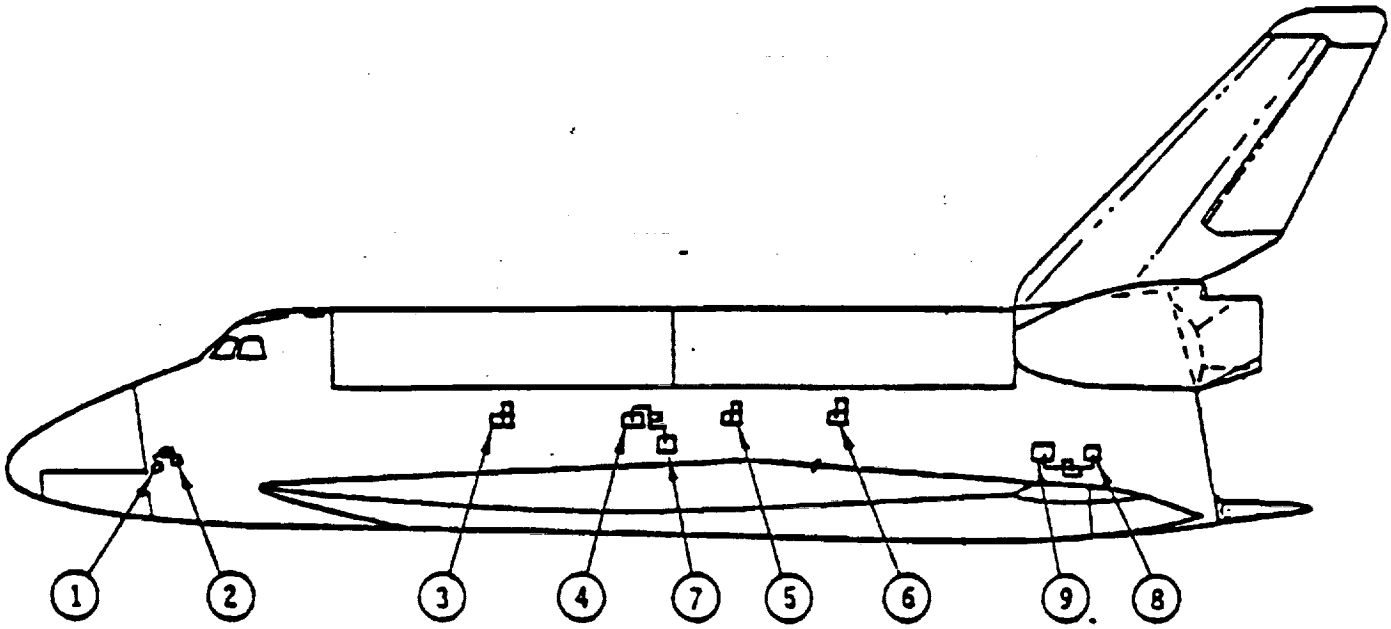
Figure 2 – PV&D SUBSYSTEM OVERVIEW

- THE SYSTEM CONSISTS OF 3 SEPARATE DEDICATED CIRCUITS.
  - FWD FUSELAGE, FWD RCS/OMS PODS, WINGS, VERTICAL STABILIZER, STAR TRACKER
  - MID FUSELAGE (PAYLOAD BAY AND LOWER EQUIPMENT BAY)
  - AFT FUSELAGE ENGINE CONTROLLERS (3), A/F BULK CONDITIONING
- EACH PROVIDES:
  - THERMAL CONDITIONING
  - MOISTURE CONTROL(+ ΔP)
  - HAZARDOUS GAS DILUTION
  - CONTAMINATION CONTROL



- ALL PURGED COMPARTMENTS USE STRUCTURAL VENT PORTS AS OUTLETS

Figure 3 – PURGE SYSTEM

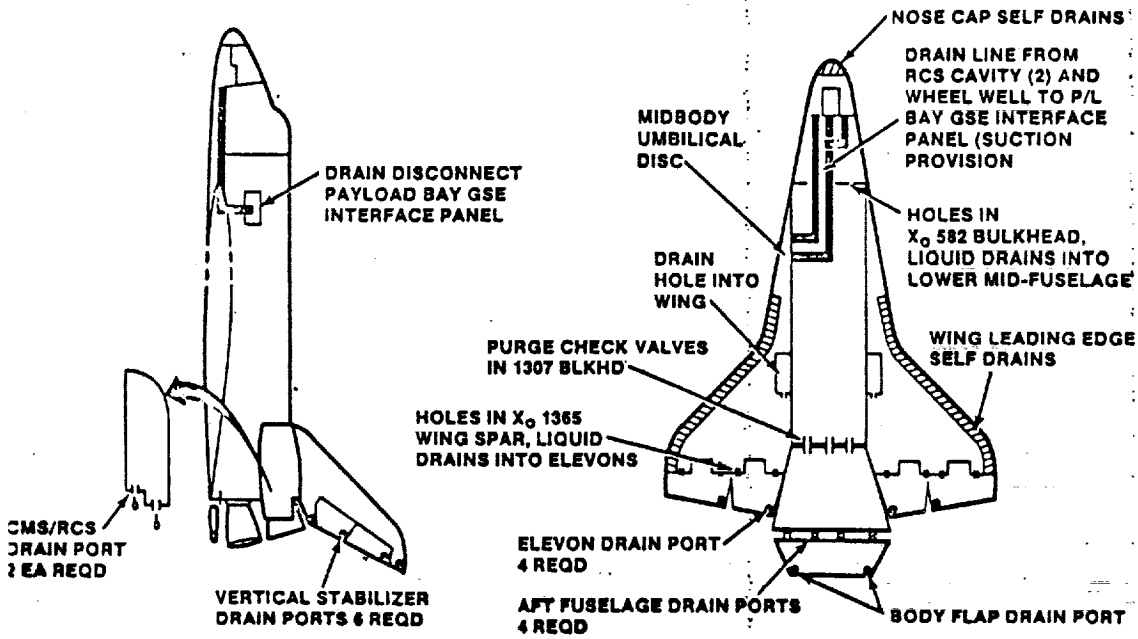


VENT NO.*	COMPT VENTED	VENT DOOR SUBSYSTEM
1	FWD RCS	FORWARD
2	FWD FUS	
7	WING	PAYLOAD BAY AND WING
4	MID FUS	
5	MID FUS	PAYLOAD BAY
3	MID FUS	
6	MID FUS	
8	OMS POD	AFT
9	AFT FUS	

*LH AND RH

Figure 4 – VENT SYSTEM

VERTICAL DRAIN SYSTEM



HORIZONTAL DRAIN SYSTEM

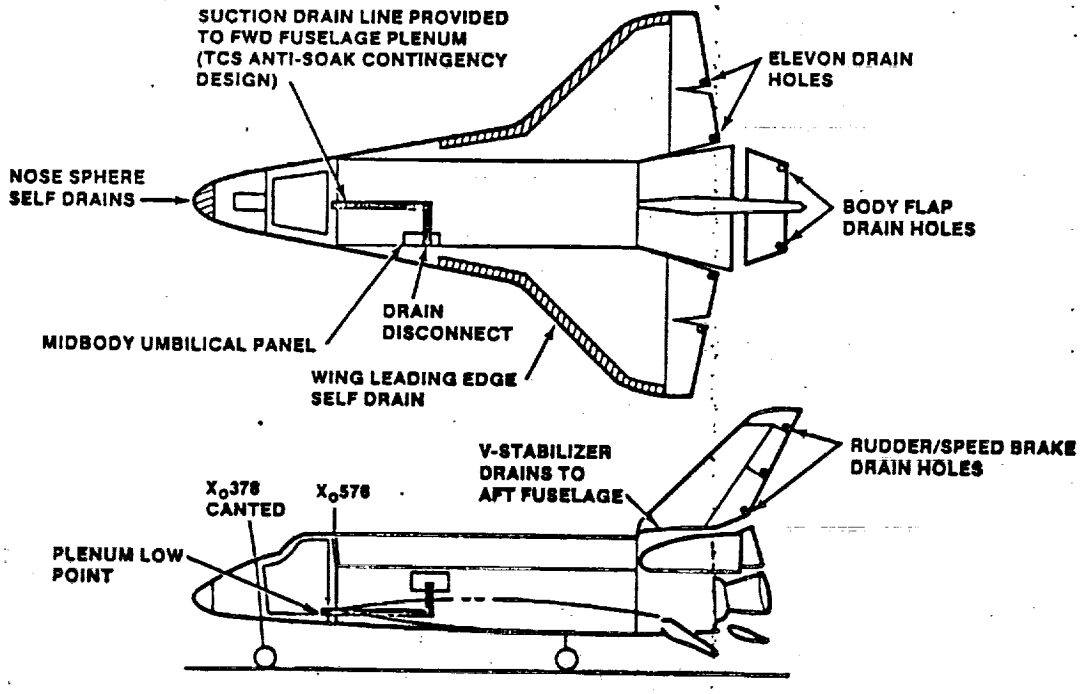


Figure 5 – DRAIN SYSTEM

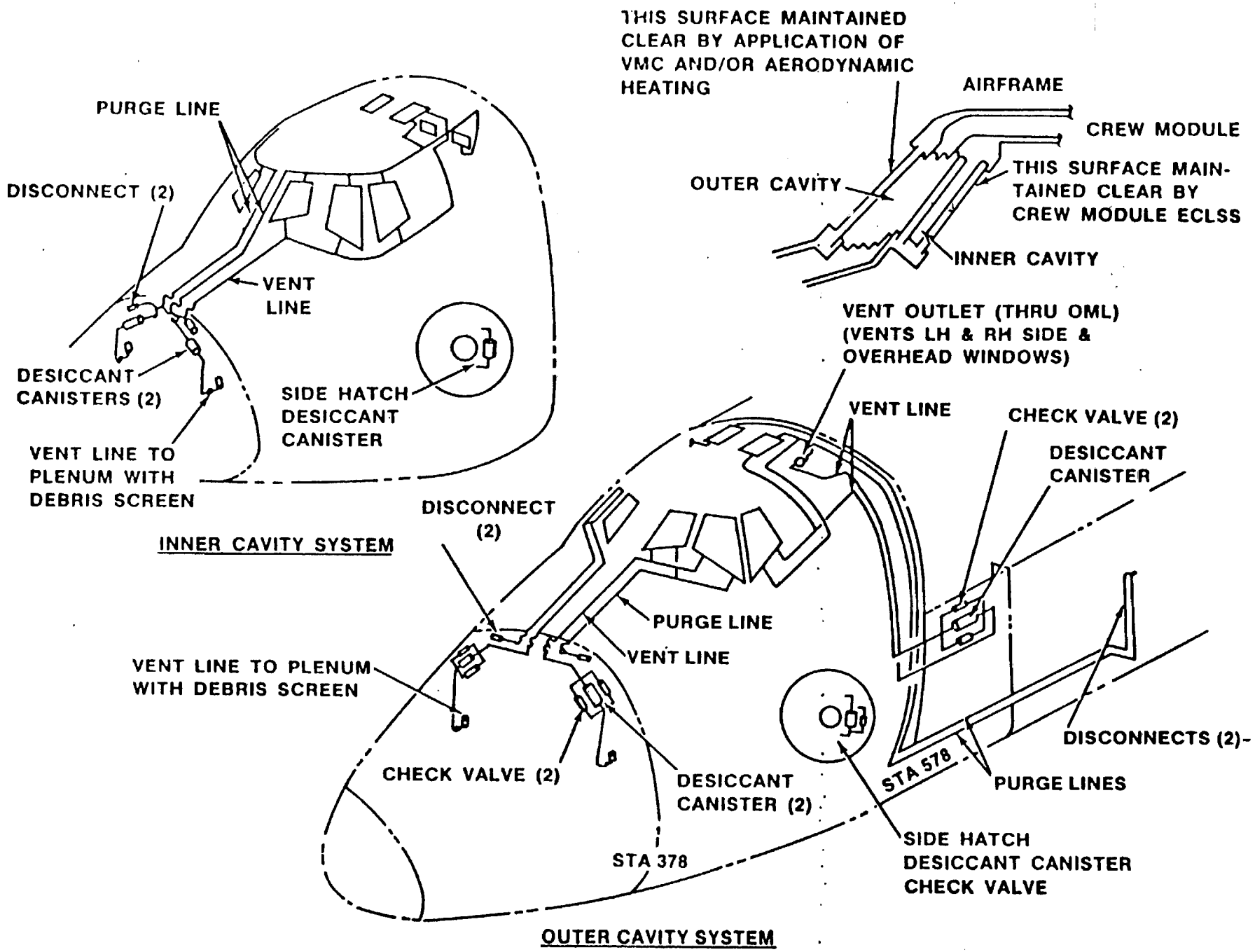


Figure 6 – WINDOW CAVITY CONDITIONS SYSTEM

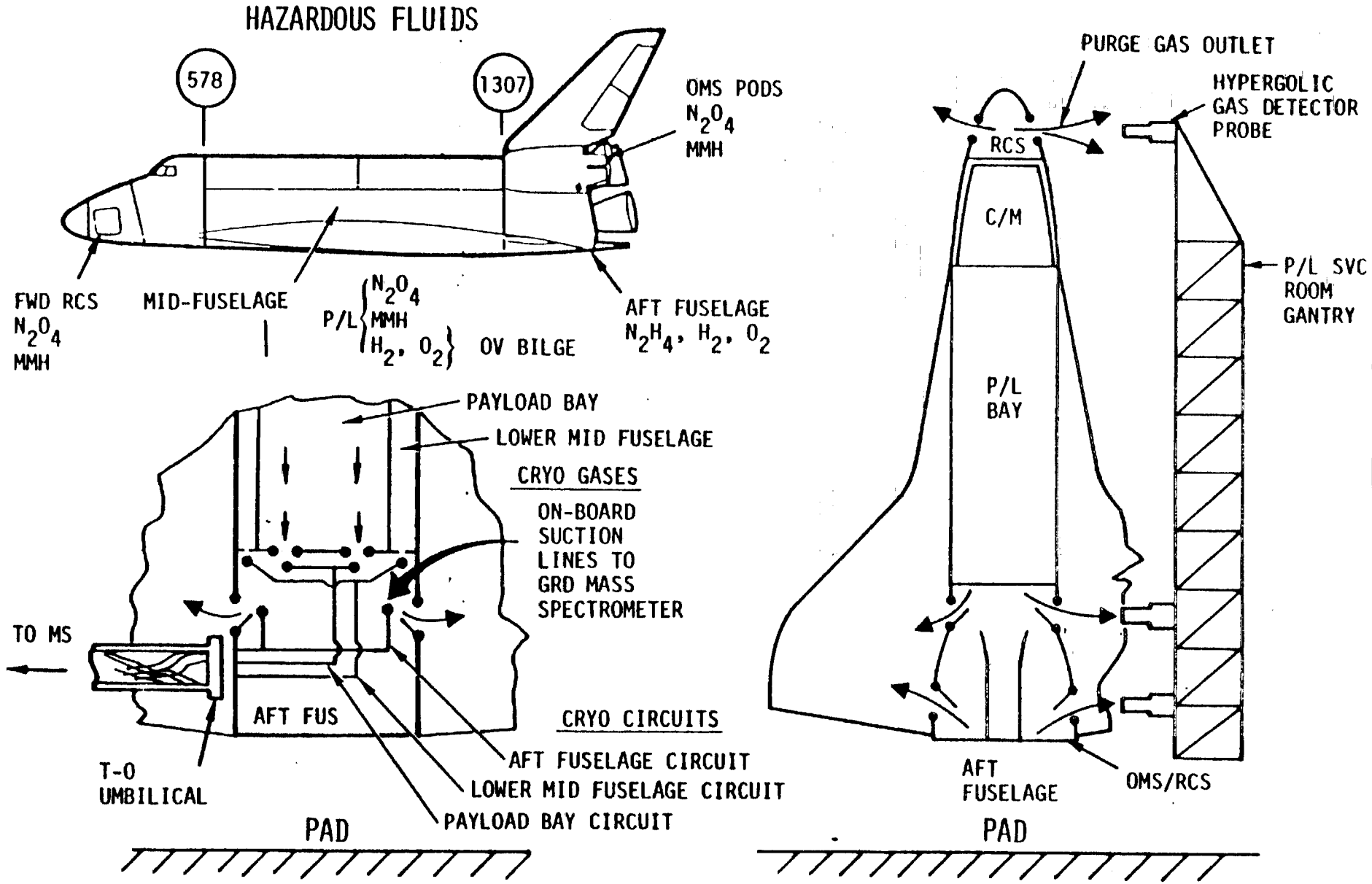
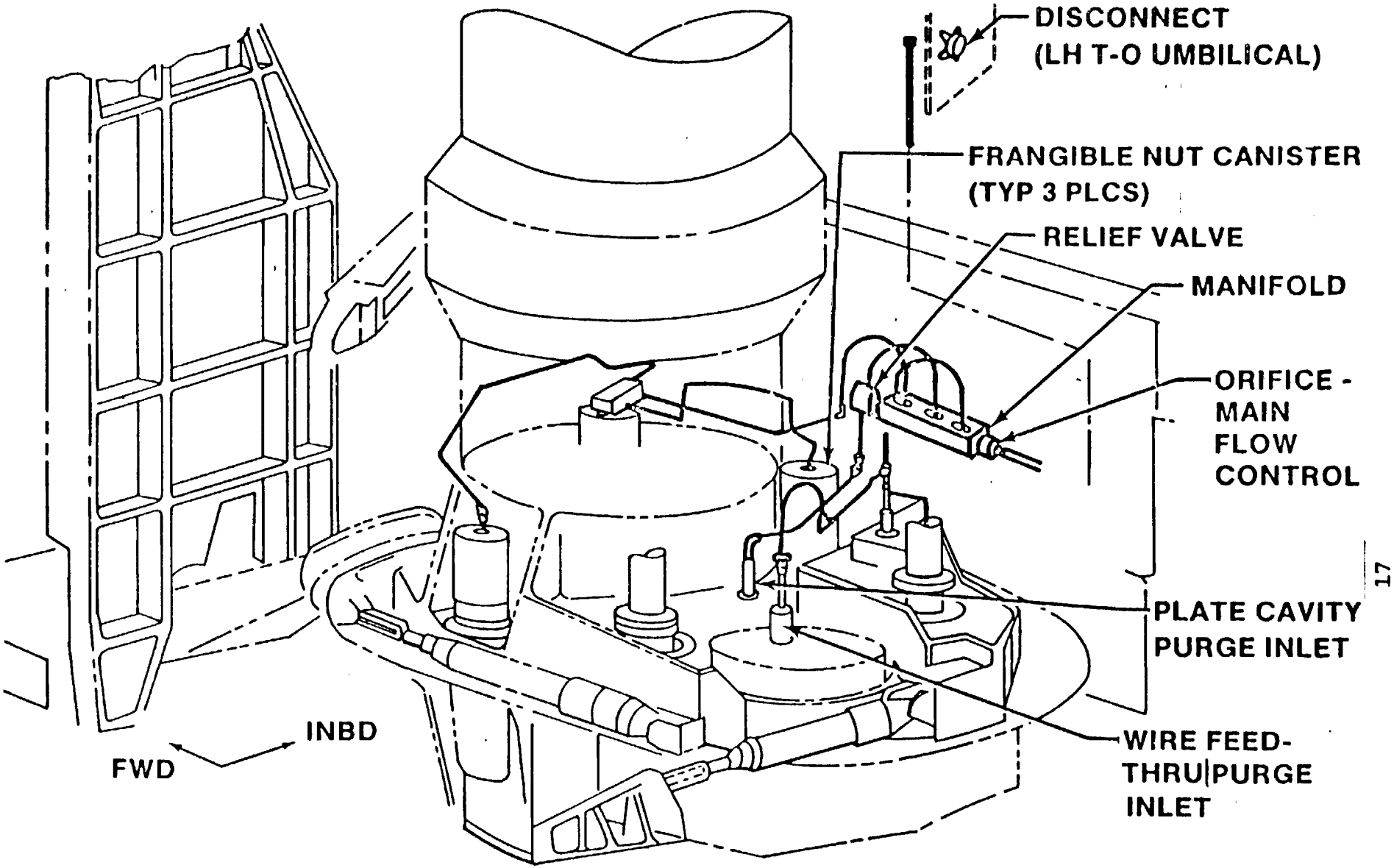


Figure 7 – HAZARDOUS GAS DETECTION SYSTEM



ET/ORBITER DISCONNECT PURGE SYSTEM

LH_2 SIDE (SHOWN) • LOX SIDE (OPP)

Figure 8 — ET/ORB DISCONNECT PURGE SYSTEM

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 six (6) systems of of the PV&D subsystem. Further discussion of each of these systems and the applicable failure modes is provided in subsequent paragraphs of this section.

TABLE I Summary of IOA Failure Modes and Criticalities

Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
Purge System	-	-	-	-	-	14	14
HGDS	-	-	-	-	-	4	4
Drain System	-	-	-	-	-	5	5
WCCS	2	4	2	-	-	12	20
Vent System	-	6	-	-	-	8	14
ET/ORB Discn.	2	-	-	-	-	3	5
TOTAL	4	10	2	0	0	46	62

Four (4) of the sixty-two (62) failure modes analyzed were determined to be single failures which could result in loss of crew or vehicle. A possible loss of mission could result if any of twelve (12) single failures occurred. 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 IOA Potential Critical Items

Criticality:	1/1	2/1R	2/2	3/1R	3/2R	TOTAL
Purge System	-	-	-	-	-	-
HGDS	-	-	-	-	-	-
Drain System	-	-	-	-	-	-
WCCS	2	4	2	-	-	8
Vent System	-	6	-	-	-	6
ET/ORB Discn.	2	-	-	-	-	2
Total	4	10	2	0	0	16

4.1 Analysis Results – Purge System

There are fourteen (14) failure modes identified for the Purge System all of which are identified as criticality 3/3.

4.2 Analysis Results – Hazardous Gas Detection System (HGDS)

There are four (4) failure modes identified for the HGDS all of which are determined to be criticality 3/3.

4.3 Analysis Results – Drain System

There are five (5) failure modes identified for the Drain System all of which are determined to be criticality 3/3.

4.4 Analysis Results – Window Cavity Conditioning System (WCCS)

There are twenty (20) failure modes identified for the WCCS. Of these, two (2) are criticality 1/1, four (4) are criticality 2/1R, two (2) are criticality 2/2, and twelve (12) are criticality 3/3. Eight (8) failures are identified as PCIs. These PCIs are listed in Appendix D.

4.5 Analysis Results – Vent System

There are fourteen (14) failure modes identified for the Vent System. Of these, six (6) are criticality 2/1R, and eight (8) are criticality 3/3. Six (6) failures are identified as PCIs. These PCIs are listed in Appendix D.

4.6 Analysis Results – ET/Orbiter Disconnect Purge System

There are five (5) failure modes identified for the ET/Orbiter Disconnect Purge System. Of these, two (2) are criticality 1/1, and three (3) are criticality 3/3. Two (2) failures are identified as PCIs. These PCIs 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. NSTS 22206, Instructions for Preparation of FMEA and CIL, 21 August 1987.

2. SD72-SH-0101-5, Requirements Definition Document Purge, Vent and Drain Subsystem, 9 September 1977.

3. JSC-12770-10, Shuttle Flight Operations Manual Active Vent Doors, 28 February 1982.

4. V070-384031, Vent System Installation - Mid Fuselage, Rev. C, 12 December 1985.

5. V070-385031, Vent System Installation - Aft Fuselage, Rev. D, 12 June 1985.

6. V070-381031, RCS/FWD Fuselage Vent Doors, Rev. E, 6 May 1985.

7. V070-384052, Tube Instl - Drain System, Mid Fuselage, Rev. B, 2 December 1983.

8. V070-385052, Drain System Installation Aft Fuselage, 3 March 1976.

9. V070-382051, Tube Instl-Drain System Fwd Fuselage, 6 February 1975.

10. V070-385020, Purge System Installation ET/ORB Disconnect, L02, Rev. C, 13 December 1985.

11. V070-385030, Tube Instl-T.O Umbilical Panel to Fwd Keel Beam, ET/ORB Disconnect Purge System Rev. D, 12 December 1986.

12. V070-385070, Purge System Installation ET/ORB Disconnect, LH2, Rev. D, 11 February 1982.

13. V070-382011, Duct Installation Purge Circuit No. 1 Fwd Fuselage, Rev. E, 15 September 1986.

14. V070-385011, Purge System Installation, Rev. D, 23 July 1986.

15. VL70-003324, Schematic Window Cavity Conditioning System, 16 January 1974.

16. V070-381071, Window Conditioning Outboard System, Rev. D, 18 March 1982.

17. MC276-0021, Procurement Specification Quick Disconnect, Rev. H, 27 February 1981.

18. V070-595501, Mechanical Installation, Vent Door Mechanism, Aft Fuselage and OMS, Rev. C, 23 March 1983.

19. V070-592501, Mechanical Assembly, Fwd Vent Doors Mechanism, Rev. D, 9 November 1984.

20. V070-594501, Mechanical Installation Vent Door Mechanism P/L Bay and Wing (407), 13 March 1984.

21. MC147-0009, Procurement Specification Forward Vent Doors Actuator, Rev. B, 31 July 1981.

APPENDIX A
ACRONYMS

AOA	- Abort-Once-Around
ATO	- Abort-To-Orbit
CIL	- Critical Items List
CRIT	- Criticality
CWS	- Caution and Warning System
ECLSS	- Environmental Control and Life Support System (Subsystem)
EPDC	- Electrical Power, Distribution and Control
EPG	- Electrical Power Generator
ET	- External Tank
FC	- Fuel Cell
FCP	- Fuel Cell Power (Plant)
FMEA	- Failure Modes and Effects Analysis
FSSR	- Flight Systems Software Requirements
GAS	- Get-Away Special
GPC	- General Purpose Computer
GSE	- Ground Support Equipment
HDC	- Hybrid Driver Controller
IOA	- Independent Orbiter Assessment
MDAC	- McDonnell Douglas Astronautics Company
MDM	- Multiplexer/Demultiplexer
NA	- Not Applicable
NASA	- National Aeronautics and Space Administration
NSTS	- National Space Transportation System
OF	- Operational Forward
OMRSD	- Operational Maintenance Requirements & Specifications Document
OMS	- Orbital Maneuvering System
PCA	- Power Control Assembly
PCI	- Potential Critical Item
PLS	- Primary Landing Site
PRCB	- Program Requirements Control Board
PRSDS	- Power Reactant Storage and Distribution System
PSA	- Power Section Assembly
PV&D	- Purge Vent & Drain
RCS	- Reaction Control System
RI	- Rockwell International
RPC	- Remote Power Controller
RTLS	- Return-to-Landing Site
STS	- Space Transportation System
TAL	- Transatlantic Abort Landing
TCS	- Thermal Control System (Subsystem)
VCM	- Volatile Condensable Material
WCCS	- Window Cavity Conditioning System
WRS	- Water Removal Subsystem

APPENDIX B

DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.1 Definitions
B.2 Project Level Ground Rules and Assumptions

APPENDIX B
DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.1 Definitions

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

INTACT ABORT DEFINITIONS:

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

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

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

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

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

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

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

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

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

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

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

MISSION - assigned performance of a specific Orbiter flight with payload/objective accomplishments including orbit phasing and altitude (excludes secondary payloads such as GAS cans, middeck P/L, etc.)

MULTIPLE ORDER FAILURE - describes the failure due to a single cause or event of all units which perform a necessary (critical) function

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

OPS - software operational sequence

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

PHASE DEFINITIONS:

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

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

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

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

LANDING/SAFING PHASE - begins at first main gear touchdown and ends with the completion of post-landing safing operations

APPENDIX B
DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.2 IOA Project Level Ground Rules and Assumptions

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

1. The operational flight software is an accurate implementation of the Flight System Software Requirements (FSSRs).

   RATIONALE: Software verification is out-of-scope of this task.

2. After liftoff, any parameter which is monitored by system management (SM) or which drives any part of the Caution and Warning System (C&W) will support passage of Redundancy Screen B for its corresponding hardware item.

   RATIONALE: Analysis of on-board parameter availability and/or the actual monitoring by the crew is beyond the scope of this task.

3. Any data employed with flight software is assumed to be functional for the specific vehicle and specific mission being flown.

   RATIONALE: Mission data verification is out-of-scope of this task.

4. All hardware (including firmware) is manufactured and assembled to the design specifications/drawings.

   RATIONALE: Acceptance and verification testing is designed to detect and identify problems before the item is approved for use.

5. All Flight Data File crew procedures will be assumed performed as written, and will not include human error in their performance.

   RATIONALE: Failures caused by human operational error are out-of-scope of this task.

6. All hardware analyses will, as a minimum, be performed at the level of analysis existent within NASA/Prime Contractor Orbiter FMEA/CILs, and will be permitted to go to greater hardware detail levels but not lesser.

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

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

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

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

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

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

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

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

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

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

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

APPENDIX C
DETAILED ANALYSIS

This section contains the IOA analysis worksheets employed during the analysis of the DPS subsystem. The information on these worksheets is intentionally similar to the FMEA's written by Rockwell and the NASA. Each of these sheets identifies the item being analyzed, and parent assembly, as well as the function. For each failure mode, the possible causes are outlined, and the assessed hardware and functional criticality for each mission phase is listed, as described in the Rockwell Desk Instructions 100-2G. 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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/20/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9001 ABORT: /NA

ITEM: UMBILICAL DISCONNECT
FAILURE MODE: FAIL TO CONNECT

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) PURGE SYSTEM
3) UMBILICAL DISCONNECTS (3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: T-O UMBILICAL
PART NUMBER: MC276-0029

CAUSES: CONTAMINATION, PIECE-PART FAILURE, WEARING, CHAFING

EFFECTS/RATIONALE:
LOSS OF THE ABILITY TO PROVIDE PURGE GAS FROM GSE THROUGH THE UMBILICAL TO ORBITER STRUCTURAL COMPARTMENTS. LOSS OF CAPABILITY TO ANY OF THREE SEPARATE COMPARTMENTS (3 SEPARATE DISCONNECTS) TO PROVIDE HGD, THERMAL, AND MOISTURE CONTROL DURING PRELAUNCH AND POST-LANDING ACTIVITY. POTENTIAL EFFECT ON PAYLOAD/ORBITER ELECTRONIC EQUIPMENT DUE TO LOSS OF THERMAL CONDITIONING AND HGD REMOVAL.

REFERENCES: VC70-000006, SD72-SH-0101-5, V070-385011

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/20/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9002 ABORT: /NA

ITEM: UMBILICAL DISCONNECT
FAILURE MODE: FAILS TO DISCONNECT

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) PURGE SYSTEM
3) UMBILICAL DISCONNECTS (3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: T-O UMBILICAL
PART NUMBER: MC276-0029

CAUSES: CONTAMINATION, CORROSION

EFFECTS/RATIONALE:
UMBILICALS UTILIZED DURING GROUND OPERATION PRE-LIFT OFF AND POST-LANDING TO PROVIDE PURGE GAS FOR 3 SEPARATE PURGE CRICUITS. UMBILICAL DISCONNECTED AT T-O RETRACTION. DISCONNECTS HELD TOGETHER BY MOUNTING PLATES, NO MECHANICAL CONNECTIONS. FAILURE TO DISCONNECT IS NOT A CREDIBLE FAILURE.

REFERENCES: VC70-000006, SD72-SH-0101-5, V070-385011

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/20/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9003 ABORT: /NA

ITEM: UMBILICAL DISCONNECT
FAILURE MODE: INTERNAL/EXTERNAL LEAKAGE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) PURGE SYSTEM
3) UMBILICAL DISCONNECTS (3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: T-O UMBILICAL
PART NUMBER: MC276-0029

CAUSES: CONTAMINATION, PIECE-PART FAILURE

EFFECTS/RATIONALE:
UMBILICAL LEAKAGE WILL PROVIDE PARTIAL FLOW OF N2 AND/OR AIR TO THE ORBITER STRUCTURAL COMPARMENTS CAUSING DEGRADED PURGE CAPABILITY. ITEM USED ONLY DURING GROUND OPERATIONS FOR HAZARDOUS GAS DILUTION, THERMAL CONTROL AND MOISTURE CONTROL.

REFERENCES: VC70-000006, V070-385011

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/29/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9004 ABORT: /NA

ITEM: VALVE, UMBILICAL DISCONNECT
FAILURE MODE: FAILS TO REMAIN OPEN

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) PURGE SYSTEM
3) UMBILICAL DISCONNECTS
4) VALVE (3)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: T-O UMBILICAL
PART NUMBER: MC276-0029

CAUSES: PIECE-PART FAILURE

EFFECTS/RATIONALE:
VALVE FAILURE WILL PREVENT THE INDUCTION OF PURGE GAS INTO ORBITER STRUCTURAL COMPARTMENTS. THE ABSENCE OF PURGE GAS PRE/POST-FLIGHT WILL PREVENT THE ABILITY TO PROVIDE ORBITER AVIONICS AND PAYLOADS WITH THERMAL CONDITIONING, MOISTURE CONTROL, HAZARDOUS GAS DILUTION IN THE AFFECTED ORBITER COMPARTMENTS.

REFERENCES: VC70-000006, V070-385011

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/01/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9005 ABORT: 3/3

ITEM: VALVE, UMBILICAL DISCONNECT
FAILURE MODE: FAILS TO REMAIN CLOSED

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) PURGE SYSTEM
3) UMBILICAL DISCONNECTS
4) VALVE (3)
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:	/	AOA:	3/3
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING:	3/3		

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

LOCATION: T-0 UMBILICAL
PART NUMBER: MC276-0029

CAUSES: CONTAMINATION, SPRING FAILURE

EFFECTS/RATIONALE:
FAILURE OF THE ORBITER INTERFACE AT THE UMBILICAL DISCONNECT WILL ALLOW PRESSURE DIFFERENTIAL, DURING ASCENT, AND HOT GAS INGESTION DURING ENTRY, POSSIBLE DAMAGE OF THE PURGE DUCTING. THE DESIGN OF THE DISCONNECT IS FAILED CLOSED.

REFERENCES: VC70-000006, V070-385011

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/01/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9006 ABORT: /NA

ITEM: CHECK VALVE
FAILURE MODE: FAILS TO REMAIN OPEN, FAILS TO OPEN

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) PURGE SYSTEM
3) CHECK VALVE (7)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: ME284-0484

CAUSES: CONTAMINATION, WEARING

EFFECTS/RATIONALE:
CHECK VALVE FAILURE PRODUCES PARTIAL LOSS OF PURGE GAS FLOW AND HGD DILUTION. IN ADDITION, ORBITER NON-PRESSURIZED COMPARTMENT ISOLATION SHALL BE VIOLATED AND ALLOWANCE OF REVERSE FLOW OF HGD IS ALSO PROBABLE. THE CHECK VALVE IS INTERNALLY REDUNDANT, DUAL FAILURE IS REQUIRED FOR TOTAL VALVE FAILURE.

REFERENCES: ME284-0484

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/01/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9007 ABORT: /NA

ITEM: CHECK VALVE
FAILURE MODE: FAILS TO REMAIN CLOSED, FAILS TO CLOSE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) PURGE SYSTEM
3) CHECK VALVE (7)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: ME284-0484

CAUSES: CONTAMINATION, PIECE-PART FAILURE

EFFECTS/RATIONALE:
VALVE FAILURE TO CLOSE PRODUCES THE LOSS OF ORBITER NON-PRESURIZED STRUCTURAL COMPARTMENT ISOLATION ALLOWING HDG FLOW BETWEEN COMPARTMENTS, PRESSSURE DIFFERENTIAL AND THERMAL CONDITIONING LOSS DURING VENT OPERATIONS.

REFERENCES: ME284-0484

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/01/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9008 ABORT: /NA

ITEM: CHECK VALVE
FAILURE MODE: INTERNAL LEAKAGE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) PURGE SYSTEM
3) CHECK VALVE (7)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: ME284-0484

CAUSES: CONTAMINATION, PIECE-PART FAILURE

EFFECTS/RATIONALE:
VALVE LEAKAGE WILL DEGRADE THE INTEGRITY OF ISOLATING ORBITER NON PRESSURIZED STRUCTURAL COMPARTMENTS, ALLOWING MINOR HGD FLOW BETWEEN COMPARTMENTS.

REFERENCES: ME284-0484

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/01/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9009 ABORT: /NA

ITEM: CHECK VALVE
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) PURGE SYSTEM
3) CHECK VALVE (7)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: ME284-0484

CAUSES: CONTAMINATION, PIECE-PART FAILURE

EFFECTS/RATIONALE:
VALVE DESIGN DUCTS LEAKAGE TO THE DOWNSTREAM SIDE OF VALVE. FLOW RATE AND COMPARTMENT ISOLATION RETAINED.

REFERENCES: ME284-0484

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/01/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9010 ABORT: /NA

ITEM: CHECK VALVE
FAILURE MODE: FAILS TO REMAIN OPEN, FAILS TO OPEN

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) PURGE SYSTEM
3) CHECK VALVE (14)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: 1307 BLKHD
PART NUMBER: ME284-0484

CAUSES: CONTAMINATION, CORRISION

EFFECTS/RATIONALE:
CHECK VALVE PROVIDE PURGE AND VENT OF THE PAYLOAD BAY THROUGH THE 1307 BLKHD AND 6 OF THE 14 VALVES PROVIDE HGD MONITORING. FAILURE OF VALVE TO OPEN/REMAIN OPEN WILL NOT PREVENT PURGE, VENT OR HGD. REDUNDANT VALVES WILL CONTINUE SATISFACTORY OPERATIONS/FUNCTIONS.

REFERENCES: V070-385011

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/01/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9011 ABORT: 3/3

ITEM: CHECK VALVE
FAILURE MODE: FAILS TO REMAIN CLOSED, FAILS TO CLOSE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) PURGE SYSTEM
3) CHECK VALVE (14)
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:	/	AOA:	3/3
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING:	3/3		

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

LOCATION: 1307 BLKHD
PART NUMBER: ME284-0484

CAUSES: CONTAMINATION, PIECE-PART FAILURE

EFFECTS/RATIONALE:
CHECK VALVE FAILURE WILL VIOLATE THE INTEGRITY OF PAYLOAD BAY AND AFT COMPARTMENT STRUCTURAL ISOLATION. THE EFFECTS ARE HGD FLOW FROM EACH COMPARTMENT TO THE OTHER AND PRESSURE DIFFERENTIALS DUE TO VENTING DURING ASCENT/DECENT.

REFERENCES: V070-385011

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/01/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9012 ABORT: 3/3

ITEM: CHECK VALVE
FAILURE MODE: INTERNAL/EXTERNAL LEAKAGE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) PURGE SYSTEM
3) CHECK VALVES (14)
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:	/	AOA:	3/3
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING:	3/3		

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

LOCATION: 1307 BLKHD
PART NUMBER: ME284-0484

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
CHECK VALVE LEAKAGE WILL VIOALTE ORBITER STRUCTURAL COMPARTMENT ISOLATION ALLOWING MINIMAL HGD FLOW BETWEEN COMPARTMENTS AND DELTA PRESSURE IN STRUCTURAL COMPARTMENTS.

REFERENCES: V070-385011

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/01/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9013 ABORT: /NA

ITEM: DUCTING/FLEXIBLE BELLOWS/STRAPS
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) PURGE SYSTEM
3) DUCTING
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: V070-384011, ME277-0015, ME277-0009, NAS1922

CAUSES: CONTAMINATION, TEMPERATURE, VIBRATION

EFFECTS/RATIONALE:
LEAKAGE IN THE PURGE DUCTING NETWORK WILL DEGRADE PURGE GAS SUPPLY TO THE ORBITER STRUCTURAL COMPARTMENTS. LEAKAGE MAY OCCUR AT DUCT JOINTS SECURED BY STEEL STRAPS AND FLEXIBLE BELLOWS INTERFACES. LEAKAGE WILL HAMPER HGD DILUTION, THERMAL CONTROL, AND MOISTURE CONTROL IN ORBITER STRUCTURAL COMPARTMENTS.

REFERENCES: ME277-009, V070-382011, V070-384050

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/01/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9014 ABORT: 3/3

ITEM: DUCTING
FAILURE MODE: RESTRICTED FLOW, CLOG

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) PURGE SYSTEM
3) DUCTING
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: V070-384011, ME277-0015, ME277-0009

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
PURGE DUCTING CLOGS WILL DEGRADE PURGE MEDIA FLOW IN ORBITER STURCTURAL COMPARTMENTS. PURGE FLUID FILTRATION IS PROVIDED PRE-INTRODUCTION TO ORBITER. PURGE DUCTING CLOG IS NOT A VIABLE FAILURE MODE.

REFERENCES: V070-382011, V070-384050

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/04/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9015 ABORT: /NA

ITEM: UMBILICAL DISCONNECT
FAILURE MODE: FAILS TO CONNECT

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) HGDS
3) UMBILICAL DISCONNECT (3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: T-O DISCONNECT PANEL
PART NUMBER: MC276-0021

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
FAILURE TO CONNECT WILL PREVENT THE DETECTION OF HGD IN THE PAYLOAD BAY AND AFT/FWD FUSELAGE DURING PRELAUNCH AND POST LANDING OPERATIONS. THIS FAILURE CAN BE CORRECTED DURING GROUND OPERATIONS.

REFERENCES: MC276-0021, V070-385071

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/04/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9016 ABORT: /NA

ITEM: UMBILICAL DISCONNECT
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) HGDS
3) UMBILICAL DISCONNECT (3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: T-0 UMBILICAL PANEL
PART NUMBER: MC276-0021

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
LEAKAGE WILL DEGRADE THE CAPABILITY OF THE HGDS GSE DETECTION HARDWARE TO MONITOR HGDS SAMPLES ACCURATELY DUE TO THE DILUTION OF SAMPLES BY THE SURROUNDING ATMOSPHERE.

REFERENCES: MC276-0021, V070-385071

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/11/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9017 ABORT: /NA

ITEM: PIPING
FAILURE MODE: RESTRICTED FLOW, CLOGS

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) HGDS
3) PIPING (3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT FUSELAGE, PLD BAY, FWD RCS FUSELAGE
PART NUMBER: V070-385070

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
CLOGS IN THE HGDS .25 INCH TUBING WILL DEGRADE/PREVENT THE CAPABILITY TO MONITOR/ANALYZE HAZARDOUS GAS IN THE AFT/FWD FUSELAGE, PAYLOAD BAY, AND/OR MID FUSELAGE, DEPENDING ON WHICH OF THE 3 LINES IN CLOGGED.

REFERENCES: V070-385070

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/11/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9018 ABORT: /NA

ITEM: PIPING
FAILURE MODE: INTERNAL/EXTERNAL LEAKAGE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) HGDS
3) PIPING (3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT FUSELAGE
PART NUMBER: V070-3855070

CAUSES: VIBRATION, PIECE-PART FAILURE/BREAK

EFFECTS/RATIONALE:
THE HGDS SAMPLE LINES ARE 1/4 INCH, .016 THICK STAINLESS STEEL TUBING. THE COUPLINGS ARE INDICTION-BRAZED SLEEVE JOINTS, THEREFORE LEAKAGE IS NOT A VIABLE FAILURE.

REFERENCES: V070-3855070

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/11/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9019 ABORT: /NA

ITEM: QUICK DISCONNECT
FAILURE MODE: FAIL TO CONNECT

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) DRAIN SUBSYSTEM
3) QUICK DISCONNECT (3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: MC261-0038

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
COMPONENT FAILURE TO CONNECT WILL ALLOW MOISTURE TO REMAIN IN ORBITER STRUCTURAL COMPARTMENTS. THE GSE ASPIRATOR USED DURING GROUND OPERATION COULD NOT BE ATTACHED TO VEHICLE TO DRAIN ORBITER STRUCTURAL COMPARTMENTS.

REFERENCES: V070-382051

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/11/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9020 ABORT: /NA

ITEM: QUICK DISCONNECT
FAILURE MODE: FAIL TO DISCONNECT

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) DRAIN SUBSYSTEM
3) QUICK DISCONNECT (3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: MC621-0038

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
FAILURE TO DISCONNECT WILL NOT ALLOW SEPERATION OF GSE ASPIRATOR FROM THE ORBITER DRAIN SUBSYSTEM IN ORDER FOR FLIGHT PREPARATION. THE DISCONNECT IS USED ONLY FOR GROUND OPERATIONS AND CAN BE MANUALLY REMOVED PRIOR TO LAUNCH/COUNTDOWN.

REFERENCES: V070-382051

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/11/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9021 ABORT: /NA

ITEM: QUICK DISCONNECT
FAILURE MODE: INTERNAL/EXTERNAL LEAKAGE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) DRAIN SUBSYSTEM
3) QUICK DISCONNECT (3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: MC621-0038

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
EXTERNAL LEAKAGE WILL IMPACT THE AMOUNT OF TIME REQUIRED TO DRAIN ORBITER STRUCTRAL COMPARTMENT. DRAINAGE ONLY REQUIRED DURING GROUND OPERATION, THEREFORE NO IMPACT TO MISSION/FLIGHT.

REFERENCES: V070-382051

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/12/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9022 ABORT: /NA

ITEM: TUBING
FAILURE MODE: RESTRICTED FLOW, CLOGS

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) DRAIN SUBSYSTEM
3) TUBING (3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: V070-382051

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
CLOGGED DRAIN TUBING WILL SLOW/PREVENT DRAINAGE OF ORBITER STRUCTURAL COMPARTMENTS. LOSS OF DRAINAGE CAPABILITY OCCURS DURING GROUND OPERATIONS, WHICH WOULD ALLOW FOR CORRECTION PRIOR TO LAUNCH/COUNTDOWN.

REFERENCES: VC70-000008

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/12/87
SUBSYSTEM: PV&D
MDAC ID: 9023

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

ITEM: TUBING
FAILURE MODE: INTERNAL/EXTERNAL LEAKAGE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) DRAIN SUBSYSTEM
3) TUBING (3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: V070-382051

CAUSES: LOOSE JOINTS/FITTINGS

EFFECTS/RATIONALE:
LEAKAGE OF DRAINAGE TUBING WOULD OCCUR DURING GROUND OPERATIONS ONLY, WHEN THE GSE SYSTEM WOULD DRAW FLUIDS THRU THE TUBING. TUBING IS 3/8 INCH STAINLESS STEEL WITH DYNATUBE AND BRAZED JOINTS. JOINT LEAKAGE IS NOT A PROBABLE FAILURE.

REFERENCES: VC70-000008

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/17/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9024 ABORT: /NA

ITEM: GN2 PURGE DISCONNECT
FAILURE MODE: FAIL TO CONNECT

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) WCCS
3) GN2 PURGE DISCONNECT (8)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: MC621-0038

CAUSES: CONTAMINATION, WEARING

EFFECTS/RATIONALE:
FAILURE TO CONNECT THE GROUND SUPPLIED PURGE GAS NETWORK TO THE WINDOW CAVITY PURGE SYSTEM CAUSES LOSS OF CONTROL OF ORBITER WINDOW ENVIRONMENT PRODUCING CONDENSATION AND CONTAMINATION LIMITING VISIBILITY. SYSTEM IS ONLY UTILIZED DURING GROUND OPERATION, WHICH ALLOWS FOR FIX OR REPLACEMENT OF DEFECTIVE COMPONENT.

REFERENCES: VC70-38071

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/17/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9025 ABORT: /NA

ITEM: GN2 PURGE DISCONNECT
FAILURE MODE: FAIL TO DISCONNECT

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) WCCS
3) GN2 PURGE DISCONNECT (8)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: MC621-0038

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
FAILURE TO DISCONNECT THE GROUND SUPPLIED PURGE GAS NETWORK FROM THE ORBITER WINDOW CAVITY PURGE SYSTEM WILL PREVENT WINDOW CONFIGURATION FOR FLIGHT. FAILURE CAN BE DETECTED AND CORRECTED DURING PRE-LAUNCH OPS.

REFERENCES: VC70-38071

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/17/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9026 ABORT: /NA

ITEM: GN2 PURGE DISCONNECT
FAILURE MODE: INTERNAL/EXTERNAL LEAKAGE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) WCCS
3) GN2 PURGE DISCONNECT (8)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: MC621-0038

CAUSES: CONTAMINATION, LOOSE FITTINGS

EFFECTS/RATIONALE:
LEAKAGE WILL AFFECT AMOUNT OF PURGE GAS SUPPLIED TO THE WCCS. OPERATION OCCURS DURING GROUND TURNAROUND ACTIVITY, LEAKAGE CAN BE REPAIRED, NO IMPACT TO FLIGHT OPERATIONS.

REFERENCES: VC70-38071

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/17/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 2/1R
MDAC ID: 9027 ABORT: 2/1R

ITEM: ASCENT RELIEF VALVE
FAILURE MODE: FAILS TO REMAIN OPEN, FAILS TO OPEN

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) WCCS
3) ASCENT RELIEF VALVE (5)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: MC284-0437

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
VALUE OPERATION IS ONLY REQUIRED WHEN DESICCANT/FILTER HAS FAILED. VALVE FAILURE WILL ALLOW PRESSURE TO BUILD ACROSS THE OUTER CAVITY WINDOW PANEL WITH POTENTIAL THERMAL PANE RUPTURE.

REFERENCES: VC70-383121

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/17/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9028 ABORT: 3/3

ITEM: ASCENT RELIEF VALVE
FAILURE MODE: FAILS TO REMAIN CLOSED, FAILS TO CLOSE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) WCCS
3) ASCENT RELIEF VALVE (5)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: MC284-0437

CAUSES: CONTAMINATION, PIECE-PART FAILURE

EFFECTS/RATIONALE:
VALVE FAILURE WILL DEGRADE THE OUTER WINDOW CAVITY PRESSURE AND ALLOW CONTAMINANTS AND CONDENSATES TO ENTER WHICH MAY CAUSE WINDOW FOGGING. WINDOWS HAVE SEPARATE SYSTEMS ALLOWING VEHICLE OPERATION FROM RIGHT OR LEFT WINDOWS.

REFERENCES: VC70-383121

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/24/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9029 ABORT: 3/3

ITEM: ASCENT RELIEF VALVE
FAILURE MODE: INTERNAL/EXTERNAL LEAKAGE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) WCCS
3) ASCENT RELIEF 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:	/	AOA:	3/3
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING:	3/3		

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

LOCATION:
PART NUMBER: MC284-0437

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
LEAKAGE WILL DEGRADE WCCS PURGE NETWORK AND ATMOSPHERE IN THE OUTER WINDOW CAVITY WHICH MAY ALLOW WINDOW FOGGING.

REFERENCES: V070-383121

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/25/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9030 ABORT: 3/3

ITEM: DESCENT RELIEF VALVE
FAILURE MODE: FAILS TO REMAIN CLOSED, FAILS TO CLOSE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) WCCS
3) DESCENT RELIEF VALVE
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: MC284-0437

CAUSES: CONTAMINATION, PIECE-PART FAILURE

EFFECTS/RATIONALE:
VALVE FAILURE WILL DEGRADE THE OUTER WINDOW CAVITY PRESSURE AND ALLOW CONTAMINANTS AND CONDENSATES TO ENTER WHICH MAY CAUSE WINDOW FOGGING. WINDOWS HAVE SEPARATE SYSTEMS ALLOWING VEHICLE OPERATION FROM RIGHT OR LEFT WINDOWS.

REFERENCES: VC70-383121

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/25/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 2/1R
MDAC ID: 9031 ABORT: 2/1R

ITEM: DESCENT RELIEF VALVE
FAILURE MODE: FAILS TO REMAIN OPEN, FAILS TO OPEN

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) WCCS
3) DESCENT RELIEF VALVE
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: MC284-0437

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
VALVE OPERATION IS ONLY REQUIRED WHEN DESICCANT/FILTER HAS FAILED. VALVE FAILURE WILL ALLOW PRESSURE TO BUILD ACROSS THE OUTER CAVITY WINDOW PANEL AND MAY CAUSE THERMAL PANE RUPTURE.

REFERENCES: VC70-383121

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/25/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9032 ABORT: 3/3

ITEM: DESCENT RELIEF VALVE
FAILURE MODE: INTERNAL/EXTERNAL LEAKAGE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) WCCS
3) DESCENT RELIEF VALVE
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: MC284-0437

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
LEAKAGE WILL DEGRADE WCCS PURGE NETWORK AND ATMOSPHERE IN THE OUTER WINDOW CAVITY WHICH MAY ALLOW WINDOW FOGGING.

REFERENCES: VC70-383121

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/25/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 2/1R
MDAC ID: 9033 ABORT: 2/1R

ITEM: DESICCANT/FILTER OUTER CAVITY
FAILURE MODE: RESTRICTED FLOW, CLOGS

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) WCCS
3) DESICCANT/FILTER (7)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

REDUNDANCY SCREENS: A [1] B [NA] C [P]

LOCATION: OUTER WINDOW CAVITY
PART NUMBER: V070-381120

CAUSES: CONTAMINATION, TEMPERATURE

EFFECTS/RATIONALE:
FAILURE WILL EFFECT THE PRIMARY CONTAMINATION CONTROL ELEMENT AND VENTING CAPABILITY FOR ASCENT REPRESSURE AND DESCENT DEPRESSURE. BYPASS VALVE BACKUP PROVIDED FOR PRESSURE RELIEF, WINDOW CAVITY FOGGING MAY OCCUR DUE TO LACK OF CONTAMINATION CONTROL/PURGE CAPABILITY. FILTER CHECK/REPLACED BEFORE/AFTER EACH MISSION.

REFERENCES: V070-381140

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/25/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9034 ABORT: 3/3

ITEM: DESICCANT/FILTER OUTER CAVITY
FAILURE MODE: RESTRICTED FLOW, SATURATES

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) WCCS
3) DESICCANT/FILTER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: OUTER WINDOW CAVITY
PART NUMBER: V070-381120

CAUSES: TEMPERATURE, MOISTURE

EFFECTS/RATIONALE:
FAILURE WILL EFFECT THE PRIMARY CONTAMINATION CONTROL ELEMENT AND VENTING CAPABILITY FOR ASCENT REPRESSURE AND DESCENT DEPRESSURE. BYPASS VALVE BACKUP PROVIDED FOR PRESSURE RELIEF, WINDOW CAVITY FOGGING MAY OCCUR DUE TO LACK OF CONTAMINATION CONTROL/PURGE CAPABILITY. FILTER CHECK/REPLACED BEFORE/AFTER EACH MISSION.

REFERENCES: V070-381140

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/25/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 2/1R
MDAC ID: 9035 ABORT: 2/1R

ITEM: DESICCANT/FILTER OUTER CAVITY
FAILURE MODE: INTERNAL/EXTERNAL LEAKAGE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) WCCS
3) DESICCANT/FILTER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

REDUNDANCY SCREENS: A [1] B [NA] C [P]

LOCATION: OUTER WINDOW CAVITY
PART NUMBER: V070-381120

CAUSES: CONTAMINATION, LOOSE FITTINGS

EFFECTS/RATIONALE:
FAILURE WILL EFFECT THE PRIMARY CONTAMINATION CONTROL ELEMENT AND VENTING CAPABILITY FOR ASCENT REPRESSURE AND DESCENT DEPRESSURE. BYPASS VALVE BACKUP PROVIDED FOR PRESSURE RELIEF, WINDOW CAVITY FOGGING MAY OCCUR DUE TO LACK OF CONTAMINATION CONTROL/PURGE CAPABILITY.

REFERENCES: V070-381140

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/01/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 1/1
MDAC ID: 9036 ABORT: 1/1

ITEM: TUBING
FAILURE MODE: RESTRICTED FLOW, CLOGS

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) WCCS
3) TUBING, OUTER CAVITY
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: V070-382164, V070-381071

CAUSES: CONTAMINATION, TEMPERATURE

EFFECTS/RATIONALE:
CLOGS OF TUBING NETWORK WILL RESTRICT THE PURGE GAS FLOW DURING GROUND TURNAROUND AND DEGRADE THE CAPABILITY OF WINDOW CAVITY VENTING REPRESSURIZATION DURING ASCENT AND DEPRESSURIZATION DURING DESCENT. POSSIBLE THERMAL PANE RUPTURE.

REFERENCES: V070-384026

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/01/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 1/1
MDAC ID: 9037 ABORT: 1/1

ITEM: TUBING
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) WCCS
3) TUBING, OUTER CAVITY
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: V070-382164, V070-381071

CAUSES: CONTAMINATION, PIECE-PART FAILURE, LOOSE FITTINGS

EFFECTS/RATIONALE:
LEAKAGE OF TUBING NETWORK WILL DEGRADE THE ABILITY OF WCCS CONTAMINATION AND MOISTURE CONTROL. POSSIBLE LOSS OF CABIN PRESSURE DUE TO WINDOW CAVITY PURGE LINE LEAKAGE. INCREASED DELTA PRESSURE ON OUTER WINDOW CAVITY AND HATCH WINDOW. POSSIBLE THERMAL PANE RUPTURE.

REFERENCES: V070-384026

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/25/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9038 ABORT: 3/3

ITEM: DESICCANT/FILTER
FAILURE MODE: INTERNAL/EXTERNAL LEAKAGE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) WCCS
3) DESICCANT/FILTER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: HATCH WINDOW
PART NUMBER: V070-381120

CAUSES: CONTAMINATION, TEMPERATURE

EFFECTS/RATIONALE:
FAILURE WILL EFFECT THE PRIMARY CONTAMINATION CONTROL ELEMENT AND VENTING CAPABILITY FOR ASCENT REPRESSURE AND DESCENT DEPRESSURE. BYPASS VALVE BACKUP PROVIDED FOR PRESSURE RELIEF, WINDOW CAVITY FOGGING MAY OCCUR DUE TO LACK OF CONTAMINATION CONTROL/PURGE CAPABILITY. FILTER CHECK/REPLACED BEFORE/AFTER EACH MISSION.

REFERENCES: V070-381140

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/01/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9039 ABORT: 3/3

ITEM: DESICCANT/FILTER, INNER WINDOW
FAILURE MODE: RESTRICTED FLOW, SATURATED

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) WCCS
3) DESICCANT/FILTER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: INNER WINDOW CAVITY
PART NUMBER: V070-381120

CAUSES: CONTAMINATION, EXCESS MOISTURE

EFFECTS/RATIONALE:
FAILURE WILL EFFECT THE PRIMARY CONTAMINATION CONTROL ELEMENT, VENTING CAPABILITY FOR ASCENT REPRESSURE AND DESCENT DEPRESSURE, AND THE ABILITY TO PROVIDE PURGE GAS TO THE WINDOW CAVITY. FOGGING MAY OCCUR DUE TO LACK OF CONTAMINATION CONTROL/PURGE CAPABILITY. FILTER CHECK/REPLACED BEFORE/AFTER EACH MISSION.

REFERENCES: V070-381140

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/01/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9040 ABORT: 3/3

ITEM: DESICCANT/FILTER, INNER WINDOW
FAILURE MODE: RESTRICTED FLOW, CLOGS

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) WCCS
3) DESICCANT/FILTER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: INNER WINDOW CAVITY
PART NUMBER: V070-381120

CAUSES: CONTAMINATION, EXCESS MOISTURE

EFFECTS/RATIONALE:
FAILURE WILL EFFECT THE PRIMARY CONTAMINATION CONTROL ELEMENT, VENTING CAPABILITY FOR ASCENT REPRESSURE AND DESCENT DEPRESSURE, AND THE ABILITY TO PROVIDE PURGE GAS TO THE WINDOW CAVITY. FOGGING MAY OCCUR DUE TO LACK OF CONTAMINATION CONTROL/PURGE CAPABILITY. FILTER CHECK/REPLACED BEFORE/AFTER EACH MISSION.

REFERENCES: V070-381140

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/01/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9041 ABORT: 3/3

ITEM: DESICCANT/FILTER, INNER WINDOW
FAILURE MODE: INTERNAL/EXTERNAL LEAKAGE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) WCCS
3) DESICCANT/FILTER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: INNER WINDOW CAVITY
PART NUMBER: V070-381120

CAUSES: CONTAMINATION, LOOSE FITTINGS

EFFECTS/RATIONALE:
FAILURE WILL EFFECT THE PRIMARY CONTAMINATION CONTROL ELEMENT, VENTING CAPABILITY FOR ASCENT REPRESSURE AND DESCENT DEPRESSURE, AND THE ABILITY TO PROVIDE PURGE GAS TO THE WINDOW CAVITY. FOGGING MAY OCCUR DUE TO LACK OF CONTAMINATION CONTROL/PURGE CAPABILITY. FILTER CHECK/REPLACED BEFORE/AFTER EACH MISSION.

REFERENCES: V070-381140

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/01/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 2/2
MDAC ID: 9042 ABORT: 2/2

ITEM: TUBING
FAILURE MODE: RESTRICTED FLOW, CLOGS

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) WCCS
3) TUBING, INNER CAVITY
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: V070-381256, V070-383102

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
CLOGS OF TUBING NETWORK WILL RESTRICT THE PURGE GAS FLOW DURING GROUND TURNAROUND AND DEGRADE THE CAPABILITY OF WINDOW CAVITY VENTING REPRESSURIZATION DURING ASCENT AND DEPRESSURIZATION DURING DESCENT. CLOGS SHOULD BE DETECTED DURING GROUND TURN AROUND. POSSIBLE LOSS/DEGRADATION OF CABIN ATMOSPHERE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/01/87
SUBSYSTEM: PV&D
MDAC ID: 9043

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

ITEM: TUBING
FAILURE MODE: EXTERNAL LEAKAGE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) WCCS
3) TUBING, INNER CAVITY
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: V070-38400, V070-381300

CAUSES: CONTAMINATION, PIECE-PART FAILURE, LOOSE FITTINGS

EFFECTS/RATIONALE:
LEAKAGE OF TUBING NETWORK WILL DEGRADE THE ABILITY OF WCCS CONTAMINATION AND MOISTURE CONTROL. POSSIBLE LOSS OF CABIN PRESSURE DUE TO INNER WINDOW CAVITY PURGE LINE LEAKAGE. INCREASED DELTA PRESSURE ON INNER WINDOW CAVITY.

REFERENCES: VL70-003324

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/05/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 2/1R
MDAC ID: 9044 ABORT: 2/1R

ITEM: DOOR ASSEMBLY, FORWARD FUSELAGE
FAILURE MODE: PHYSICAL BINDING/JAMMING

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) VENT SYSTEM
3) DOOR ASSEMBLY (1,2)
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 [1] B [F] C [P]

LOCATION: RCS FWD, FWD FUSELAGE PLENUM
PART NUMBER: V070-380308

CAUSES: CONTAMINATION, TEMPERATURE, CORROSION

EFFECTS/RATIONALE:
VENT DOOR ASSEMBLY HINGE BINDING WILL PREVENT ORBITER STRUCTURAL COMPARTMENT VENTING, PRESSURIZATION/REPRESSURIZATION CAPABILITY. FAILURE OF ALL VENT DOORS ASSOCIATED WITHIN THIS SPECIFIC STRUCTURAL COMPARTMENT LOCATION WILL PERMIT STRUCTURAL STRESS AND POSSIBLE STRUCTURAL FAILURE.

REFERENCES: ME621-0043, V070-381031

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/05/87
SUBSYSTEM: PV&D
MDAC ID: 9045

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

ITEM: DOOR ASSEMBLY, FORWARD FUSELAGE
FAILURE MODE: INTERNAL/EXTERNAL LEAKAGE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) VENT SYSTEM
3) DOOR ASSEMBLY (1,2)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: RCS FWD, FWD FUSELAGE PLENUM
PART NUMBER: V070-380308

CAUSES: CONTAMINATION, TEMPERATURE, SEAL FAILURE

EFFECTS/RATIONALE:
VENT DOOR LEAKAGE WILL ALLOW ORBITER STRUCTURAL COMPARTMENT PRESSURE DEGRADATION AND POSSIBLE HOT GAS ENTRY DURING ASCENT/DEORBIT, WITH POSSIBLE THERMAL DAMAGE TO DOOR AND DUCTING. FUNCTIONAL EFFECT OF LEAKAGE SHOULD BE MINIMUM TO VENT SYSTEM OPERATION AND ORBITER STRUCTURAL COMPARTMENT INTEGRITY.

REFERENCES: ME621-0043, V070-381031

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/05/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 2/1R
MDAC ID: 9046 ABORT: 2/1R

ITEM: DOOR ASSEMBLY, PAYLOAD BAY
FAILURE MODE: PHYSICAL BINDING/JAMMING

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) VENT SYSTEM
3) DOOR ASSEMBLY (3, 5, 6)
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 [1] B [F] C [P]

LOCATION: PAYLOAD BAY
PART NUMBER: V070-384031

CAUSES: CONTAMINATION, TEMPERATURE, CORROSION

EFFECTS/RATIONALE:
VENT DOOR ASSEMBLY HINGE BINDING WILL PREVENT ORBITER STRUCTURAL COMPARTMENT VENTING, PRESSURIZATION/REPRESSURIZATION CAPABILITY. FAILURE OF ALL VENT DOORS ASSOCIATED WITHIN THIS SPECIFIC STRUCTURAL COMPARTMENT LOCATION WILL PERMIT STRUCTURAL STRESS AND POSSIBLE STRUCTURAL (BULKHEAD) FAILURE.

REFERENCES: ME621-0043, V070-384031

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/05/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9047 ABORT: 3/3

ITEM: DOOR ASSEMBLY, PAYLOAD BAY
FAILURE MODE: INTERNAL/EXTERNAL LEAKAGE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) VENT SYSTEM
3) DOOR ASSEMBLY (3, 5, 6)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PAYLOAD BAY
PART NUMBER: V070-384031

CAUSES: CONTAMINATION, TEMPERATURE, SEAL FAILURE

EFFECTS/RATIONALE:
VENT DOOR LEAKAGE WILL ALLOW ORBITER STRUCTURAL COMPARTMENT PRESSURE DEGRADATION AND POSSIBLE HOT GAS ENTRY DURING ASCENT/DEORBIT, WITH POSSIBLE THERMAL DAMAGE TO DOOR AND DUCTING. FUNCTIONAL EFFECT OF LEAKAGE SHOULD BE MINIMUM TO VENT SYSTEM OPERATION AND ORBITER STRUCTURAL COMPARTMENT INTEGRITY.

REFERENCES: ME621-0043, V070-384031

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/05/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 2/1R
MDAC ID: 9048 ABORT: 2/1R

ITEM: DOOR ASSEMBLY, WINGS AND MID FUSELAGE
FAILURE MODE: PHYSICAL BINDING/JAMMING

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) VENT SYSTEM
3) DOOR ASSEMBLY (4, 7)
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 [1] B [F] C [P]

LOCATION: LOWER MID FUSELAGE (LMF), PLD BAY
PART NUMBER: V070-384031

CAUSES: CONTAMINATION, TEMPERATURE, CORROSION

EFFECTS/RATIONALE:
VENT DOOR ASSEMBLY HINGE BINDING WILL PREVENT ORBITER STRUCTURAL COMPARTMENT VENTING, PRESSURIZATION/REPRESSURIZATION CAPABILITY. FAILURE OF ALL VENT DOORS ASSOCIATED WITHIN THIS SPECIFIC STRUCTURAL COMPARTMENT LOCATION WILL PERMIT STRUCTURAL STRESS AND POSSIBLE STRUCTURAL (WINGS, LMF) FAILURE.

REFERENCES: ME621-0043, V070-384031

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/05/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9049 ABORT: 3/3

ITEM: DOOR ASSEMBLY, WINGS AND MID FUSELAGE
FAILURE MODE: INTERNAL/EXTERNAL LEAKAGE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) VENT SYSTEM
3) DOOR ASSEMBLY (4, 7)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: LOWER MID FUSELAGE (LMF), PLD BAY
PART NUMBER: V070-384031

CAUSES: CONTAMINATION, TEMPERATURE, SEAL FAILURE

EFFECTS/RATIONALE:
VENT DOOR LEAKAGE WILL ALLOW ORBITER STRUCTURAL COMPARTMENT PRESSURE DEGRADATION AND POSSIBLE HOT GAS ENTRY DURING ASCENT/DEORBIT, WITH POSSIBLE THERMAL DAMAGE TO DOOR AREA. FUNCTIONAL EFFECT OF LEAKAGE SHOULD BE MINIMUM TO VENT SYSTEM OPERATION AND ORBITER STRUCTURAL COMPARTMENT INTEGRITY.

REFERENCES: ME621-0043, V070-384031

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/05/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 2/1R
MDAC ID: 9050 ABORT: 2/1R

ITEM: DOOR ASSEMBLY, AFT FUSELAGE
FAILURE MODE: PHYSICAL BINDING/JAMMING

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) VENT SYSTEM
3) DOOR ASSEMBLY (8, 9)
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 [1] B [F] C [P]

LOCATION: AFT FUSELAGE
PART NUMBER: V070-385031

CAUSES: CONTAMINATION, TEMPERATURE, CORROSION

EFFECTS/RATIONALE:
VENT DOOR ASSEMBLY HINGE BINDING WILL PREVENT ORBITER STRUCTURAL COMPARTMENT VENTING, PRESSURIZATION/REPRESSURIZATION CAPABILITY. FAILURE OF ALL VENT DOORS ASSOCIATED WITHIN THIS SPECIFIC STRUCTURAL COMPARTMENT LOCATION WILL PERMIT STRUCTURAL STRESS AND POSSIBLE STRUCTURAL FAILURE.

REFERENCES: ME621-0043, V070-385031

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/05/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9051 ABORT: 3/3

ITEM: DOOR ASSEMBLY, AFT FUSELAGE
FAILURE MODE: INTERNAL/EXTERNAL LEAKAGE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) VENT SYSTEM
3) DOOR ASSEMBLY (8, 9)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT FUSELAGE
PART NUMBER: V070-385031

CAUSES: CONTAMINATION, TEMPERATURE, SEAL FAILURE

EFFECTS/RATIONALE:
VENT DOOR LEAKAGE WILL ALLOW ORBITER STRUCTURAL COMPARTMENT PRESSURE DEGRADATION AND POSSIBLE HOT GAS ENTRY DURING ASCENT/DEORBIT, WITH POSSIBLE THERMAL DAMAGE TO DOOR AND DUCTING. FUNCTIONAL EFFECT OF LEAKAGE SHOULD BE MINIMUM TO VENT SYSTEM OPERATION AND ORBITER STRUCTURAL COMPARTMENT INTEGRITY.

REFERENCES: ME621-0043, V070-385031

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/09/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 2/1R
MDAC ID: 9052 ABORT: 2/1R

ITEM: PASSIVE RELIEF VENT DOOR, WING
FAILURE MODE: FAILS TO REMAIN OPEN, FAILS TO OPEN, PHYSICAL BINDING/JAMMING

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) VENT SYSTEM
3) PASSIVE RELIEF VENT DOOR, ASCENT
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: WING/LMF
PART NUMBER: MC284-0539

CAUSES: CONTAMINATION, PIECE-PART FAILURE, CORROSION

EFFECTS/RATIONALE:
RELIEF VENT DOOR FAILURE WILL PRECLUDE WING VENTING AND PRODUCE WING STRUCTURAL STRESS. DOOR OPERATION IS ONLY REQUIRED AFTER FAILURE OF THE ACTIVE VENT DOOR (7).

REFERENCES: SD72-SH-0101-5

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/05/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9053 ABORT: 3/3

ITEM: PASSIVE RELIEF VENT DOOR, WING
FAILURE MODE: FAILS TO REMAIN CLOSED, FAILS TO CLOSE, PHYSICAL BINDING/JAMMING

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) VENT SYSTEM
3) PASSIVE RELIEF VENT DOOR, ASCENT
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: WING/LMF
PART NUMBER: MC284-0539

CAUSES: CONTAMINATION, PIECE-PART FAILURE, SPRING FAILURE

EFFECTS/RATIONALE:
PASSIVE RELIEF VENT DOOR FAILURE WILL PREVENT ORBITER WING AND LMF COMPARTMENT ISOLATION ALLOWING CROSS VENTING AND PRESSURIZATION. RELIEF VENT DOOR OPERATION IS ONLY REQUIRED AFTER FAILURE OF THE ACTIVE VENT DOOR (7).

REFERENCES: SD72-SH-0101-5

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/09/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 2/1R
MDAC ID: 9054 ABORT: 2/1R

ITEM: PASSIVE RELIEF VENT DOOR, WING
FAILURE MODE: FAILS TO REMAIN OPEN, FAILS TO OPEN, PHYSICAL BINDING/JAMMING

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) VENT SYSTEM
3) PASSIVE RELIEF VENT DOOR, DESCENT
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: WING/LMF
PART NUMBER: MC284-0539

CAUSES: CONTAMINATION, PIECE-PART FAILURE, CORROSION

EFFECTS/RATIONALE:
RELIEF VENT DOOR FAILURE WILL PRECLUDE WING REPRESSURIZATION AND PRODUCE WING STRUCTURAL STRESS. DOOR OPERATION IS ONLY REQUIRED AFTER FAILURE OF THE ACTIVE VENT DOOR (7).

REFERENCES: SD72-SH-0101-5

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/05/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9055 ABORT: 3/3

ITEM: PASSIVE RELIEF VENT DOOR, WING
FAILURE MODE: FAILS TO REMAIN CLOSED, FAILS TO CLOSE, PHYSICAL BINDING/JAMMING

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) VENT SYSTEM
3) PASSIVE RELIEF VENT DOOR, DESCENT
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: WING/LMF
PART NUMBER: MC284-0539

CAUSES: CONTAMINATION, PIECE-PART FAILURE, SPRING FAILURE

EFFECTS/RATIONALE:
PASSIVE RELIEF VENT DOOR FAILURE WILL PREVENT ORBITER WING AND LMF COMPARTMENT ISOLATION ALLOWING CROSS VENTING AND INHIBIT REPRESSURIZATION. RELIEF VENT DOOR OPERATION IS ONLY REQUIRED AFTER FAILURE OF THE ACTIVE VENT DOOR (7).

REFERENCES: SD72-SH-0101-5

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/12/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9056 ABORT: 3/3

ITEM: FILTER, LMF/PLD BAY
FAILURE MODE: RESTRICTED FLOW, CLOGS

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) VENT SYSTEM
3) LMF/PLD BAY LINER
4) FILTER (6)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: MC286-0081

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
FILTERS PROVIDE CONTAMINATION CONTROL IN THE PLD BAY. CLOGGED FILTER WILL DEGRADE THE ABILITY TO REPRESSURIZE AND VENT THE PLD BAY. FILTERS ARE LOCATED IN PLD BAY LINER SEPARATING THE LMF FROM THE PLD BAY.

REFERENCES: V070-384031

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/12/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9057 ABORT: 3/3

ITEM: SHIELD, EMI
FAILURE MODE: RESTRICTED FLOW, CLOGS

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) VENT SYSTEM
3) VENT DOORS
4) SHIELD, EMI (16)
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:	/		

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

LOCATION:
PART NUMBER: V070-384327

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
EMI SHIELDS LOCATED IN EACH VENT DOOR PROVIDE EMI PROTECTION AND ALLOWS VENTING. SHIELD DESIGN, LOCATION AND FUNCTION PRECLUDES CLOGGING AS A FAILURE MODE.

REFERENCES: V070-385314

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/12/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9058 ABORT: /

ITEM: ET/ORB PURGE DISCONNECT
FAILURE MODE: FAILS TO CONNECT

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) ET/ORB PURGE SYSTEM
3) ET/ORB PURGE DISCONNECT (2)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: T-O UMBILICAL
PART NUMBER: MC276-0021

CAUSES: CONTAMINATION, WEARING

EFFECTS/RATIONALE:
THE PURGE DISCONNECT IS UTILIZED DURING PRELAUNCH OPERATIONS TO CONNECT THE ORBITER/ET PURGE SYSTEM TO THE GROUNDED SUPPLIED PURGE GAS NETWORK. FAILURE WILL PRECLUDE THE CAPABILITY TO SUPPLY GROUND PURGE GAS TO THE ORB/ET DISCONNECT. THE FAILURE IS PRIOR TO ANY HAZARDOUS GAS APPLICATION AND CAN BE FIXED, MAY CAUSE LAUNCH DELAY.

REFERENCES: MC276-0021

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/12/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9059 ABORT: /NA

ITEM: ET/ORB PURGE DISCONNECT
FAILURE MODE: FAILS TO DISCONNECT

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) ET/ORB PURGE SYSTEM
3) ET/ORB PURGE DISCONNECT (2)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: T-O UMBILICAL
PART NUMBER: MC276-0021

CAUSES: CONTAMINATION, CORRISION

EFFECTS/RATIONALE:
THE PURGE DISCONNECT IS UTILIZED DURING PRELAUNCH OPERATIONS TO CONNECT THE ORBITER/ET PURGE SYSTEM TO THE GROUND SUPPLIED PURGE GAS NETWORK. AUTOMATIC DISCONNECT AT T-O RETRACTION. THE INTERFACE (ORB/GSE), HAS NO MECHANICAL CONNECTIONS, ONLY HELD TOGETHER AT MOUNTING PLATES. FAILURE TO DISCONNECT DOES NOT APPEAR AS A CERDIBLE FAILURE.

REFERENCES: MC276-0021

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/12/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 3/3
MDAC ID: 9060 ABORT: /NA

ITEM: ET/ORB PURGE DISCONNECT
FAILURE MODE: INTERNAL/EXTERNAL LEAKAGE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) ET/ORB PURGE SYSTEM
3) ET/ORB PURGE DISCONNECT (2)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: T-O UMBILICAL
PART NUMBER: MC276-0021

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
THE PURGE DISCONNECT IS UTILIZED DURING PRELAUNCH OPERATIONS TO CONNECT THE ORBITER/ET PURGE SYSTEM TO THE GROUND SUPPLIED PURGE GAS NETWORK. LEAKAGE WILL DEGRADE THE FUNCTIONAL CAPABILITY TO SUPPLY PURGE GAS TO THE ET/ORB PLATE GAP CAVITY ALLOWING CRYOPUMPING AND ICE FORMATION DURING PRELAUNCH.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/12/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 1/1
MDAC ID: 9061 ABORT: 1/1

ITEM: ET/ORB PURGE DISTRIBUTION NETWORK
FAILURE MODE: CLOGS, RESTRICTED FLOW

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) ET/ORB PURGE SYSTEM
3) DISTRIBUTION NETWORK (2)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: V070-385020/030/070

CAUSES: CONTAMINATION, TEMPERATURE

EFFECTS/RATIONALE:
THE PURGE DISTRIBUTION NETWORK PROVIDES GSE SUPPLIED PURGE GAS TO THE ET/ORB DISCONNECT. THE NETWORK OF TUBING, FLEX HOSES AND ORIFICES PREVENTS CRYOPUMPING AND ICING OF THE ET/ORB DISCONNECT DURING LAUNCH OPERATIONS. FAILURE WILL PREVENT/DEGRADE FUNCTIONAL CAPABILITY CAUSING POSSIBLE EXPLOSION DUE TO GAS BUILD UP. POSSIBLE ICING CAN PREVENT ET/ORB SEPARATION.

REFERENCES: V070-385020/030/070

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/12/87 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: PV&D FLIGHT: 1/1
MDAC ID: 9062 ABORT: 1/1

ITEM: ET/ORB PURGE DISTRIBUTION NETWORK
FAILURE MODE: LEAKAGE

LEAD ANALYST: P. BYNUM SUBSYS LEAD: P. BYNUM

BREAKDOWN HIERARCHY:
1) PV&D
2) ET/ORB PURGE SYSTEM
3) DISTRIBUTION NETWORK (2)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: V070-385020/030/070

CAUSES: CONTAMINATION, PIECE-PART FAILURE, VIBRATION

EFFECTS/RATIONALE:
THE PURGE DISTRIBUTION NETWORK PROVIDES GSE SUPPLIED PURGE GAS TO THE ET/ORB DISCONNECT. THE NETWORK OF TUBING, FLEX HOSES AND ORIFICES PREVENTS CRYOPUMPING AND ICING OF THE ET/ORB DISCONNECT DURING LAUNCH OPERATIONS. FAILURE WILL DEGRADE FUNCTIONAL CAPABILITY ALLOWING HAZARDOUS GASES INTO EXPLOSIVE ENVIRONMENT AND ALLOW ICING OF ET/ORB SEPARATION MECHANISMS.

REFERENCES: V070-385020/030/070

APPENDIX D
POTENTIAL CRITICAL ITEMS

MDAC-ID	FLIGHT	ITEM	FAILURE MODE
9027	2/1R	ASCENT RELIEF VALVE	FAILS TO REMAIN OPEN, FAILS TO OPEN
9031	2/1R	DESCENT RELIEF VALVE	FAILS TO REMAIN OPEN, FAILS TO OPEN
9033	2/1R	DESICCANT/FILTER OUTER CAVITY	RESTRICTED FLOW, CLOGS
9035	2/1R	DESICCANT/FILTER OUTER CAVITY	INTERNAL/EXTERNAL LEAKAGE
9036	1/1	TUBING	RESTRICTED FLOW, CLOGS
9037	1/1	TUBING	EXTERNAL LEAKAGE
9042	2/2	TUBING	RESTRICTED FLOW, CLOGS
9043	2/2	TUBING	EXTERNAL LEAKAGE
9044	2/1R	DOOR ASSEMBLY, FORWARD FUSELAGE	PHYSICAL BINDING/ JAMMING
9046	2/1R	DOOR ASSEMBLY, PAYLOAD BAY	PHYSICAL BINDING/ JAMMING
9048	2/1R	DOOR ASSEMBLY, WINGS AND MID FUSELAGE	PHYSICAL BINDING/ JAMMING
9050	2/1R	DOOR ASSEMBLY, AFT FUSELAGE	PHYSICAL BINDING/ JAMMING
9052	2/1R	PASSIVE RELIEF VENT DOOR, ASCENT	FAILS TO OPEN, FAILS TO REMAIN OPEN
9054	2/1R	PASSIVE RELIEF VENT DOOR, DESCENT	FAILS TO OPEN, FAILS TO REMAIN OPEN
9061	1/1	ET/ORB PURGE DISTRIBUTION NETWORK	CLOGS, RESTRICTED FLOW
9062	1/1	ET/ORB PURGE DISTRIBUTION NETWORK	LEAKAGE