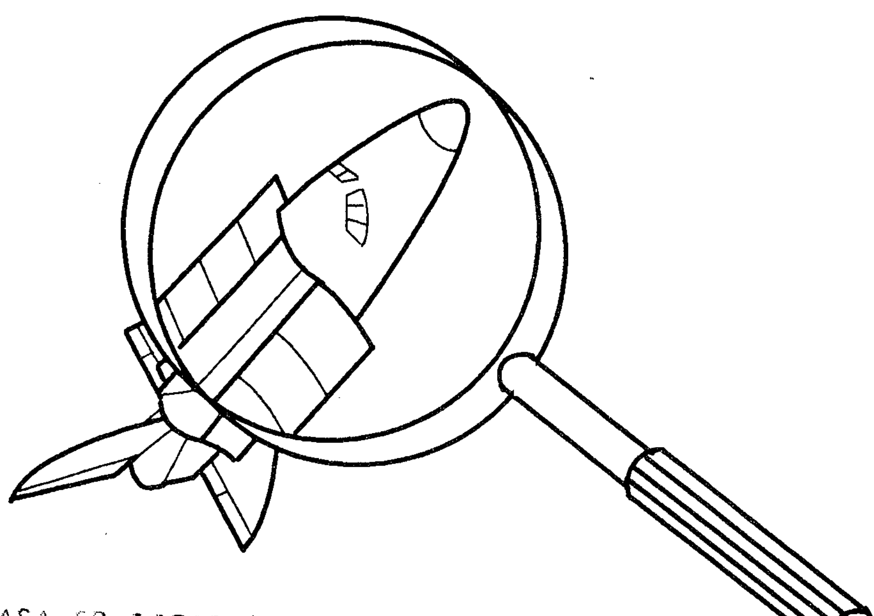
CR-185535

INDEPENDENT ORBITER ASSESSMENT

ASSESSMENT OF THE PURGE, VENT AND DRAIN SUBSYSTEM



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INDEPENDENT ORBITER ASSESSMENT

ASSESSMENT
OF THE
PURGE,
VENT AND DRAIN
SUBSYSTEM

05 FEBRUARY 1988

MCDONNELL DOUGLAS ASTRONAUTICS COMPANY
HOUSTON DIVISION

SPACE TRANSPORTATION SYSTEM ENGINEERING AND OPERATIONS SUPPORT

WORKING PAPER NO. 1.0-WP-VA88005-02

INDEPENDENT ORBITER ASSESSMENT
ASSESSMENT OF THE PURGE, VENT AND DRAIN SUBSYSTEM FMEA/CIL

5 FEBRUARY 1988

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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 effort first completed an analysis of the Purge, Vent and Drain (PV&D) hardware, generating draft failure modes and potential critical items. To preserve independence, this analysis was accomplished without reliance upon the results contained within the NASA FMEA/CIL documentation. The IOA results were then compared to the NASA FMEA/CIL baseline with proposed Post 51-L updates included. A resolution of each discrepancy from the comparison is provided through additional analysis as required. This report documents the results of that comparison for the Orbiter Purge, Vent and Drain 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 (HGDSA) - Monitors hazardous gas concentrations
  - Tubing/Couplings
  - Quick Disconnects

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 proposed Post 51-L Orbiter FMEA/CIL 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 proposed Post 51-L NASA and Prime Contractor FMEA/CIL. 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 FMEA/CIL which is documented in this report.

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 Ground Rules and Assumptions

The ground rules and assumptions used in the IOA are defined 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.

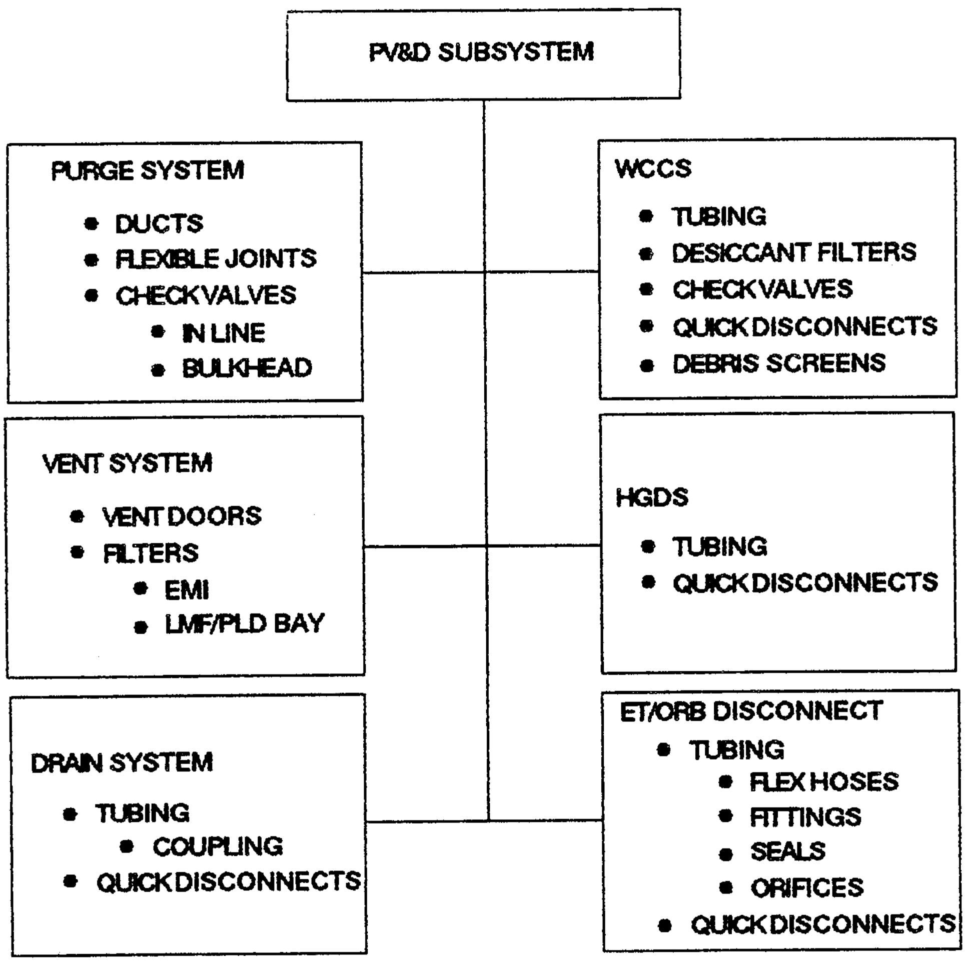


Figure 2 – PV&D SUBSYSTEM OVERVIEW

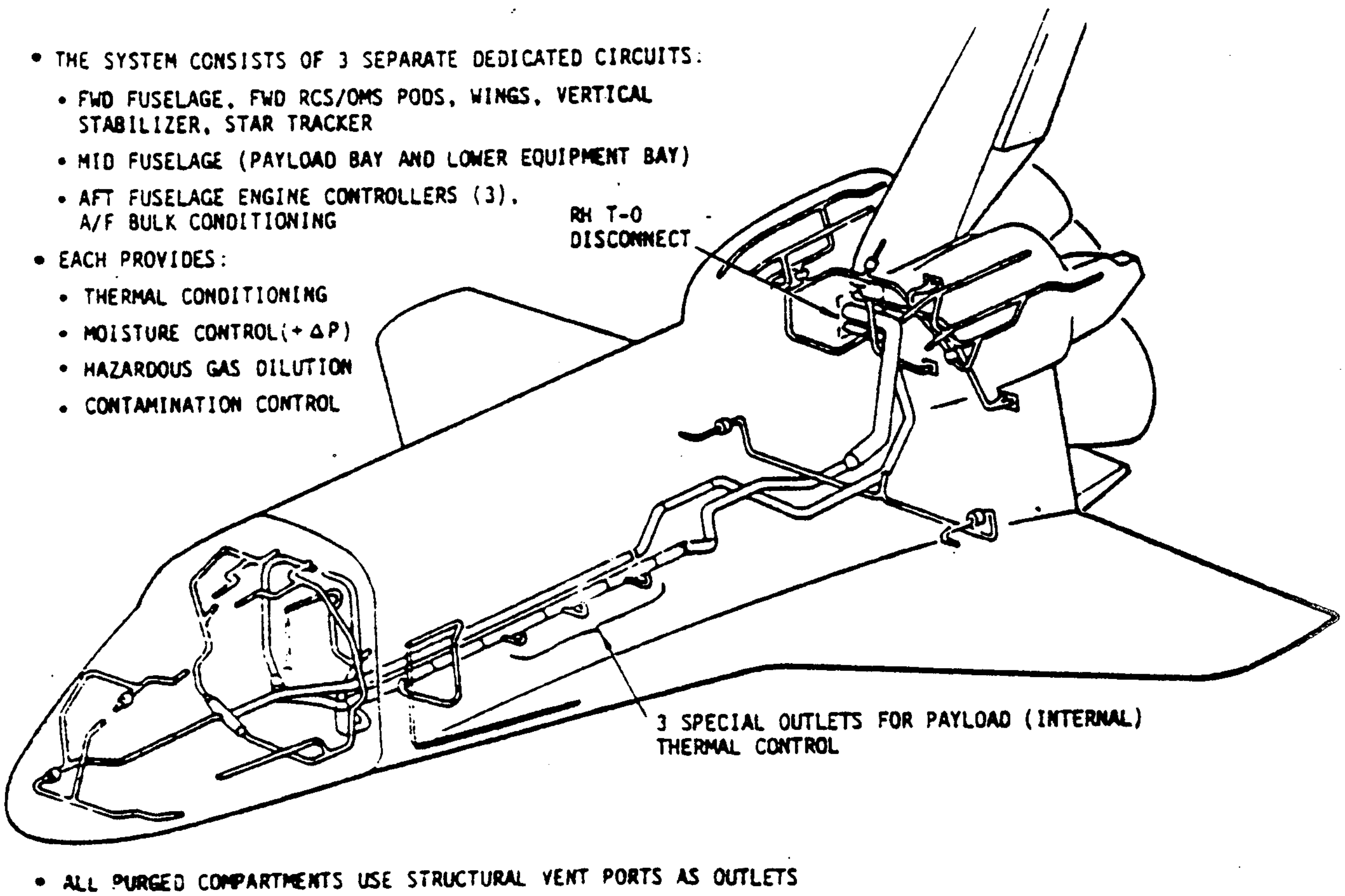
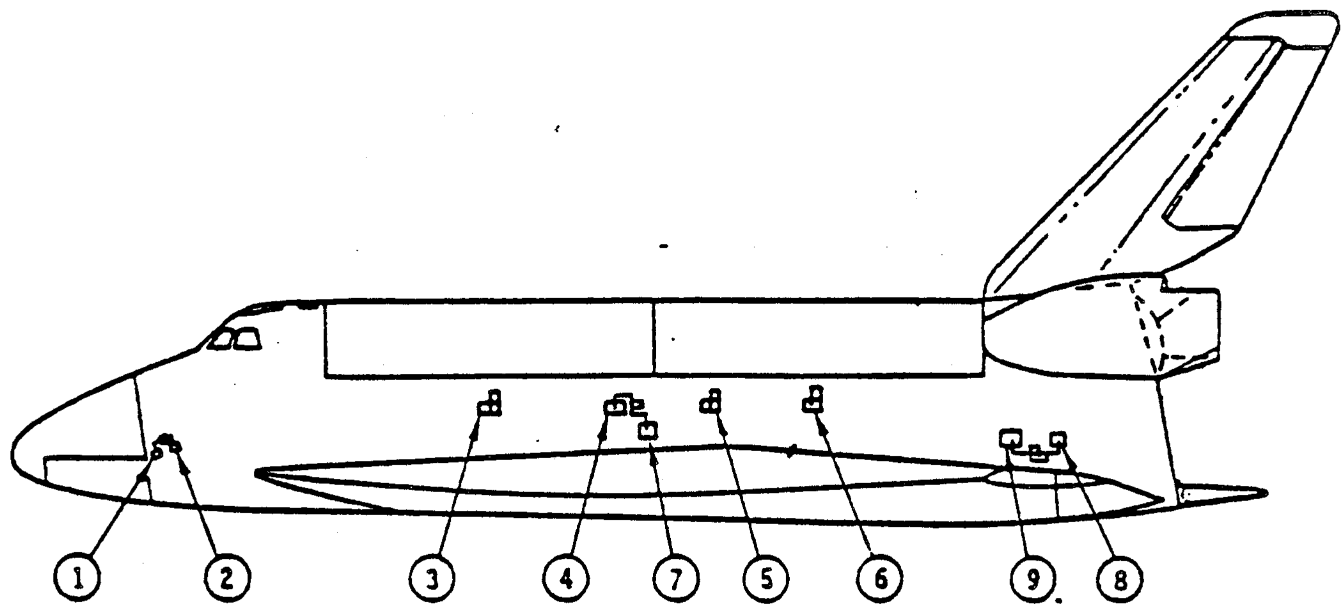


Figure 3 – PURGE SYSTEM

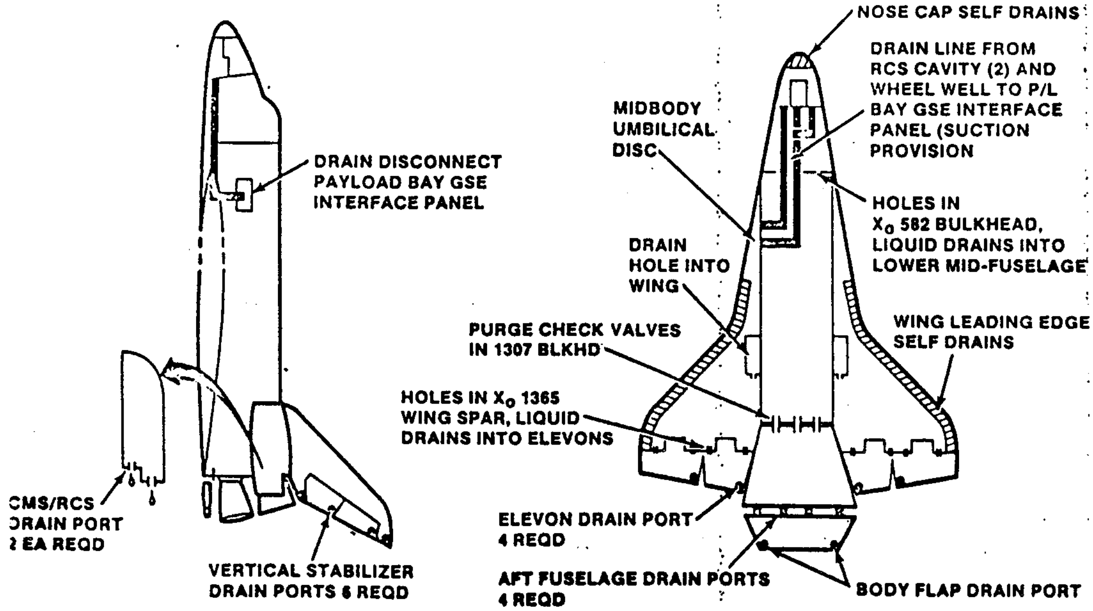


VENT NO.*	COMPT VENTED	VENT DOOR SUBSYSTEM
1	FWD RCS	FORWARD
2	FWD FUS	
7	WING	PAYLOAD BAY AND WING
4	MID FUS	
5	MID FUS	PAYLOAD BAY
3	MID FUS	
6	MID FUS	
8	OMS POD	AFT
9	AFT FUS	

*LH AND RH

Figure 4 – VENT SYSTEM

VERTICAL DRAIN SYSTEM



HORIZONTAL DRAIN SYSTEM

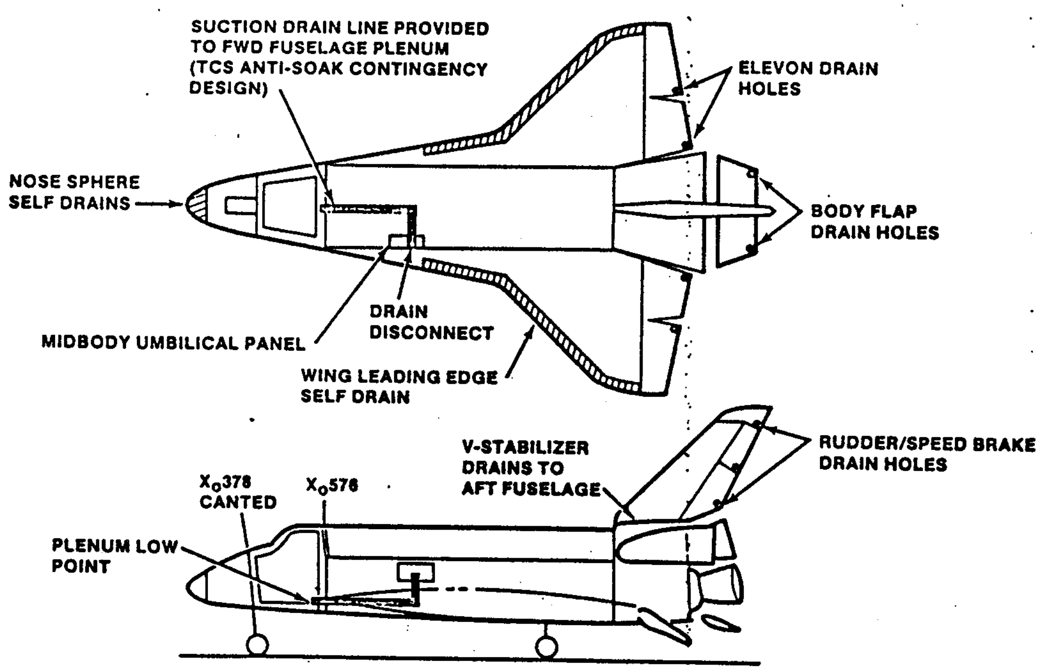


Figure 5 — DRAIN SYSTEM

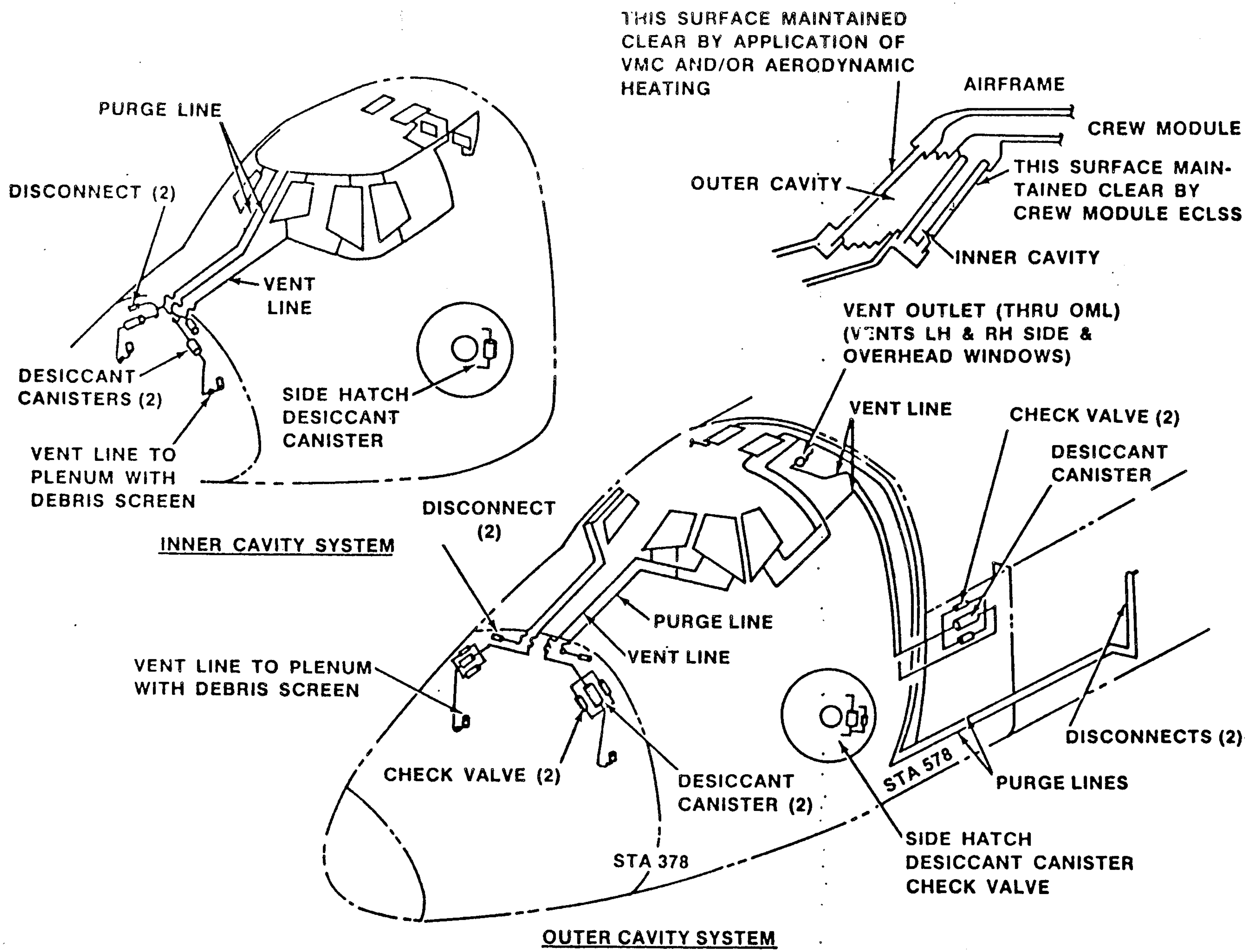


Figure 6 — WINDOW CAVITY CONDITIONS SYSTEM

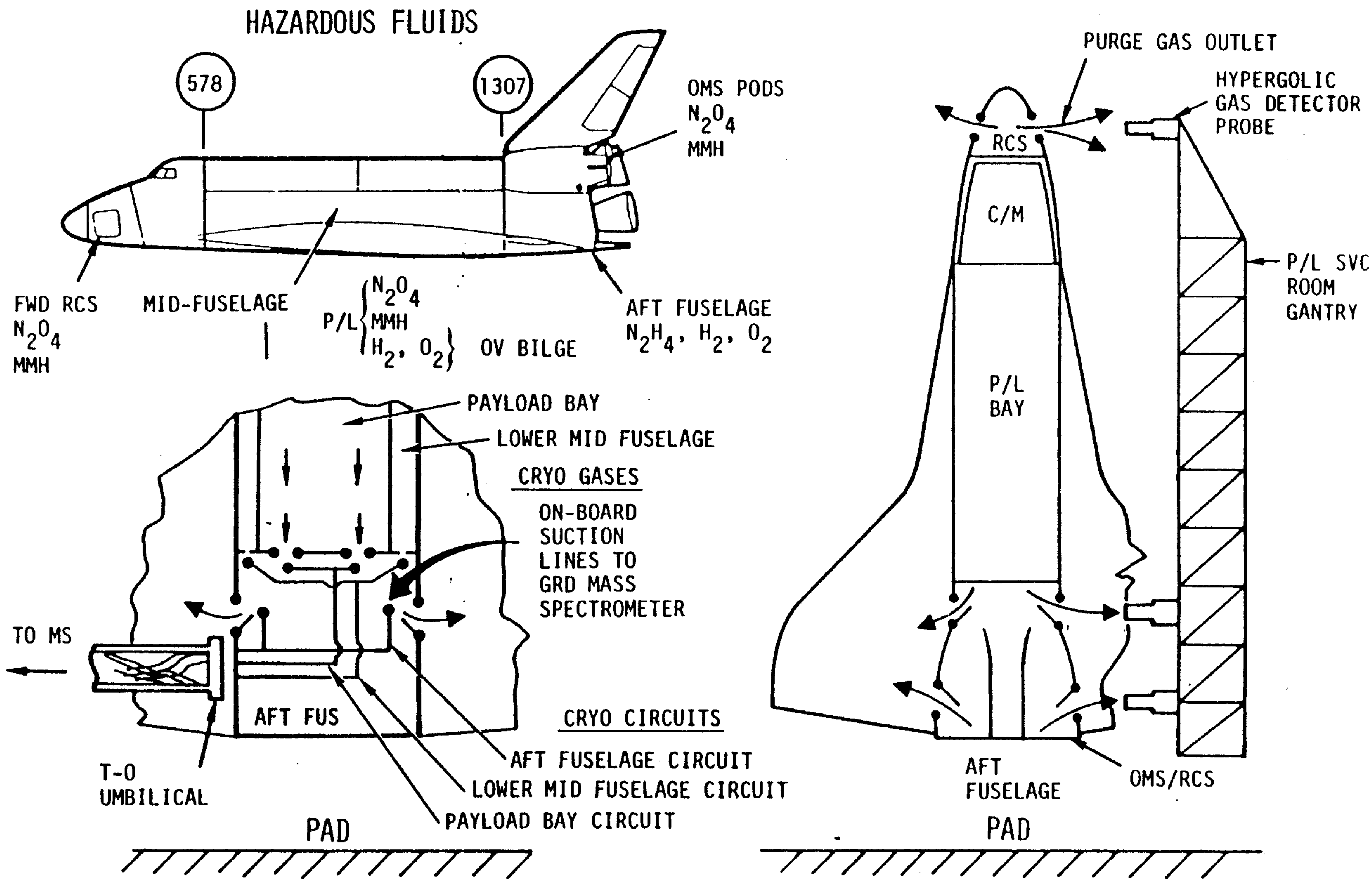
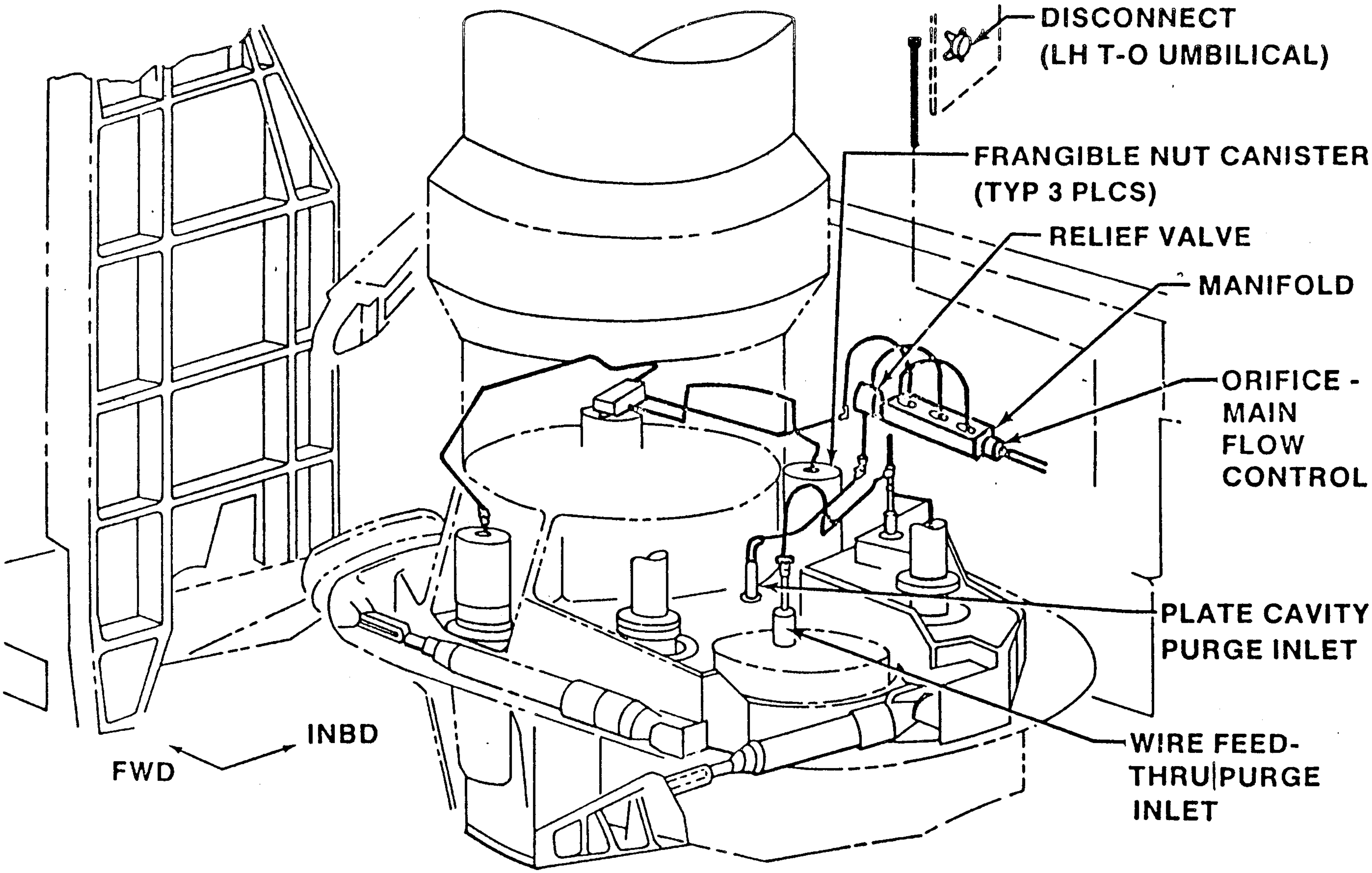


Figure 7 — HAZARDOUS GAS DETECTION SYSTEM



ET/ORBITER DISCONNECT PURGE SYSTEM

LH_2 SIDE (SHOWN) • LOX SIDE (OPP)

Figure 8 — ET/ORB DISCONNECT PURGE SYSTEM

4.0 ASSESSMENT RESULTS

The IOA analysis of the PV&D hardware initially generated sixty-two (62) failure mode worksheets and identified sixteen (16) Potential Critical Items (PCIs) before starting the assessment process. These analysis results were compared to the proposed NASA Post 51-L baseline (20 November 1987) of forty-six (46) FMEAs and eight (8) CIL items. The discrepancy between the number of IOA and NASA FMEAs can be explained by the different approach used by NASA and IOA to group failure modes and define subsystem hardware components. Upon completion of the assessment three (3) failure modes were generated by the IOA analysis that were not covered by the NASA FMEAs. The IOA recommends the addition of these failure modes to the NASA FMEA baseline.
In both the IOA analysis report and the NASA FMEA baseline the PV&D subsystem were divided into the six (6) systems identified in section 3.0 (subsystem description).

In the following, the unmapped IOA column is the raw number of IOA failure modes. The mapped IOA column is the number of IOA failure modes after they have been mapped into the NASA FMEAs. The issues column is the IOA failure modes that were unable to be mapped onto NASA FMEAs and/or have differences in criticality or redundancy screens.

PV&D Systems	IOA Unmapped	IOA Mapped	NASA	Issues
Purge	14	12	10	1
Vent	14	14	2	0
Drain	5	5	5	0
WCCS	20	19	21	3
HGDS	4	4	5	0
ET/ORB Discn.	5	4	3	1
Total	62	49	46	5

Appendix C presents the detailed assessment worksheets for each failure mode identified and assessed. Appendix D highlights the NASA Critical Items and corresponding IOA worksheet ID. Appendix E contains IOA analysis worksheets supplementing previous analysis results reported in Space Transportation System Engineering and Operations Support (STSEOS) Working Paper No. 1.0-WP-VA87001-04, Analysis of the PV&D Subsystem, 18 November 1987. Appendix F provides a cross reference between the NASA FMEA and corresponding IOA worksheet(s). IOA recommendation are also summarized.

A summary of the quantity of NASA FMEAs assessed, versus the recommended IOA baseline, and any issues identified is presented in Table I.

TABLE I Summary of IOA FMEA Assessment			
System	NASA	IOA	ISSUES
Purge	10	14	1
Vent	2	14	0
Drain	5	5	0
WCCS	21	20	0
HGDS	5	4	0
ET/ORB Discn.	3	5	1
TOTAL	46	62	2

A summary of the quantity of NASA CIL items assessed, versus the recommended IOA baseline, and any issues identified is presented in Table II.

TABLE II Summary of IOA CIL Assessment			
System	NASA	IOA	ISSUES
Purge	-	-	-
Vent	-	6	-
Drain	-	-	-
WCCS	7	8	3
HGDS	-	-	-
ET/ORB Discn.	1	2	-
TOTAL	8	16	3

Table III presents a summary of the recommended failure criticalities for each of the six (6) systems 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 III Summary of IOA Recommended Failure 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 IV. Appendix D presents a cross reference between each potential critical item (PCI) and a specific assessment worksheet in Appendix C.

TABLE IV 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

The scheme for assigning IOA assessment (Appendix C) and analysis (Appendix E) worksheet numbers is shown in Table V.

Table V IOA Worksheets Numbers	
System	IOA ID Number
Purge	PV&D-9001 to PV&D-9014
Vent	PV&D-9044 to PV&D-9057
Drain	PV&D-9019 to PV&D-9023
WCCS	PV&D-9024 to PV&D-9043
HGDS	PV&D-9015 to PV&D-9018
ET/ORB Discn.	PV&D-9058 to PV&D-9062

4.1 Assessment Results - Purge System

The IOA analysis generated fourteen (14) failure modes for the Purge System all of which are identified as criticality 3/3. The assessment between the IOA Purge System worksheets and NASA Post 51-L FMEA/CIL baseline produced one issue. IOA recommends the addition of a FMEA to the NASA Baseline for the failure mode, check valve leakage, identified in IOA worksheet 9009. The criticality for this failure mode is 3/3. IOA also has deleted IOA worksheet 9014 as the failure mode, ducting clog, does not appear to be a credible failure.

4.2 Assessment Results - Hazardous Gas Detection System (HGDS)

The IOA analysis generated four (4) failure modes for the HGDS all of which are identified as criticality 3/3. The assessment between the IOA HGDS worksheets and NASA Post 51-L FMEA/CIL baseline produced no issues. The assessment also produced one (1) additional IOA analysis worksheet (9063X) to cover the failure mode, HGDS quick disconnect fail to disconnect. The IOA analysis results for this additional FMEA agreed with the NASA findings.

4.3 Assessment Results - Drain System

The IOA analysis generated five (5) failure modes for the Drain System all of which are determined to be criticality 3/3. The assessment between IOA worksheets and NASA Post 51-L Baseline FMEA/CIL produced no issues.

4.4 Assessment Results - Window Cavity Condition System (WCCS)

The IOA analysis generated twenty (20) failure modes for the WCCS. Of the identified failure modes 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) failure are identified as PCIs. These PCIs are listed in Appendix D. The assessment between the IOA WCCS Worksheets and NASA Post 51-L FMEA/CIL produced three (3) issues. IOA recommends the addition of a FMEA to the NASA Baseline for the failure mode, WCCS outer cavity tubing clogging, identified in IOA Worksheet 9036. The criticality for this failure mode is 1/1 and therefore also requires NASA generate a CIL. IOA agreed with, after further review/analysis, NASA Baseline FMEA/CIL 01-5-332404-5, WCCS desiccant filter outer cavity leakage, criticality of 1/1. However, NASA Baseline FMEA/CIL 01-5-332404-6 describes same component, same failure, same results but different windows with the same design as a criticality 3/3. IOA recommends combining the two NASA FMEAs with a criticality 1/1. IOA disagrees with NASA baseline FMEA 01-5-332406-5 designated criticality 3/3. IOA worksheet 9037 for the same failure mode, WCCS outer cavity tubing leakage, identifies the criticality as 1/1. NASA Baseline FMEA 01-5-332403-1 identifies the same failure mode for the tubing but for a different set of windows as a criticality 1/1. After further analysis IOA determined that the windows are all of the same design. Therefore the criticality of 1/1 should be consistent. IOA recommends the combination of NASA FMEA/CILs 01-5-332403-1 and 01-5-332406-5 with an identified criticality of 1/1 presented on NASA baseline FMEA/CIL 01-5-3320403-1 and IOA worksheet 9037.

4.5 Assessment Results - Vent System

The IOA analysis generated fourteen (14) failure modes for the Vent System. Of the identified failure modes 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. THe assessment between the IOA worksheets and NASA Post 51-L Baseline produced no issues. IOA generated IOA worksheets 9044 thru 9055 which covered the Orbiter Vent Door and Hinge bearing, these worksheets had no corresponding FMEAs in the PV&D Baseline. However, corresponding FMEAs where generated in the Active Vent Door/Mechanical Acutation NASA Post 51-L Baseline. In the Initial Review IOA and NASA disagreed with screen A. After further Review/Analysis IOA agreed with the NASA Baseline, understanding that detection of one of the dual bearing failure was not credible during OMRSD defined testing.

4.6 Assessment Results - ET/Orbiter Disconnect Purge System

The IOA analysis generated five (5) failure modes for the ET/ORB Disconnect Purge System. Of the identified failure modes two (2) are criticality 1/1, and three (3) are criticality 3/3. Two (2) failure modes are identified as PCIs. These PCIs are listed in Appendix D. The assessment between the IOA worksheets and the NASA Post 51-L Baseline produced one issue. IOA recommends the addition of a FMEA to the NASA Baseline for the failure mode, ET/ORB purge disconnect external leakage, identified in IOA worksheet 9060. The criticality for this failure mode is 3/3. IOA recognizes this as a credible failure mode.

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.

22. MDAC ID PV&D Working Paper No. 1.0-WP-VA87001-04, 18 November 1987.

23. NASA-JSC FMEA and CIL Review for PV&D, 20 November 1987.

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

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

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 ASSESSMENT

This section contains the IOA assessment worksheets generated during the assessment of this subsystem. The information on these worksheets facilitates the comparison of the NASA FMEA/CIL (Post 51-L) to the IOA detailed analysis worksheets included in Appendix E. Each of these worksheets identifies the NASA FMEA being assessed, corresponding MDAC Analysis Worksheet ID (Appendix E), hardware item, criticality, redundancy screens, and recommendations. For each failure mode, the highest assessed hardware and functional criticality is compared and discrepancies noted as "N" in the compare row under the column where the discrepancy occurred.

LEGEND FOR IOA ASSESSMENT WORKSHEETS

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

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

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

NASA Data :
- Baseline = NASA FMEA/CIL
- New = Baseline with Proposed Post 51-L Changes

CIL Item :
- X = Included in CIL

Compare Row :
- N = Non compare for that column (deviation)

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9001
NASA FMEA #: 01-5-380001-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9001
ITEM: UMBILICAL DISCONNECT

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9002
NASA FMEA #: 01-5-380001-2

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9002
ITEM: UMBILICAL DISCONNECT

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9003
NASA FMEA #: 01-5-380001-3

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9003
ITEM: UMBILICAL DISCONNECT

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9004
NASA FMEA #: 01-5-380001-4

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9004
ITEM: VALVE, UMBILICAL DISCONNECT

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9005
NASA FMEA #: 01-5-380001-5

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9005
ITEM: VALVE, UMBILICAL DISCONNECT

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9006
NASA FMEA #: 01-5-380003-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9006
ITEM: CHECK VALVE

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9007
NASA FMEA #: 01-5-380003-2

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9007
ITEM: CHECK VALVE

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9008
NASA FMEA #: 01-5-380003-2

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9008
ITEM: CHECK VALVE

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9009
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9009
ITEM: CHECK VALVE

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[N /N]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[3 /3]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
VALVE LEAKAGE COULD OCCUR AT THE MOUNTING FLANGES AT THE DUCTING. FAILURE IS CONSIDERED CREDIBLE, THE GENERATION OF A NASA FMEA IS RECOMMENDED FOR IOA ANALYSIS WORK SHEET 9009.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9010
NASA FMEA #: 01-5-38005-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9010
ITEM: CHECK VALVE

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9011
NASA FMEA #: 01-5-38005-2

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9011
ITEM: CHECK VALVE

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9012
NASA FMEA #: 01-5-38005-2

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9012
ITEM: CHECK VALVE

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9013
NASA FMEA #: 01-5-38004-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9013
ITEM: DUCTING/FLEXIBLE BELLOWS/STRAPS

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9014
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9014
ITEM: DUCTING

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[N /N]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
PURGE DUCTING CLOG DOES NOT APPEAR TO BE A CREDIBLE FAILURE MODE. DUCT SIZING RANGES BETWEEN 1.5 INCHES TO 11 INCHES IN DIAMETER AND THE PURGE MEDIUM IS FILTERED PRIOR TO INTRODUCTION TO THE ORBITER PURGE DUCTING. THEREFORE IOA ANALYSIS WORKSHEET 9014 HAS BEEN CANCELLED.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9015
NASA FMEA #: 01-5-380301-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9015
ITEM: UMBILICAL DISCONNECT

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM	
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ]	*
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]	
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]	

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9016
NASA FMEA #: 01-5-380301-3

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9016
ITEM: UMBILICAL DISCONNECT

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9017
NASA FMEA #: 01-5-380302-2

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9017
ITEM: PIPING

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9018
NASA FMEA #: 01-5-380302-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9018
ITEM: PIPING

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9019
NASA FMEA #: 01-5-384051-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9019
ITEM: QUICK DISCONNECT

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9020
NASA FMEA #: 01-5-384051-2

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9020
ITEM: QUICK DISCONNECT

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9021
NASA FMEA #: 01-5-384051-3

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9021
ITEM: QUICK DISCONNECT

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9022
NASA FMEA #: 01-5-384052-2

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9022
ITEM: TUBING

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9023
NASA FMEA #: 01-5-384052-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9023
ITEM: TUBING

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9024
NASA FMEA #: 01-5-332401-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9024
ITEM: GN2 PURGE DISCONNECT

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9025
NASA FMEA #: 01-5-332401-2

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9025
ITEM: GN2 PURGE DISCONNECT

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9026
NASA FMEA #: 01-5-332401-3

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9026
ITEM: GN2 PURGE DISCONNECT

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9027
NASA FMEA #: 01-5-332405-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9027
ITEM: ASCENT RELIEF VALVE

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[NA]	[P]	[X] *
IOA	[2 /1R]	[P]	[NA]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [X]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9028
NASA FMEA #: 01-5-33405-5

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9028
ITEM: ASCENT RELIEF VALVE

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9029
NASA FMEA #: 01-5-33405-6

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9029
ITEM: ASCENT RELIEF VALVE

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM	
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ]	*
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]	
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]	

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)	

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9030
NASA FMEA #: 01-5-332405-5

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9030
ITEM: DESCENT RELIEF VALVE

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9031
NASA FMEA #: 01-5-332405-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9031
ITEM: DESCENT RELIEF VALVE

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[NA]	[P]	[X] *
IOA	[2 /1R]	[P]	[NA]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9032
NASA FMEA #: 01-5-332405-6

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9032
ITEM: DESCENT RELIEF VALVE

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9033
NASA FMEA #: 01-5-332404-1, -332408-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9033
ITEM: DESICCANT/FILTER OUTER CAVITY

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[NA]	[P]	[X] *
IOA	[2 /1R]	[P]	[NA]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9034
NASA FMEA #: 01-5-332404-4

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9034
ITEM: DESICCANT/FILTER OUTER CAVITY

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9035
NASA FMEA #: 01-5-332404-5

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9035
ITEM: DESICCANT/FILTER OUTER CAVITY

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[ ]	[ ]	[ ]	[X] *
IOA	[2 /1R]	[P]	[NA]	[P]	[X]
COMPARE	[N /N]	[N]	[N]	[N]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
AFTER FURTHER REVIEW/ANALYSIS, IOA AGREES WITH THE NASA BASELINE FMEA, AS FAILURE MODE COULD BE CONSIDERED AS HAVING SAME EFFECT AS WCCS TUBING LEAKAGE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9035A
NASA FMEA #: 01-5-332404-6

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9035
ITEM: DESICCANT/FILTER OUTER CAVITY

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[2 /1R]	[P]	[NA]	[P]	[X]
COMPARE	[N /N]	[N]	[N]	[N]	[N]

RECOMMENDATIONS: (If different from NASA)

	[1 /1]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
NASA BASELINE FMEA/CIL 01-5-332404-5 AND IOA ASSESSMENT SHEET PV&D-9035 ADDRESS THE SAME FAILURE MODE BUT FOR A DIFFERENT WINDOW CAVITY WITH THE SAME DESIGN. IOA ASSESSMENT SHEET PV&D-9035 AGREED WITH THE NASA BASELINE CRITICALITY OF 1/1. THEREFORE IT IS RECOMMENDED THAT THE CRITICALITY OF NASA FMEA/CIL 01-5-332404-6 BE UPGRADED TO CRITICALITY 1/1.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9036
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9036
ITEM: TUBING

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[1 /1]	[ ]	[ ]	[ ]	[X]
COMPARE	[N /N]	[ ]	[ ]	[ ]	[N]

RECOMMENDATIONS: (If different from NASA)

[1 /1]	[ ]	[ ]	[ ]	[A] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
A PV&D FMEA/CIL WAS NOT FOUND FOR THE FAILURE MODE, WCCS OUTER TUBING CLOGS. TUBING CLOGS WILL DEGRADE WCCS DEPRESSURIZATION AND REPRESSURIZATION CAPABILITY WITH POSSIBLE THERMAL PANE RUPTURE. IT IS RECOMMENDED THAT A FMEA/CIL BE ADDED FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9037
NASA FMEA #: 01-5-332403-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9037
ITEM: TUBING

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[ ]	[ ]	[ ]	[X] *
IOA	[1 /1]	[ ]	[ ]	[ ]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
NASA BASELINE FMEA 01-5-332406-5 HAS A CRITICALITY 3/3 FOR THE SAME FAILURE MODE, SAME HARDWARE, SAME EFFECT AS NASA BASELINE FMEA 01-5-332403-1 WHICH HAS A CRITICALITY OF 1/1. IT IS RECOMMENDED THAT NASA EITHER COMBINE THE TWO FMEAs OR UPGRADE THE 3/3 TO A 1/1.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9037A
NASA FMEA #: 01-5-332406-5

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9037
ITEM: TUBING

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM	
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ]	*
IOA	[1 /1]	[ ]	[ ]	[ ]	[X]	
COMPARE	[N /N]	[ ]	[ ]	[ ]	[N]	

RECOMMENDATIONS: (If different from NASA)

	[1 /1]	[ ]	[ ]	[ ]	[A] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
NASA BASELINE FMEA 01-5-332406-5 HAS A CRITICALITY 3/3 FOR THE SAME FAILURE MODE, SAME HARDWARE, SAME EFFECT AS NASA BASELINE FMEA 01-5-332403-1 WHICH HAS A CRITICALITY OF 1/1. IT IS RECOMMENDED THAT NASA EITHER COMBINE THE TWO FMEAs OR UPGRADE THE 3/3 TO A 1/1.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9038
NASA FMEA #: 01-5-332408-5

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9038
ITEM: DESICCANT/FILTER

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /2]	[ ]	[ ]	[ ]	[X] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[N /N]	[ ]	[ ]	[ ]	[N]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
AFTER FURTHER ANALYSIS/REVIEW IOA AGREES WITH THE NASA FMEA/CIL BASELINE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9039
NASA FMEA #: 01-5-332408-4, -332409-4

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9039
ITEM: DESICCANT/FILTER, INNER WINDOW

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9040
NASA FMEA #: 01-5-332408-2, -332409-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9040
ITEM: DESICCANT/FILTER, INNER WINDOW

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9041
NASA FMEA #: 01-5-332409-5

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9041
ITEM: DESICCANT/FILTER, INNER WINDOW

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9042
NASA FMEA #: 01-5-332406-3

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9042
ITEM: TUBING

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[2 /2]	[ ]	[ ]	[ ]	[X]
COMPARE	[N /N]	[ ]	[ ]	[ ]	[N]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
AFTER FURTHER ANALYSIS/REVIEW IOA AGREES WITH THE NASA FMEA/CIL BASELINE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9043
NASA FMEA #: 01-5-332406-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9043
ITEM: TUBING

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /2]	[ ]	[ ]	[ ]	[X] *
IOA	[2 /2]	[ ]	[ ]	[ ]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9044
NASA FMEA #: 01-5-380101-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9044
ITEM: DOOR ASSEMBLY, FORWARD FUSELAGE

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[F]	[NA]	[P]	[X] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[/]	[N]	[N]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
AFTER FURTHER REVIEW IOA AGREES WITH THE NASA BASELINE SCREEN A. IOA AGREES THAT THERE IS NOT AN APPARENT METHOD VIA OMRSD DEFINED TESTING TO DETECT FIRST FAILURE OF DUAL ROTATIONAL HINGE BEARING.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9045
NASA FMEA #: 01-5-380101-2

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9045
ITEM: DOOR ASSEMBLY, FORWARD FUSELAGE

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9046
NASA FMEA #: 01-5-380117-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9046
ITEM: DOOR ASSEMBLY, PAYLOAD BAY

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[F]	[NA]	[P]	[X] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[/]	[N]	[N]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
AFTER FURTHER REVIEW IOA AGREES WITH THE NASA BASELINE SCREEN A. IOA AGREES THAT THEIR APPEARS TO BE NO APPARENT METHOD TO DETECT THE FIRST FAILURE OF A DUAL ROTATIONAL HINGE BEARING WHICH CAN BE DEFINED IN OMRSD TESTING.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9047
NASA FMEA #: 01-5-380117-2

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9047
ITEM: DOOR ASSEMBLY, PAYLOAD BAY

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9048
NASA FMEA #: 01-5-380109-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9048
ITEM: DOOR ASSEMBLY, WINGS AND MID FUSELAGE

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[F]	[NA]	[P]	[X] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[/]	[N]	[N]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
AFTER FURTHER ANALYSIS IOA AGREES WITH THE NASA FMEA BASELINE. SEE MDAC ID PV&D-9046 FOR DETAIL.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9049
NASA FMEA #: 01-5-380109-2

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9049
ITEM: DOOR ASSEMBLY, WINGS AND MID FUSELAGE

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9050
NASA FMEA #: 01-5-380125-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9050
ITEM: DOOR ASSEMBLY, AFT FUSELAGE

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[F]	[NA]	[P]	[X] *
IOA	[2 /1R]	[P]	[F]	[P]	[X]
COMPARE	[/]	[N]	[N]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [X]
INADEQUATE [ ]

REMARKS:
AFTER FURTHER REVIEW IOA AGREES WITH THE NASA FMEA SCREEN A DESIGNATION. SEE PV&D-9046 FOR DETAIL.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9051
NASA FMEA #: 01-5-380125-2

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9051
ITEM: DOOR ASSEMBLY, AFT FUSELAGE

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9052
NASA FMEA #: 01-5-380133-2

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9052
ITEM: PASSIVE RELIEF VENT DOOR, WING

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[NA]	[P]	[X] *
IOA	[2 /1R]	[P]	[NA]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [X]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9053
NASA FMEA #: 01-5-380133-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9053
ITEM: PASSIVE RELIEF VENT DOOR, WING

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE:	12/07/87	NASA DATA:	
ASSESSMENT ID:	PV&D-9054	BASELINE	[X]
NASA FMEA #:	01-5-380134-2	NEW	[ ]

SUBSYSTEM: PV&D
MDAC ID: 9054
ITEM: PASSIVE RELIEF VENT DOOR, WING

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[2 /1R]	[P]	[NA]	[P]	[X] *
IOA	[2 /1R]	[P]	[NA]	[P]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/07/87
ASSESSMENT ID: PV&D-9055
NASA FMEA #: 01-5-380134-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9055
ITEM: PASSIVE RELIEF VENT DOOR, WING

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9056
NASA FMEA #: 01-5-380101-2

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: PV&D
MDAC ID: 9056
ITEM: FILTER, LMF/PLD BAY

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9057
NASA FMEA #: 01-5-380101-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: PV&D
MDAC ID: 9057
ITEM: SHIELD, EMI

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9058
NASA FMEA #: 01-5-385002-1

NASA DATA:
BASELINE [ ]
NEW [X]

SUBSYSTEM: PV&D
MDAC ID: 9058
ITEM: ET/ORB PURGE DISCONNECT

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9059
NASA FMEA #: 01-5-385002-2

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9059
ITEM: ET/ORB PURGE DISCONNECT

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9060
NASA FMEA #:

NASA DATA:
BASELINE [ ]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9060
ITEM: ET/ORB PURGE DISCONNECT

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[/]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[N /N]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[3 /3]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:
A PV&D FMEA WAS NOT GENERATED FOR THE FAILURE MODE, ET/ORB PURGE DISCONNECT LEAKAGE. LEAKAGE WILL DEGRADE THE CAPABILITY TO SUPPLY PURGE GAS TO THE ET/ORB PURGE DISTRIBUTION NETWORK. LEAKAGE SHOULD BE DETECTED DURING GROUND OPS PRIOR TO LIFT OFF. IT IS RECOMMENDED THAT NASA GENERATE A FMEA FOR THIS FAILURE MODE.

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9061
NASA FMEA #: 01-5-385001-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9061
ITEM: ET/ORB PURGE DISTRIBUTION NETWORK

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[ ]	[ ]	[ ]	[X] *
IOA	[1 /1]	[ ]	[ ]	[ ]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [X]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 12/08/87
ASSESSMENT ID: PV&D-9062
NASA FMEA #: 01-5-385001-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9062
ITEM: ET/ORB PURGE DISTRIBUTION NETWORK

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[1 /1]	[ ]	[ ]	[ ]	[X] *
IOA	[1 /1]	[ ]	[ ]	[ ]	[X]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)
ADEQUATE [X]
INADEQUATE [ ]

REMARKS:

APPENDIX C
ASSESSMENT WORKSHEET

ASSESSMENT DATE: 1/23/88
ASSESSMENT ID: PV&D-9063X
NASA FMEA #: 01-5-380301-1

NASA DATA:
BASELINE [X]
NEW [ ]

SUBSYSTEM: PV&D
MDAC ID: 9063
ITEM: UMBILICAL DISCONNECT

LEAD ANALYST: P. BYNUM

ASSESSMENT:

	CRITICALITY FLIGHT HDW/FUNC	REDUNDANCY SCREENS A	B	C	CIL ITEM
NASA	[3 /3]	[ ]	[ ]	[ ]	[ ] *
IOA	[3 /3]	[ ]	[ ]	[ ]	[ ]
COMPARE	[/]	[ ]	[ ]	[ ]	[ ]

RECOMMENDATIONS: (If different from NASA)

	[/]	[ ]	[ ]	[ ]	[ ] (ADD/DELETE)

* CIL RETENTION RATIONALE: (If applicable)

ADEQUATE [ ]
INADEQUATE [ ]

REMARKS:

APPENDIX D

CRITICAL ITEMS

NASA FMEA	MDAC ID	ITEM	FAILURE MODE
01-5-332405-1	9027	ASCENT RELIEF VALVE	FAILS TO OPEN
01-5-332405-1	9031	DESCENT RELIEF VALVE	FAILS TO OPEN
01-5-332404-1	9033	DESICCANT FILTER OUTER CAVITY	CLOGS
01-5-332404-5	9035	DESICCANT FILTER	LEAKAGE
01-5-332403-1	9037	TUBING	LEAKAGE
	9042	TUBING	CLOGS
01-5-332406-1	9043	TUBING	LEAKAGE
01-5-380101-1	9044	VENT DOOR (1, 2)	JAMMING
01-5-380117-1	9046	VENT DOOR (3, 5, 6)	JAMMING
01-5-380109-1	9048	VENT DOOR (4, 7)	JAMMING
01-5-380125-1	9050	VENT DOOR (8, 9)	JAMMING
01-5-380133-2	9052	ASCENT RELIEF VENT	FAILS TO OPEN
01-5-380134-2	9054	DESCENT RELIEF VENT	FAILS TO OPEN
01-5-385001-1	9061	ET/ORB PURGE DISTRIBUTION NETWORK	CLOGS
01-5-385001-1	9062	ET/ORB PURGE DISTRIBUTION NETWORK	LEAKAGE

APPENDIX E
DETAILED ANALYSIS

This appendix contains the IOA analysis worksheets supplementing previous results reported in STSEOS Working Paper 1.0-WP-VA87001-04, Analysis of the Purge, Vent and Drain Subsystem, (18 November 1987). Prior results were obtained independently and documented before starting the FMEA/CIL assessment activity. Supplemental analysis was performed to address failure modes not previously considered by the IOA. Each sheet identifies the hardware item being analyzed, parent assembly and function performed. For each failure mode possible causes are identified, and hardware and functional criticality for each mission phase are determined as described in NSTS 22206, Instructions for Preparation of FMEA and CIL, 10 October 1986. Failure mode effects are described at the bottom of each sheet and worst case criticality is identified at the top.

LEGEND FOR IOA ANALYSIS WORKSHEETS

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

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

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

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 1/23/88
SUBSYSTEM: PV&D
MDAC ID: 9063

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

ITEM: UMBILICAL DISCONNECT
FAILURE MODE: FAILS TO DISCONNECT

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 DISCONNECT IS PRECLUDED DUE TO DISCONNECT DESIGN. THEIR ARE NO MECHANICAL CONNECTIONS WHICH COULD PREVENT THE MOUNTING PLATES FROM DISCONNECTING.

REFERENCES: MC276-0021, V070-385071

APPENDIX F

NASA FMEA TO IOA WORKSHEET CROSS REFERENCE/RECOMMENDATIONS

This section provides a cross reference between the NASA FMEA and corresponding IOA analysis worksheet(s) included in Appendix E. The Appendix F identifies: NASA FMEA Number, IOA Assessment Number, NASA criticality and redundancy screen data, and IOA recommendations.

Appendix F Legend

Code	Definition
1	IOA issue.
2	IOA recommends deleting the IOA failure mode as the failure mode is non-credible.
3	IOA generated a failure mode covered by Mechanical Actuator subsystem.
4	IOA recommends generating a FMEA for the subsystem failure mode.
5	IOA agrees with the criticality identified by the NASA FMEA/CIL.
6	IOA recommends upgrading the NASA FMEA/CIL to the IOA assessed criticality level and/or redundancy screen designation.

APPENDIX F

NASA FMEA TO IOA WORKSHEET CROSS REFERENCE / RECOMMENDATIONS

IDENTIFIERS		NASA		IOA RECOMMENDATIONS *			
NASA FMEA NUMBER	IOA ASSESSMENT NO.	CRIT HW/F	SCREENS A B C	CRIT HW/F	SCREENS A B C	OTHER (SEE LEGEND CODE)	ISSUE
	PV&D-9009	/		3/3		4	X
	PV&D-9014	/		/		2	
	PV&D-9036	/		1/1		1, 4	X
	PV&D-9060	/		3/3		4	X
01-5-332401-1	PV&D-9024	3/3		/			
01-5-332401-2	PV&D-9025	3/3		/			
01-5-332401-3	PV&D-9026	3/3		/			
01-5-332403-1	PV&D-9037	1/1		/			
01-5-332404-1	PV&D-9033	2/1R	P NA P	/			
01-5-332404-4	PV&D-9034	3/3		/			
01-5-332404-5	PV&D-9035	1/1		/		5	
01-5-332404-6	PV&D-9035A	3/3		1/1		1, 6	X
01-5-332405-1	PV&D-9027	2/1R	P NA P	/			
01-5-332405-1	PV&D-9031	2/1R	P NA P	/			
01-5-332405-5	PV&D-9028	3/3		/			
01-5-332405-5	PV&D-9030	3/3		/			
01-5-332405-6	PV&D-3029	3/3		/			
01-5-332405-6	PV&D-9032	3/3		/			
01-5-332406-1	PV&D-9043	2/2		/			
01-5-332406-3	PV&D-9042	3/3		/		5	
01-5-332406-5	PV&D-9037A	3/3		1/1		1, 6	X
01-5-332408-1	PV&D-9033	2/1R	P NA P				
01-5-332408-2	PV&D-9040	3/3		/			
01-5-332408-4	PV&D-9039	3/3		/			
01-5-332408-5	PV&D-9038	2/2		/		5	
01-5-332409-1	PV&D-9040	3/3		/			
01-5-332409-4	PV&D-9039	3/3		/			
01-5-332409-5	PV&D-9041	3/3		/			

NASA FMEA TO IOA WORKSHEET CROSS REFERENCE / RECOMMENDATIONS

IDENTIFIERS		NASA		IOA RECOMMENDATIONS *			
NASA FMEA NUMBER	IOA ASSESSMENT NO.	CRIT HW/F	SCREENS A B C	CRIT HW/F	SCREENS A B C	OTHER (SEE LEGEND CODE)	ISSUE
01-5-380001-1	PV&D-9001	3/3		/			
01-5-380001-2	PV&D-9002	3/3		/			
01-5-380001-3	PV&D-9003	3/3		/			
01-5-380001-4	PV&D-9004	3/3		/			
01-5-380001-5	PV&D-9005	3/3		/			
01-5-380003-1	PV&D-9006	3/3		/			
01-5-380003-2	PV&D-9007	3/3		/			
01-5-380003-2	PV&D-9008	3/3		/			
01-5-380004-1	PV&D-9013	3/3		/			
01-5-380005-1	PV&D-9010	3/3		/			
01-5-380005-2	PV&D-9011	3/3		/			
01-5-380005-2	PV&D-9012	3/3		/			
01-5-380101-1	PV&D-9044	2/1R	F NA P	/		3, 5	
01-5-380101-1	PV&D-9057	3/3		/			
01-5-380101-2	PV&D-9045	3/3		/			
01-5-380101-2	PV&D-9056	3/3		/		3	
01-5-380109-1	PV&D-9048	2/1R	F NA P	/		3, 5	
01-5-380109-2	PV&D-9049	3/3		/		3	
01-5-380117-1	PV&D-9046	2/1R	F NA P	/		3, 5	
01-5-380117-2	PV&D-9047	3/3		/		3	
01-5-380125-1	PV&D-9050	2/1R	F NA P	/		3, 5	
01-5-380125-2	PV&D-9051	3/3		/		3	
01-5-380133-1	PV&D-9053	3/3		/		3	
01-5-380133-2	PV&D-9052	2/1R	P NA P	/		3	
01-5-380134-1	PV&D-9055	3/3		/		3	
01-5-380134-2	PV&D-9054	2/1R	P NA P	/		3	
01-5-380301-1	PV&D-9015	3/3		/			
01-5-380301-3	PV&D-9016	3/3		/			
01-5-380302-1	PV&D-9018	3/3		/			

NASA FMEA TO IOA WORKSHEET CROSS REFERENCE / RECOMMENDATIONS

IDENTIFIERS		NASA		IOA RECOMMENDATIONS *			
NASA FMEA NUMBER	IOA ASSESSMENT NUM	CRIT HW/F	SCREENS A B C	CRIT HW/F	SCREENS A B C	OTHER (SEE LEGEND CODE)	ISSUE
01-5-380302-2	PV&D-9017	3/3		/			
01-5-384051-1	PV&D-9019	3/3		/			
01-5-384051-2	PV&D-9020	3/3		/			
01-5-384051-3	PV&D-9021	3/3		/			
01-5-384052-1	PV&D-9023	3/3		/			
01-5-384052-2	PV&D-9022	3/3		/			
01-5-380001-5	PV&D-9005	3/3		/			
01-5-385001-1	PV&D-9061	1/1		/			
01-5-385001-1	PV&D-9062	1/1		/			
01-5-385002-1	PV&D-9058	3/3		/			
01-5-385002-2	PV&D-9059	3/3		/			