MCDONNELL DOUGLAS ASTRONAUTICS COMPANY
HOUSTON DIVISION

SPACE TRANSPORTATION SYSTEMS ENGINEERING AND OPERATIONS SUPPORT

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INDEPENDENT ORBITER ASSESSMENT ANALYSIS OF THE DPS SUBSYSTEM

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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 Mode and Effects Analysis / Critical Items List (FMEA/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 the Rockwell Desk Instructions 100-2G. The IOA approach features a top-down analysis of the hardware to independently determine failure modes, criticality, and potential critical items. This report documents the independent analysis results corresponding to the Orbiter Data Processing System (DPS) hardware.

The DPS hardware is required for performing critical functions of data acquisition, data manipulation, data display, and data transfer throughout the Orbiter. Specifically, the DPS hardware consists of the following components:

- Multiplexer/Demultiplexer (MDM)
- General Purpose Computer (GPC)
- Multifunction CRT Display System (MCDS)
- Data Buses and Data Bus Couplers (DBC)
- Data Bus Isolation Amplifiers (DBIA)
- Mass Memory Unit (MMU)
- Engine Interface Unit (EIU)

The IOA analysis process utilized available DPS 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 seven major subdivisions of the DPS. A summary of the number of failure modes, by criticality, is also presented below with hardware criticality first and functional criticality second.

Summary of Failure Modes By Criticality (HW/F)							
Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
Number :	0	2	0	56	22	5	85

DPS OVERVIEW ANALYSIS SUMMARY

DPS ANALYSIS SUMMARY

CRIT.	#FM	#PCI	CRIT.	#FM	#PCI
2/1R	2	2	3/2R	22	0
3/1R	56	0	3/3	5	NA

GENERAL PURPOSE COMPUTER

MULTIPLEXER/ DEMULTIPLEXER

CRIT.	#FM	#PCI
3/1R	27	0
3/2R	9	0

ENGINE INTERFACE UNIT

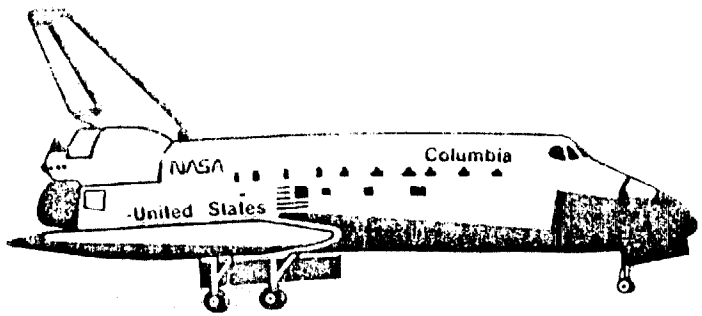
CRIT.	#FM	#PCI
3/1R	5	0
3/3	1	NA

MASS MEMORY UNIT

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

CENTRAL PROCESSING UNIT

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



DATA BUS ISOLATION AMPLIFIERS

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

DATA BUS COUPLER

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

INPUT/OUTPUT PROCESSOR

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

MULTIFUNCTION CRT DISPLAY SYSTEM

CRIT.	#FM	#PCI
3/1R	14	0
3/3	1	NA

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

Figure 1 - DPS 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 is presented as follows:

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

Due to the extensive redundancy built into the DPS the number of critical items are few. Those identified resulted from premature operation and erroneous output of the GPCs.

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 Space Transportation System (STS) Systems Office has undertaken the task of reevaluating the FMEA/CIL for the Space Shuttle design. The MDAC is providing an independent assessment of the Orbiter FMEA/CIL reevaluation results for completeness and technical accuracy.

2.2 Scope

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

2.3 Analysis Approach

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

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

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

Step 3.0 Failure events definition
- 3.1 Construct matrix of failure modes
- 3.2 Document IOA analysis results

Step 4.0 Compare IOA analysis data to Rockwell/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 DPS Ground Rules and Assumptions

The DPS ground rules and assumptions used in the IOA are defined in Appendix B. The subsystem specific ground rules were defined to limit the analysis to single-failed-parts for each failure mode. A subset of the failure mode keywords were identified for the DPS team. This allowed for commonality in the analysis results.

3.0 SUBSYSTEM DESCRIPTION

3.1 Design and Function

The DPS consists of that hardware required for data acquisition, data manipulation, data display, and data transfer on the Orbiter, and includes the five onboard computers and their interfaces. Reference Figure 2. More specifically, the DPS consists of the following components:

1. Twelve MDM units which convert and format data at the remote locations. Each MDM has internal redundancy and consists of a Multiplexer Interface Adapter (MIA), Sequential Control Unit (SCU), Input/Output Module, Analog To Digital Converter, and Power Supply. They convert and format serial digital GPC commands into parallel discrete, digital, and analog data for transfer to vehicle subsystem hardware. They also convert and format parallel discrete, digital, and analog data from vehicle subsystems into serial digital data for transmission to the GPCs. Reference Figure 3.

2. Five GPCs each consisting of a Central Processing Unit (CPU) and Input/Output Processor (IOP). The CPU functionally consists of an Arithmetic Logic Unit, Local Store, Master Bus Control Unit, Data Flow Multiplexer, Micro-code control unit, CPU Timer, Interrupt Logic, Main Memory Timing Page, Timers, Address Bus Control, Main Memory, and Power Supply. The IOP contains Control Monitor, IOP Main Memory, Channel Control, Direct Memory Access Queue, Arithmetic Logic Units, Local Store, Micro-code store and Decode, MIAs, and Time-slice and Multiplexing. One of the functions of the GPCs is to support guidance, navigation, and control requirements of the vehicle. They provide for the monitoring and control of vehicle subsystems. They also check for data transmission errors and crew input error. Vehicle system failures and out-of-tolerance conditions are annunciated by the GPCs. Reference Figure 4 and Figure 5.

3. The MCDS consisting of three Keyboard Units (KU), four Display Units (DU) and four Display Electronics Units (DEU). Each KU has a Key, Switch and Light. The DU consists of X/Y Deflection Amplifiers, Video Amplifiers, Cathode-Ray Tube, BITE and Power Supplies. The DEU has an Oscillator, Memory, Key-board Adapter, Symbol Generator, MIA, Control Logic, BITE, Load Switch, and Power Supplies. The subsystem provides for crew/vehicle interface via a keyboard and CRT display. The crew can interact with the subsystems with keyboard entries and executions. Reference Figure 6 and Figure 7.

4. Thirty serial digital data buses are connected to the Bus Terminal Units (BTUs) via 227 DBCs. The DBCs are shown in Figure 8.

5. Two DBIAs provide the amplification necessary to drive the stubs and provide isolation when the stubs are opened or shorted at the umbilicals.

6. Two MMUs containing MIAs, Read Electronics, Write Electronics, Mass Memory Control Logic, Power Supply with Switch, Tape Transport Mechanism with a motor, tape and heads. The mass memory unit stores programs for loading into the GPCs and the MCDS. Reference Figure 9.

7. Three EIUs which provide status and command capability of the main engines. The EIU contains an MIA, BITE, Status Buffer, Controller Interface Adapter, Operational Interface Element, Data Status and Power Supply. The EIU transfers main engine control commands from the GPC and main engine status for use by the GPC, the GSE launch processing system, and the operational instrumentation system. Reference Figure 10.

The DPS interfaces with many onboard Orbiter systems including the Main Propulsion System, Solid Rocket Boosters, Reaction Control System (RCS), Orbital Maneuvering System (OMS), Air Surface Controls used for guidance and control, Nose-wheel Steering, and the Master Timing Units.

3.2 Interfaces and Locations

The DPS hardware is located throughout the Orbiter. The composite data bus network provides the hardware interfaces between the GPCs and all other avionics subsystems that communicate via a digital data format. Reference Figure 11. GPCs 1 and 4 are located in Avionics Bay 1 while GPCs 2 and 5 are located in Avionics Bay 2, to provide separation of redundancy. GPC 3 is located in Avionics Bay 3. Each GPC interfaces to all Flight Critical MDMs, however only one GPC normally communicates to only one FF and one FA MDM during ascent and entry dynamic flight.

3.3 Hierarchy

Figure 2 illustrates the hierarchy of the DPS hardware and the corresponding subcomponents. Figures 3 through 10 comprise the detailed system representations.

DATA PROCESSING SUBSYSTEM OVERVIEW

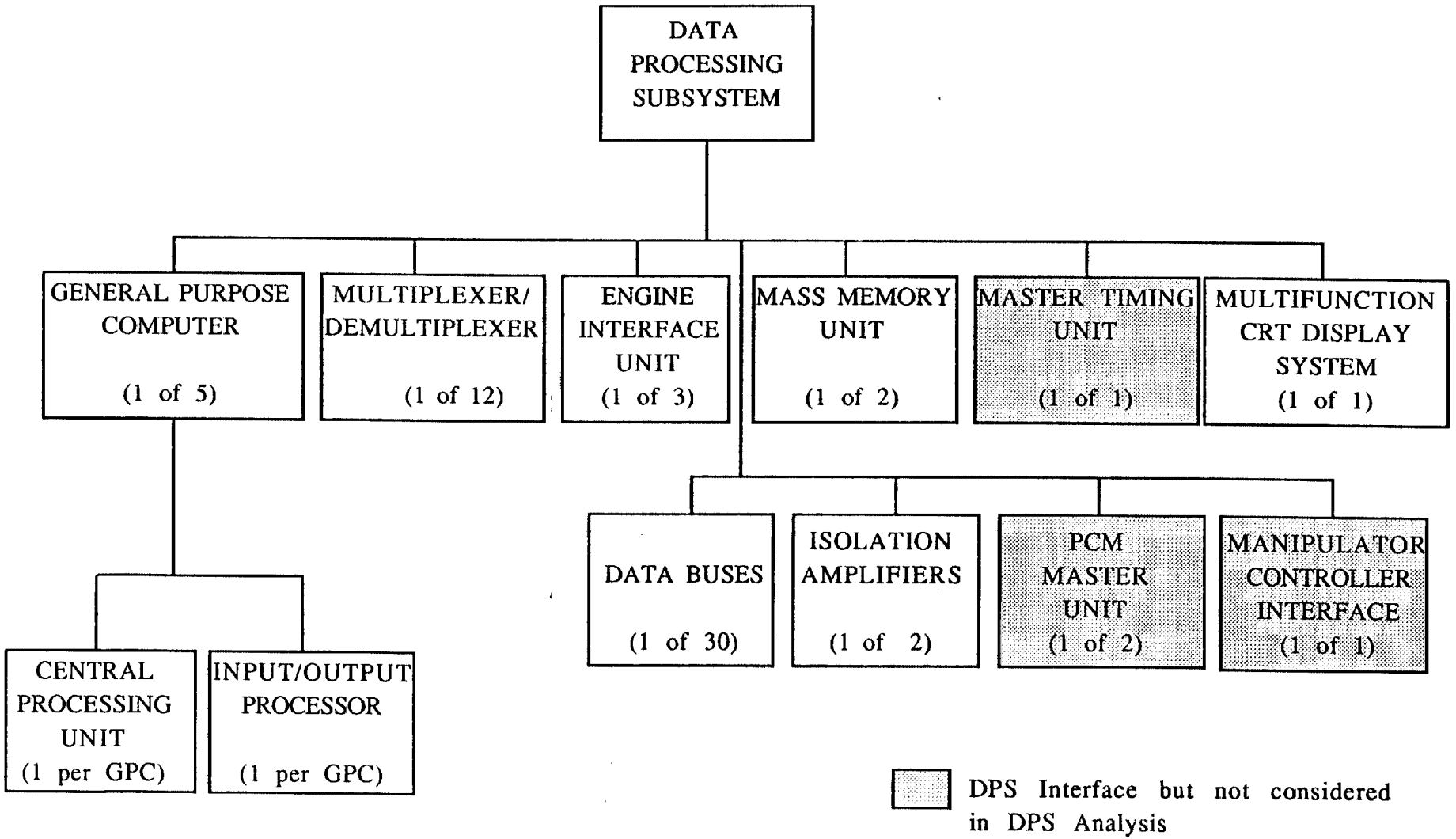


Figure 2 - DPS SUBSYSTEM OVERVIEW

DPS MULTIPLEXER/DEMULTIPLEXER

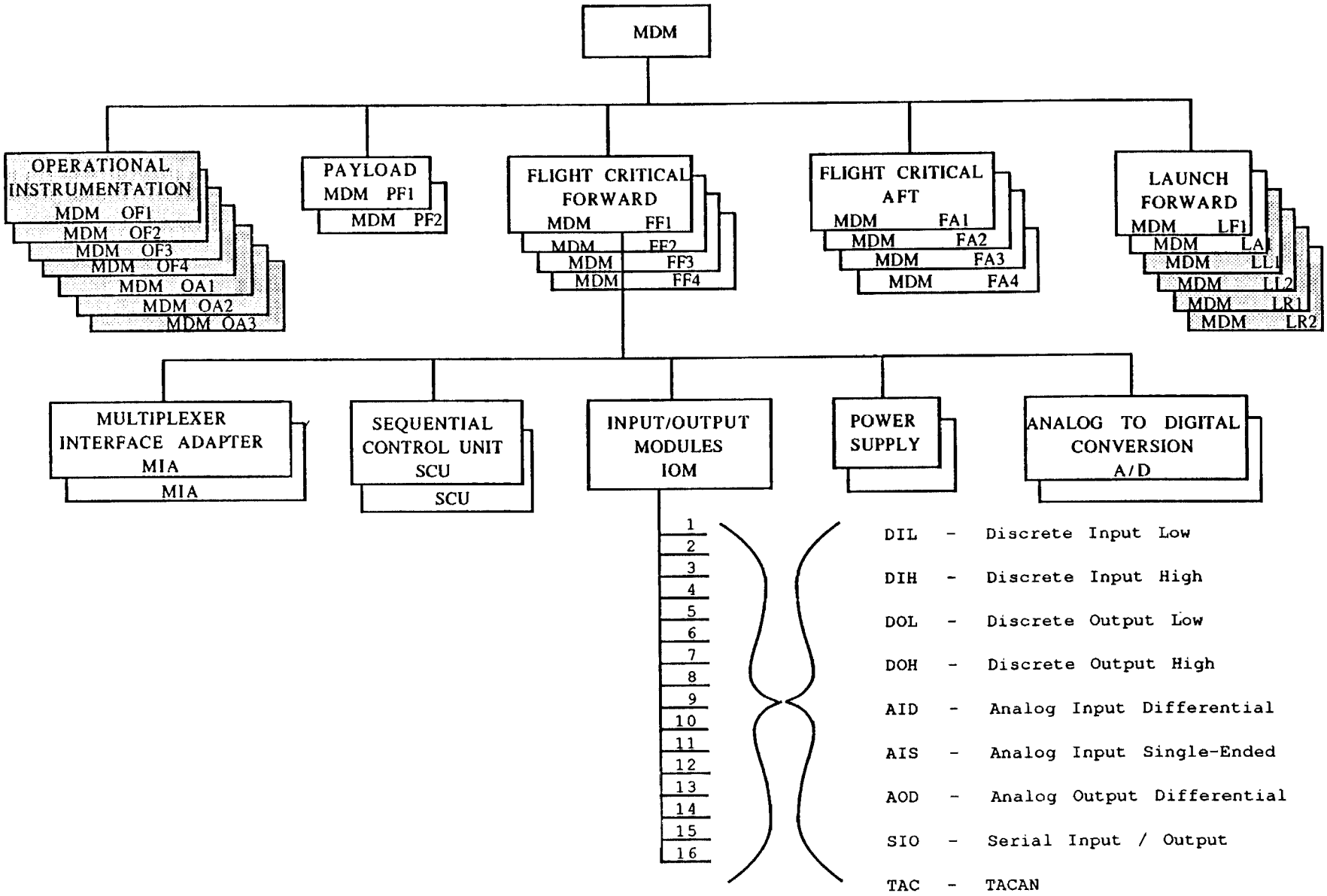


Figure 3 - DPS MULTIPLEXER/DEMULTIPLEXER (MDM)

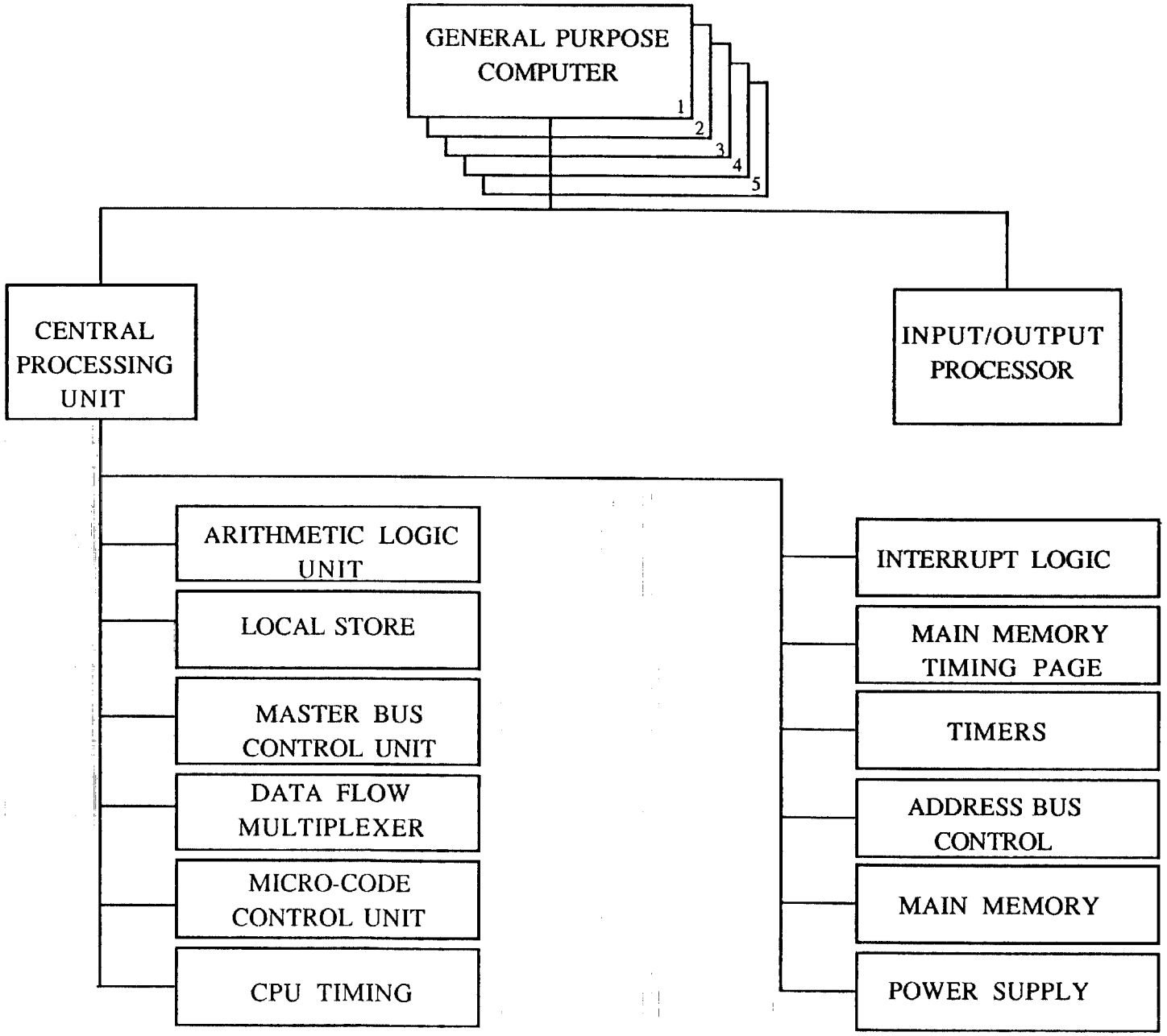


Figure 4 - DPS GPC CENTRAL PROCESSING UNIT (CPU)

DPS GPC - INPUT/OUTPUT PROCESSOR

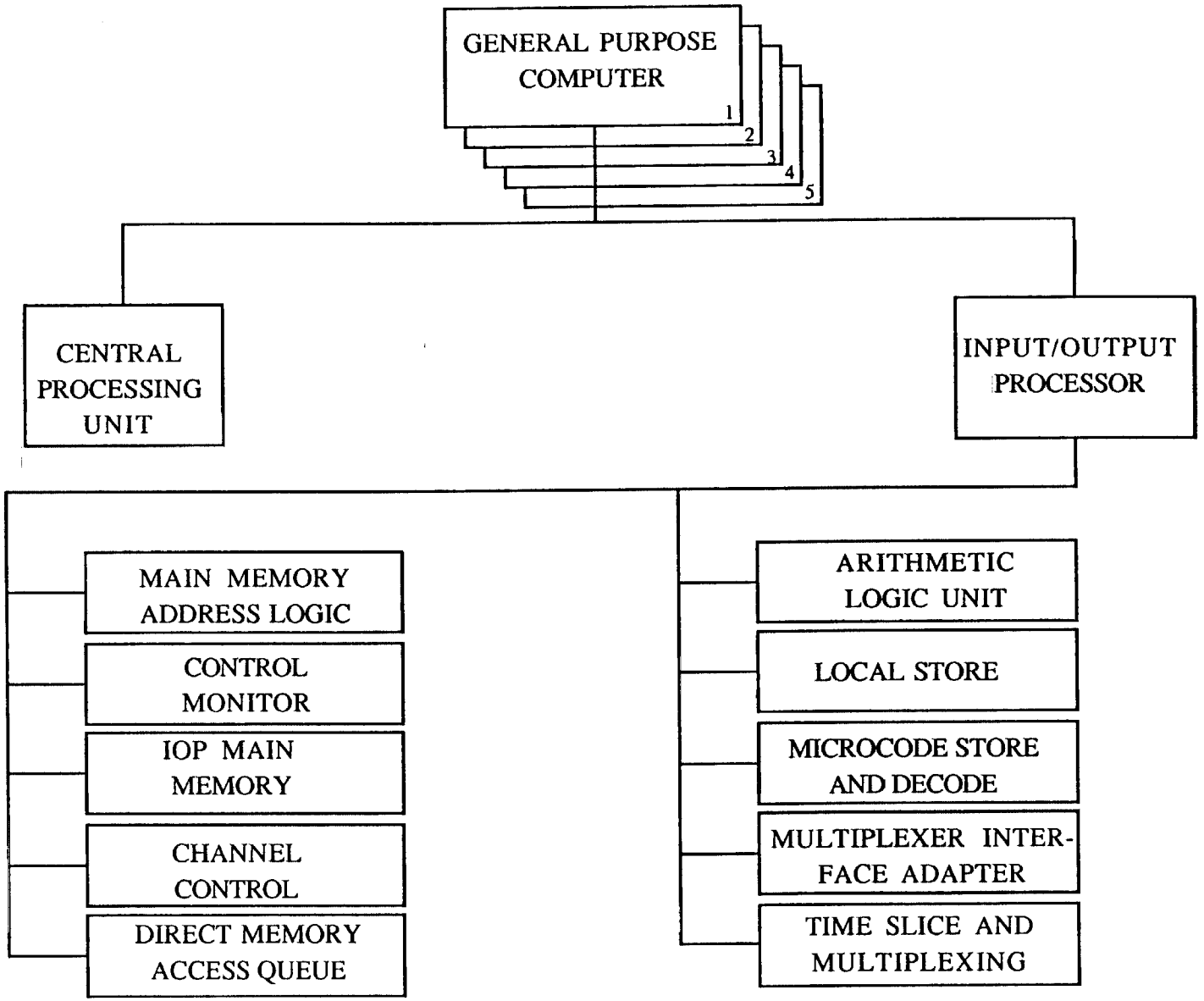


Figure 5 - DPS GPC INPUT/OUTPUT PROCESSOR (IOP)

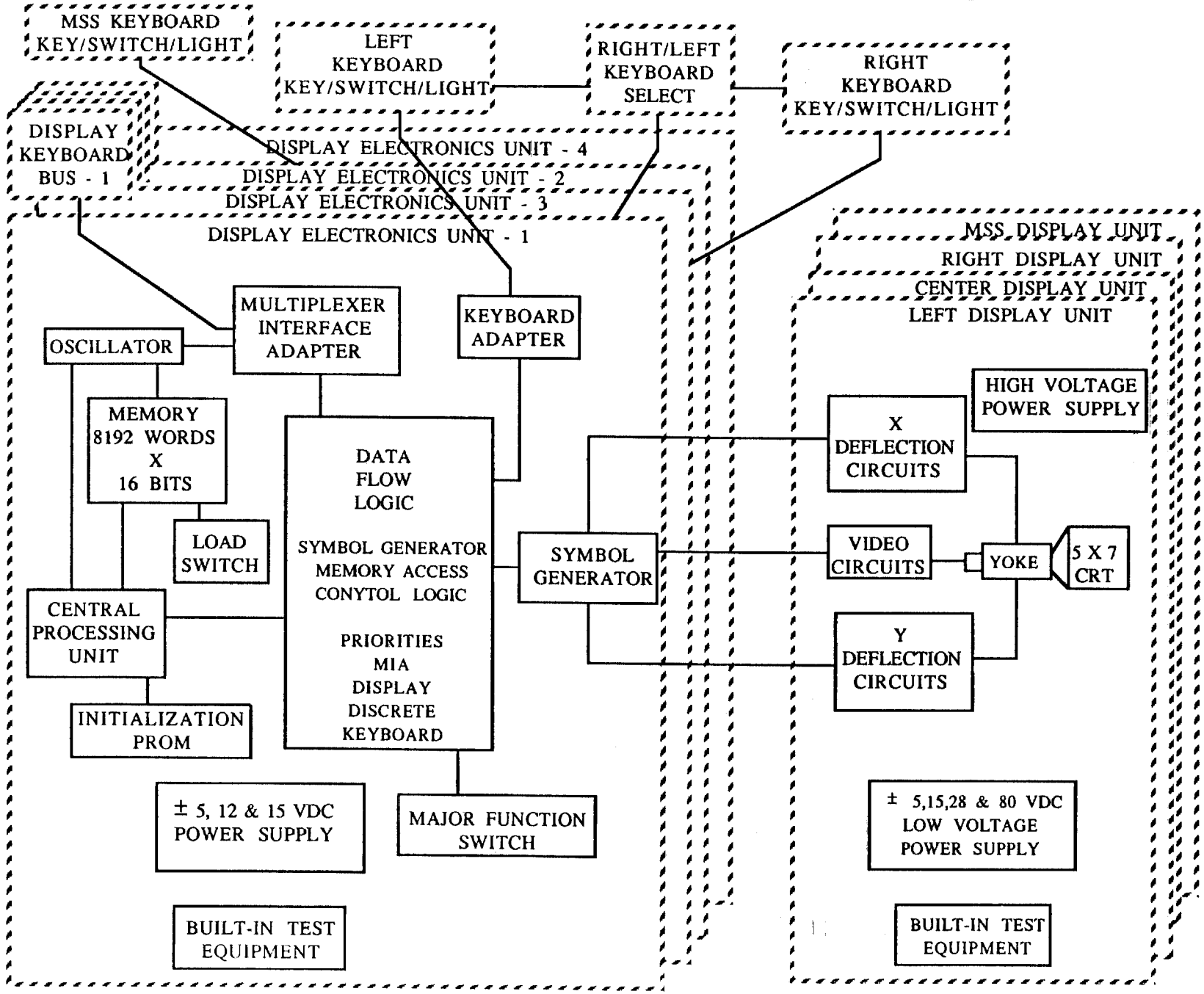


Figure 6 - DPS MCDS FUNCTIONAL BLOCK DIAGRAM

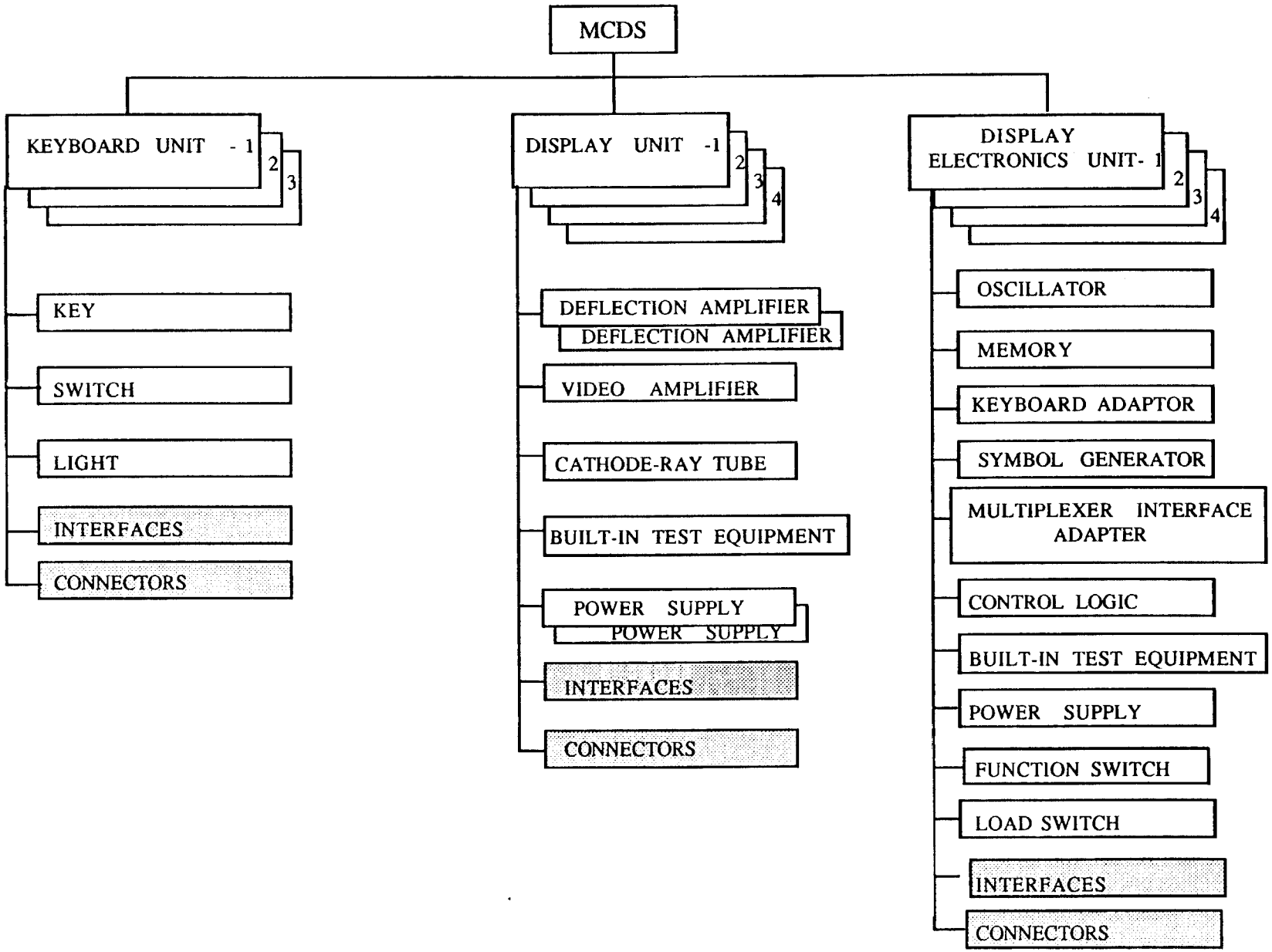
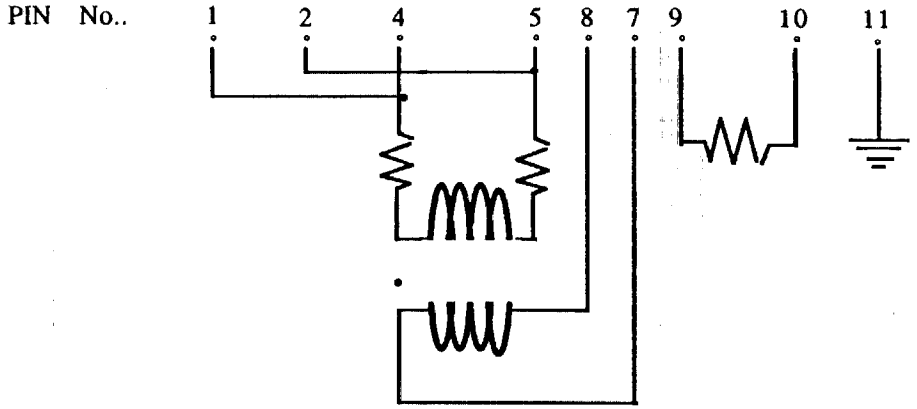


Figure 7 - DPS MCDS

DPS DATA BUS COUPLERS



QUANTITY	DATA BUS	QUANTITY	DATA BUS
6	DISPLAY/KEYBOARD-1	5	INTER-COMPUTER-4
7	DISPLAY/KEYBOARD-2	5	INTER-COMPUTER-5
6	DISPLAY/KEYBOARD-3	3	INSTRUMENTATION/PCMMU-1
7	DISPLAY/KEYBOARD-4	3	INSTRUMENTATION/PCMMU-2
11	FLIGHT CRITICAL-1	3	INSTRUMENTATION/PCMMU-3
11	FLIGHT CRITICAL-2	3	INSTRUMENTATION/PCMMU-4
11	FLIGHT CRITICAL-3	3	INSTRUMENTATION/PCMMU-5
11	FLIGHT CRITICAL-4	16	LAUNCH/BOOST-1
12	FLIGHT CRITICAL-5	16	LAUNCH/BOOST-2
12	FLIGHT CRITICAL-6	6	MASS MEMORY-1
12	FLIGHT CRITICAL-7	6	MASS MEMORY-2
12	FLIGHT CRITICAL-8	4	PAYLOAD INTERFACE-1
5	INTER-COMPUTER-1	4	PAYLOAD INTERFACE-2
5	INTER-COMPUTER-2	9	PAYLOAD-1
5	INTER-COMPUTER-3	8	PAYLOAD-2

Figure 8 - DPS DATA BUS COUPLERS (DBC)

DPS MASS MEMORY UNIT

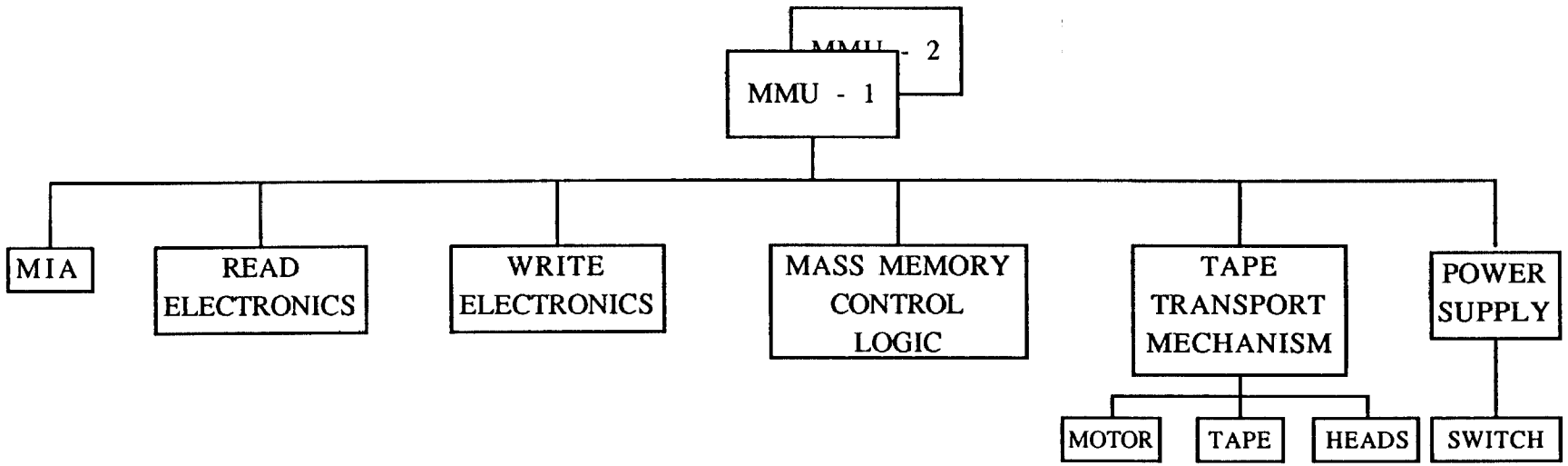


Figure 9 - DPS MASS MEMORY UNIT (MMU)

DPS ENGINE INTERFACE UNIT

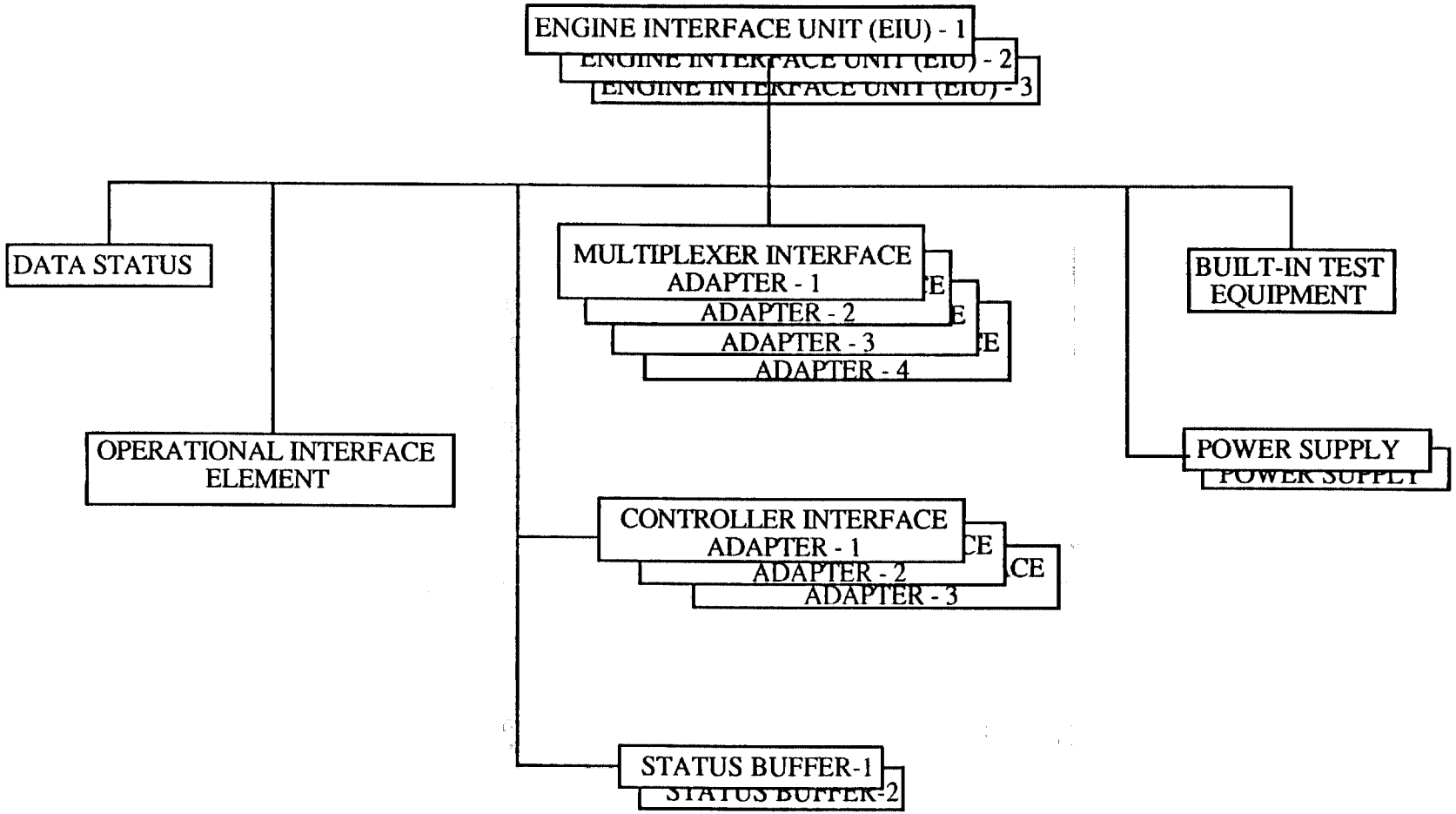


Figure 10 - DPS ENGINE INTERFACE UNIT (EIU)

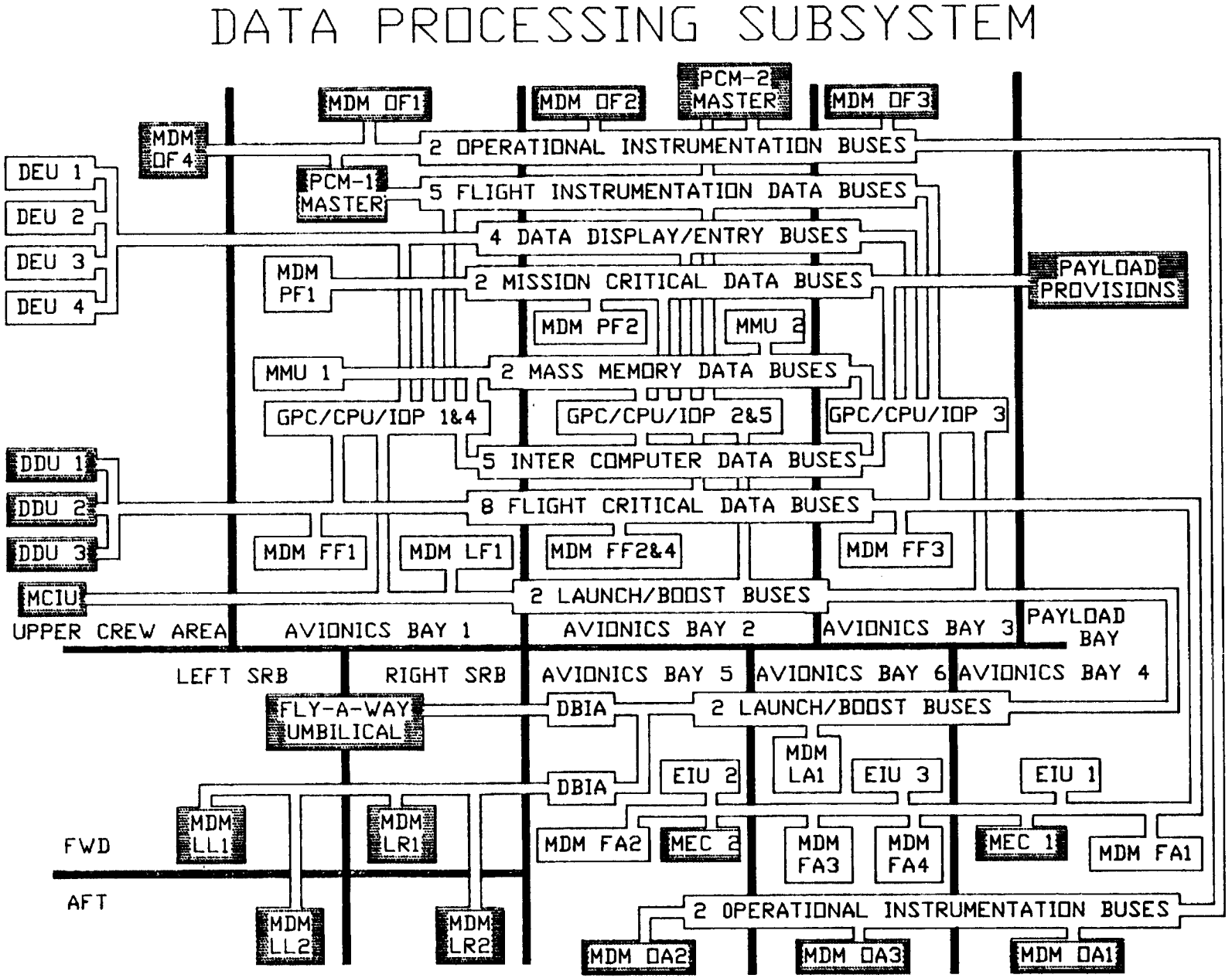


Figure 11 - DATA PROCESSING SUBSYSTEM (DPS)

4.0 ANALYSIS RESULTS

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

TABLE I Summary of Possible Failure Modes and Criticalities

Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
MDM	-	-	-	27	9	-	36
GPC	-	2	-	9	-	2	13
MCDS	-	-	-	14	-	1	15
DBC	-	-	-	1	-	-	1
DBIA	-	-	-	-	1	-	1
MMU	-	-	-	-	12	1	13
EIU	-	-	-	5	-	1	6
TOTAL	0	2	0	56	22	5	85

Of the 85 failure modes analyzed, no single failures were determined to result in loss of crew or vehicle, and two were determined to result in loss of mission. 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 Potential Critical Items

Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
GPC	-	2	-	-	-	-	2

4.1 Analysis Results MDM

The MDM analysis considered nine failure modes for four groups of MDMs; namely FF, FA, PF, LF/LA as illustrated in Figure 3. Most of the criticalities were 3/1R. No PCIs were found.

4.2 Analysis Results GPC

The GPC analysis was subdivided into IOP and CPU failures. Generic black box failures were analyzed with causes stemming from failures of the subcomponents such as the MIA, as shown in Figure 4 and Figure 5. Two PCIs were identified and are listed in Appendix D.

4.3 Analysis Results MCDS

The MCDS consists of the KU, DU, and DEU. Functional failures of components were analyzed. These components are shown functionally in Figure 6 and Figure 7. Nine failure modes were identified and fifteen worksheets were generated. No PCIs were identified.

4.4 Analysis Results DBC

Thirty serial digital data buses connect the GPC IOPs to the BTUs via 227 DBCs. The DBCs functional components are shown in Figure 8. Two failure modes were identified and one worksheet was generated. No PCIs were identified.

4.5 Analysis Results DBIA

The DBIAs consist of components required to provide isolation between the Orbiter Launch/Boost Data Buses and the SRBs and associated GSE for each. Four failure modes were identified and one worksheet was generated. No PCIs were identified.

4.6 Analysis Results MMU

The MMU analysis investigated failures in the individual components of power supply, read and write electronics, tape transport mechanism, MIA and control logic. These are shown functionally in Figure 9. The power switch and RPC were also investigated. Most of the failures were criticality 3/2R. No PCIs were identified.

4.7 Analysis Results EIU

The EIU provides commands to and status of the Main Engines. There were no failure modes analyzed that resulted in a PCI being defined. The EIU is shown functionally in Figure 10.

5.0 REFERENCES

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

1. ICD 13M15000, Vehicle/Main Engine Interface Control Document, Rev. U, 6-18-85
2. JSC-18819, DPS Console Handbook, 8-1-84
3. JSC-19041, MPS System Briefs, 10-1-84
4. JSC-18820, DPS System Briefs, 4-20-85
5. VS70-971102, Integrated System Schematic Rev. D, 9-28-85
6. JSC-17239, Booster Console Handbook, 10-17-85
7. JSC-12770, Shuttle Flight Operations Manual, Volume 5, Data Processing System, 3-24-84
8. JSC 12820, STS Operational Flight Rules, Final PCN-3, 6-28-85
9. JSC 11174, Space Shuttle Systems Handbook, Rev. C, DCN-5, 9-13-85
10. 100-2G, Rockwell International Reliability Desk Instruction Flight Hardware FMEA and CIL, 1-31-84
11. V72 Vol III, Operations and Maintenance Requirements and Specification Document - Orbiter OMRSD - DPS, 6-13-86

APPENDIX A
ACRONYMS

A/D - Analog to Digital
AID - Analog Input Differential
AIS - Analog Input Single-ended
ALU - Arithmetic Logic Unit
AOA - Abort Once Around
AOD - Analog Output Differential
ATO - Abort To Orbit
BFC - Backup Flight Controller
BFS - Backup Flight System
BITE - Built-In Test Equipment
BSS - Backup System Services
BTU - Bus Terminal Unit
CIL - Critical Items List
CPU - Central Processing Unit
CRIT - Criticality
CRT - Cathode Ray Tube
C&W - Caution and Warning System
DBC - Data Bus Coupler
DBIA - Data Bus Isolation Amplifier
DDU - Display Driver Unit
DEU - Display Electronics Unit
DIH - Discrete Input High
DIL - Discrete Input Low
DMA - Direct Memory Access
DOH - Discrete Output High
DOL - Discrete Output Low
DPS - Data Processing System
DU - Display Unit
EIU - Engine Interface Unit
EVA - Extra Vehicular Activity
FA - Flight Aft
FCOS - Flight Control Operating System
FF - Flight Forward
FM - Failure Mode
FMEA - Failure Mode and Effects Analysis
GPC - General Purpose Computer
GSE - Ground Support Equipment
IMU - Inertial Measurement Unit
IOA - Independent Orbiter Assessment
IOM - Input/Output Module
IOP - Input/Output Processor
IPL - Initial Program Load
KU - Keyboard Unit
LF - Launch Forward
LL - Launch Left
LPS - Launch Processing System
LR - Launch Right
LRU - Line Replaceable Unit
MC - Memory Configuration
MCDS - Multifunction CRT Display System
MCIU - Manipulator Controller Interface Unit

MDAC - McDonnell Douglas Astronautics Company
MDM - Multiplexer/Demultiplexer
MEC - Main Engine Controller
MIA - Multiplexer Interface Adapter
MM - Major Mode
MMU - Mass Memory Unit
MTU - Master Timing Unit
NA - Not Applicable
NASA - National Aeronautics and Space Administration
NSTS - National Space Transportation System
OA - Operational Aft
OF - Operational Forward
OMRSD - Operational Maintenance Requirements and Specifications Document
OMS - Orbital Maneuvering System
OPS - Operational Sequence
PCI - Potential Critical Item
PCM - Pulse Code Modulation
PF - Payload Forward
RCS - Reaction Control System
RHC - Rotational Hand Controller
RI - Rockwell International
RM - Redundancy Management
RMS - Remote Manipulator System
RPC - Remote Power Controller
RS - Redundant Set
RTLS - Return To Landing Site
SCU - Sequential Control Unit
SIO - Serial Input / Output
SM - Systems Management
SRB - Solid Rocket Booster
SSME - Space Shuttle Main Engine
STS - Space Transportation System
SW - Software
TAC - Tacan
TAL - Transatlantic Abort Landing
TD - Touch Down
THC - Translational Hand Controller
VDC - Volts Direct Current

APPENDIX B

DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

APPENDIX B
DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.1 Definitions

Definitions contained in Reliability Desk Instruction, 100-2G Rockwell International, 31 January 1984, were used with the following amplifications and additions.

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 To Orbit (ATO) and ends upon transition out of OPS 1.

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.

EFFECTS/RATIONALE - Description of the case which generated the highest criticality.

HIGHEST CRITICALITY - The highest criticalities 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 such as launch window, orbit phasing, and altitude.

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

NORMAL GROUND TURNAROUND - begins at end of post-landing safing operations and ends at beginning of prelaunch operations.

OPS - software operational sequence.

PHASE DEFINTIONS:

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

LIFTOFF MISSION PHASE - begins with 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 upon 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 at landing site.

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

READILY DETECTABLE - easily and obviously observable and comprehensable by flight and/or ground personnel. Readily detectable requires the capability of getting a crewmember to respond to a problem notification via real-time monitored displays, on-board alerts, visual indications, or ground notification. (Ground notification must not be considered unless sufficient time is available to perform corrective action to preclude the critical consequences of the failure, using worst-case telemetry and data.)

B.2 IOA Project Level Ground Rules and Assumptions

The philosophy embodied in Reliability Desk Instruction, 100-2G Rockwell International, 31 January 1984, 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 Lift-Off, 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 availibility and/or the actual monitoring by on-board personnel 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 MDAC IOA analysis results with other analyses requires that both analyses be performed to a comparable level of detail.

7. The presence of a failure detectability parameter in telemetry is sufficient justification for passing Redundancy Screen B. Verification that the parameter is actually monitored 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. For the purpose of passing Redundancy Screen A, the term "normal ground turnaround" shall include the prelaunch mission phase.

RATIONALE: Some items cannot be checked out until after propellant loading or main engine conditioning begins although the vehicle is still on the ground. This philosophy was adopted by the Level II PRCB.

9. At a minimum, loss of mission is declared when a failure results in a launch delay beyond the pre-planned launch window.

RATIONALE: Subsystem failures can occur near the nominal launch time. When these failures result in a launch delay, a loss of mission occurs even though the vehicle never enters into any in-flight mode.

10. 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, whatever produces the worst case effects for the phase of interest.

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

11. The "Next Related Failure" when used in determining hardware criticality 2 (one failure away from loss of crew/vehicle) is defined as the worst case failure of next redundant item. This definiton applies only to dual redundancy by definition.

RATIONALE: The RI Desk Instruction Appendix B, 3.1.1.1 states the definiton of criticality 2. For the purpose of this analysis "Next related Failure" is clearly defined to ensure project consistancy.

B.3 DPS-Specific Ground Rules and Assumptions

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

1. Electronics were considered to have the following credible failure modes.

   a. Premature operation
   b. Erroneous/erratic output
   c. No output

   RATIONALE: These failure mode keywords were the most applicable for the DPS electronics hardware.

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: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 100 ABORT: 3/1R

ITEM: MDM FF1,FF2,FF3,FF4
FAILURE MODE: LOSS OF OUTPUT TO GPC

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) FLIGHT CRITICAL FORWARD MDM (FF1..4)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2,3,2
PART NUMBER: MC615-0004-6110,5110

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS SETS COMMFAULT FLAG FOR THAT DATA. APPLICATION SW IGNORES THAT DATA. FCOS BYPASSES MDM AFTER 2ND CONSECUTIVE COMMFAULT, AND DISPLAYS FAULT MSG ON CRTS. PORT MODING MAY RECOVER MDM, BUT NOT ALLOWED DURING ASCENT UNTIL AFTER 2ND MDM FAILURE. IF ALL REDUNDANCY FAILS, LOSE USE OF IMU TORQUING, FORWARD RCS JETS, HAND CONTROLS (THC,RHC), MOST SWITCHES AND INDICATORS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 101 ABORT: 3/1R

ITEM: MDM FF1,FF2,FF3,FF4
FAILURE MODE: LOSS OF OUTPUT TO LRU

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) FLIGHT CRITICAL FORWARD MDM (FF1..4)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2,3,2
PART NUMBER: MC615-0004-6110,5110

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS DOES NOT DIRECTLY DETECT THIS ERROR VIA MDM RETURN WORD PROCESSING. FAULT TOLERANCE DEPENDS ON REDUNDANT STRINGS TO VOTING LRUS. DETECTION DEPENDS ON SEPARATE, REDUNDANT FEEDBACK SIGNALS. IF ALL REDUNDANCY FAILS, LOSE USE OF IMU TORQUING, FORWARD RCS JETS, HAND CONTROLS (THC,RHC), MOST SWITCHES AND INDICATORS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 102 ABORT: 3/1R

ITEM: MDM FF1,FF2,FF3,FF4
FAILURE MODE: ERRONEOUS OUTPUT TO GPC

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) FLIGHT CRITICAL FORWARD MDM (FF1..4)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2,3,2
PART NUMBER: MC615-0004-6110,5110

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS SETS COMMFAULT FLAG FOR THAT DATA. APPLICATION SW IGNORES THAT DATA. FCOS BYPASSES MDM AFTER 2ND CONSECUTIVE COMMFAULT, AND DISPLAYS FAULT MSG ON CRTS. PORT MODING MAY RECOVER MDM, BUT NOT ALLOWED DURING ASCENT UNTIL AFTER 2ND MDM FAILURE. IF ALL REDUNDANCY FAILS, LOSE USE OF IMU TORQUING, FORWARD RCS JETS, HAND CONTROLS (THC,RHC), MOST SWITCHES AND INDICATORS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 103 ABORT: 3/1R

ITEM: MDM FF1,FF2,FF3,FF4
FAILURE MODE: ERRONEOUS OUTPUT TO LRU

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) FLIGHT CRITICAL FORWARD MDM (FF1..4)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2,3,2
PART NUMBER: MC615-0004-6110,5110

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS DOES NOT DIRECTLY DETECT THIS ERROR VIA MDM RETURN WORD PROCESSING. FAULT TOLERANCE DEPENDS ON REDUNDANT STRINGS TO VOTING LRUS. DETECTION DEPENDS ON SEPARATE, REDUNDANT FEEDBACK SIGNALS. IF ALL REDUNDANCY FAILS, LOSE USE OF IMU TORQUING, FORWARD RCS JETS, HAND CONTROLS (THC,RHC), MOST SWITCHES AND INDICATORS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 104 ABORT: 3/1R

ITEM: MDM FF1,FF2,FF3,FF4
FAILURE MODE: PREMATURE OPERATION TO GPC

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) FLIGHT CRITICAL FORWARD MDM (FF1..4)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2,3,2
PART NUMBER: MC615-0004-6110,5110

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
THIS FAILURE ON EITHER PORT CAN INTERFERE WITH FCOS RETURNING DATA FROM OTHER BTU(S) AND CAUSE HEALTHY BTU(S) TO BE BYPASSED. PORT MODING WILL NOT FIX A BLABBING MDM. POWER CYCLING MAY RESET ELECTRONICS, BUT CANNOT BE PERFORMED DURING ASCENT (POWER SWITCHES CANNOT BE REACHED), AND WILL NOT ALWAYS STOP PREMATURE OPERATIONS. IF ALL REDUNDANCY FAILS, LOSE USE OF IMU TORQUING, FORWARD RCS JETS, HAND CONTROLS (THC,RHC), MOST SWITCHES AND INDICATORS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 105 ABORT: 3/1R

ITEM: MDM FF1,FF2,FF3,FF4
FAILURE MODE: PREMATURE OPERATION TO LRU

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) FLIGHT CRITICAL FORWARD MDM (FF1..4)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2,3,2
PART NUMBER: MC615-0004-6110,5110

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS DOES NOT DIRECTLY DETECT THIS ERROR VIA MDM RETURN WORD PROCESSING. FAULT TOLERANCE DEPENDS ON REDUNDANT STRINGS TO VOTING LRUS. DETECTION DEPENDS ON SEPARATE, REDUNDANT FEEDBACK SIGNALS. IF ALL REDUNDANCY FAILS, LOSE USE OF IMU TORQUING, FORWARD RCS JETS, HAND CONTROLS (THC,RHC), MOST SWITCHES AND INDICATORS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 106 ABORT: 3/1R

ITEM: MDM FF1,FF2,FF3,FF4
FAILURE MODE: SELECTED ALL CHANNELS WRONG

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) FLIGHT CRITICAL FORWARD MDM (FF1..4)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2,3,2
PART NUMBER: MC615-0004-6110,5110

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
THE GPC'S FCOS AND THE LRUS WOULD REJECT ALL DATA FROM THAT MDM EXCEPT ANY DATA THAT HAPPENED TO BE IN THE SAME FORMAT AS THE EXPECTED DATA. REDUNDANCY MGT. SOON DETECTS AND BYPASSES THAT MDM, AND THE EFFECTS OF WRONG DATA INPUT OR OUTPUT IS MINIMIZED. IF ALL REDUNDANCY FAILS, LOSE USE OF IMU TORQUING, FORWARD RCS JETS, HAND CONTROLS (THC,RHC), MOST SWITCHES AND INDICATORS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 107 ABORT: 3/1R

ITEM: MDM FF1,FF2,FF3,FF4
FAILURE MODE: STUCK ON A CONSTANT OUTPUT TO LRU

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) FLIGHT CRITICAL FORWARD MDM (FF1..4)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2,3,2
PART NUMBER: MC615-0004-6110,5110

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS DOES NOT DIRECTLY DETECT THIS ERROR VIA MDM RETURN WORD PROCESSING. FAULT TOLERANCE DEPENDS ON REDUNDANT STRINGS TO VOTING LRUS. DETECTION DEPENDS ON SEPARATE, REDUNDANT FEEDBACK SIGNALS. IF ALL REDUNDANCY FAILS, LOSE USE OF IMU TORQUING, FORWARD RCS JETS, HAND CONTROLS (THC,RHC), MOST SWITCHES AND INDICATORS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 108 ABORT: 3/1R

ITEM: MDM FF1,FF2,FF3,FF4
FAILURE MODE: FALSELY STUCK ON BUSY MODE

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) FLIGHT CRITICAL FORWARD MDM (FF1..4)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2,3,2
PART NUMBER: MC615-0004-6110,5110

CAUSES: VIBRATION, CORROSION, CONTAMINATION, SCU BUSY CROSS-STRAP STUCK HIGH

EFFECTS/RATIONALE:
FCOS SETS COMMFAULT FLAG FOR THAT DATA. APPLICATION SW IGNORES THAT DATA. FCOS BYPASSES MDM AFTER 2ND CONSECUTIVE COMMFAULT, AND DISPLAYS FAULT MSG ON CRTS. PORT MODING MAY RECOVER MDM, BUT NOT ALLOWED DURING ASCENT UNTIL AFTER 2ND MDM FAILURE. IF ALL REDUNDANCY FAILS, LOSE USE OF IMU TORQUING, FORWARD RCS JETS, HAND CONTROLS (THC,RHC), MOST SWITCHES AND INDICATORS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 120 ABORT: 3/1R

ITEM: MDM FA1,FA2,FA3,FA4
FAILURE MODE: LOSS OF OUTPUT TO GPC

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) FLIGHT CRITICAL AFT MDM (FA1..4)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 4,5,6,6
PART NUMBER: MC615-0004-6110,5110

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS SETS COMMFAULT FLAG FOR THAT DATA. APPLICATION SW IGNORES THAT DATA. FCOS BYPASSES MDM AFTER 2ND CONSECUTIVE COMMFAULT, AND DISPLAYS FAULT MSG ON CRTS. PORT MODING MAY RECOVER MDM, BUT NOT ALLOWED DURING ASCENT UNTIL AFTER 2ND MDM FAILURE. IF ALL REDUNDANCY FAILS, LOSE USE OF AFT RCS, BODY FLAP, AILERONS, RUDDER, SPEEDBRAKE, AND ABILITY TO PURGE SSMES AND TANKS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 121 ABORT: 3/1R

ITEM: MDM FA1,FA2,FA3,FA4
FAILURE MODE: LOSS OF OUTPUT TO LRU

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) FLIGHT CRITICAL AFT MDM (FA1..4)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 4,5,6,6
PART NUMBER: MC615-0004-6110,5110

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS DOES NOT DIRECTLY DETECT THIS ERROR VIA MDM RETURN WORD PROCESSING. FAULT TOLERANCE DEPENDS ON REDUNDANT STRINGS TO VOTING LRUS. DETECTION DEPENDS ON SEPARATE, REDUNDANT FEEDBACK SIGNALS. IF ALL REDUNDANCY FAILS, LOSE USE OF AFT RCS, BODY FLAP, AILERONS, RUDDER, SPEEDBRAKE, AND ABILITY TO PURGE SSMES AND TANKS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 122 ABORT: 3/1R

ITEM: MDM FA1,FA2,FA3,FA4
FAILURE MODE: ERRONEOUS OUTPUT TO GPC

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) FLIGHT CRITICAL AFT MDM (FA1..4)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 4,5,6,6
PART NUMBER: MC615-0004-6110,5110

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS SETS COMMFAULT FLAG FOR THAT DATA. APPLICATION SW IGNORES THAT DATA. FCOS BYPASSES MDM AFTER 2ND CONSECUTIVE COMMFAULT, AND DISPLAYS FAULT MSG ON CRTS. PORT MODING MAY RECOVER MDM, BUT NOT ALLOWED DURING ASCENT UNTIL AFTER 2ND MDM FAILURE. IF ALL REDUNDANCY FAILS, LOSE USE OF AFT RCS, BODY FLAP, AILERONS, RUDDER, SPEEDBRAKE, AND ABILITY TO PURGE SSMES AND TANKS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 123 ABORT: 3/1R

ITEM: MDM FA1,FA2,FA3,FA4
FAILURE MODE: ERRONEOUS OUTPUT TO LRU

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) FLIGHT CRITICAL AFT MDM (FA1..4)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 4,5,6,6
PART NUMBER: MC615-0004-6110,5110

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS DOES NOT DIRECTLY DETECT THIS ERROR VIA MDM RETURN WORD PROCESSING. FAULT TOLERANCE DEPENDS ON REDUNDANT STRINGS TO VOTING LRUS. DETECTION DEPENDS ON SEPARATE, REDUNDANT FEEDBACK SIGNALS. IF ALL REDUNDANCY FAILS, LOSE USE OF AFT RCS, BODY FLAP, AILERONS, RUDDER, SPEEDBRAKE, AND ABILITY TO PURGE SSMES AND TANKS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 124 ABORT: 3/1R

ITEM: MDM FA1,FA2,FA3,FA4
FAILURE MODE: PREMATURE OPERATION TO GPC

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) FLIGHT CRITICAL AFT MDM (FA1..4)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 4,5,6,6
PART NUMBER: MC615-0004-6110,5110

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
THIS FAILURE ON EITHER PORT CAN INTERFERE WITH FCOS RETURNING DATA FROM OTHER BTU(S) AND CAUSE GOOD BTU(S) TO BE BYPASSED. PORT MODING WILL NOT FIX A BLABBING MDM. POWER CYCLING MAY RESET ELECTRONICS, BUT CANNOT BE PERFORMED DURING ASCENT (POWER SWITCHES CANNOT BE REACHED), AND WILL NOT ALWAYS STOP PREMATURE OPERATIONS. IF ALL REDUNDANCY FAILS, LOSE USE OF AFT RCS, BODY FLAP, AILERONS, RUDDER, SPEEDBRAKE, AND ABILITY TO PURGE SSMES AND TANKS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 125 ABORT: 3/1R

ITEM: MDM FA1,FA2,FA3,FA4
FAILURE MODE: PREMATURE OPERATION TO LRU

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) FLIGHT CRITICAL AFT MDM (FA1..4)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 4,5,6,6
PART NUMBER: MC615-0004-6110,5110

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS DOES NOT DIRECTLY DETECT THIS ERROR VIA MDM RETURN WORD PROCESSING. FAULT TOLERANCE DEPENDS ON REDUNDANT STRINGS TO VOTING LRUS. DETECTION DEPENDS ON SEPARATE, REDUNDANT FEEDBACK SIGNALS. IF ALL REDUNDANCY FAILS, LOSE USE OF AFT RCS, BODY FLAP, AILERONS, RUDDER, SPEEDBRAKE, AND ABILITY TO PURGE SSMES AND TANKS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 126 ABORT: 3/1R

ITEM: MDM FA1,FA2,FA3,FA4
FAILURE MODE: SELECTED ALL CHANNELS WRONG

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) FLIGHT CRITICAL AFT MDM (FA1..4)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 4,5,6,6
PART NUMBER: MC615-0004-6110,5110

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
THE GPC'S FCOS AND THE LRUS WOULD REJECT ALL DATA FROM THAT MDM EXCEPT ANY DATA THAT HAPPENED TO BE IN THE SAME FORMAT AS THE EXPECTED DATA. REDUNDANCY MGT. SOON DETECTS AND BYPASSES THAT MDM, AND THE EFFECTS OF WRONG DATA INPUT OR OUTPUT IS MINIMIZED. IF ALL REDUNDANCY FAILS, LOSE USE OF AFT RCS, BODY FLAP, AILERONS, RUDDER, SPEEDBRAKE, AND ABILITY TO PURGE SSMES AND TANKS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86
SUBSYSTEM: DPS
MDAC ID: 127

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

ITEM: MDM FA1,FA2,FA3,FA4
FAILURE MODE: STUCK ON A CONSTANT OUTPUT TO LRU

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) FLIGHT CRITICAL AFT MDM (FA1..4)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 4,5,6,6
PART NUMBER: MC615-0004-6110,5110

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS DOES NOT DIRECTLY DETECT THIS ERROR VIA MDM RETURN WORD PROCESSING. FAULT TOLERANCE DEPENDS ON REDUNDANT STRINGS TO VOTING LRUS. DETECTION DEPENDS ON SEPARATE, REDUNDANT FEEDBACK SIGNALS. IF ALL REDUNDANCY FAILS, LOSE USE OF AFT RCS, BODY FLAP, AILERONS, RUDDER, SPEEDBRAKE, AND ABILITY TO PURGE SSMES AND TANKS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 128 ABORT: 3/1R

ITEM: MDM FA1,FA2,FA3,FA4
FAILURE MODE: FALSELY STUCK ON BUSY MODE

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) FLIGHT CRITICAL AFT MDM (FA1..4)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 4,5,6,6
PART NUMBER: MC615-0004-6110,5110

CAUSES: VIBRATION, CORROSION, CONTAMINATION, SCU BUSY CROSS-STRAP STUCK HIGH

EFFECTS/RATIONALE:
FCOS SETS COMMFAULT FLAG FOR THAT DATA. APPLICATION SW IGNORES THAT DATA. FCOS BYPASSES MDM AFTER 2ND CONSECUTIVE COMMFAULT, AND DISPLAYS FAULT MSG ON CRTS. PORT MODING MAY RECOVER MDM, BUT NOT ALLOWED DURING ASCENT UNTIL AFTER 2ND MDM FAILURE. IF ALL REDUNDANCY FAILS, LOSE USE OF AFT RCS, BODY FLAP, AILERONS, RUDDER, SPEEDBRAKE, AND ABILITY TO PURGE SSMES AND TANKS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 140 ABORT: 3/3

ITEM: MDM PF1,PF2
FAILURE MODE: LOSS OF OUTPUT TO GPC

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) PAYLOAD FORWARD MDM (PF1..2)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2
PART NUMBER: MC615-0004-6710,5710

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS/BSS SETS COMMFAULT FLAG FOR THAT DATA. APPLICATION SW IGNORES THAT DATA. SYSTEM SOFTWARE BYPASSES MDM AFTER 2ND CONSECUTIVE COMMFAULT, AND DISPLAYS FAULT MSG ON CRTS. PORT MODING MAY NOT RECOVER MDM. IF ALL REDUNDANCY FAILS, LOSE ABILITY TO RELEASE, OPEN, CLOSE, AND LATCH PAYLOAD BAY DOORS, AND ABILITY TO CRADLE AND LATCH RMS ARM WITHOUT AN EVA.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 141 ABORT: 3/3

ITEM: MDM PF1,PF2
FAILURE MODE: LOSS OF OUTPUT TO LRU

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) PAYLOAD FORWARD MDM (PF1..2)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2
PART NUMBER: MC615-0004-6710,5710

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS/BSS DOES NOT DIRECTLY DETECT THIS ERROR VIA MDM RETURN WORD PROCESSING. FAULT TOLERANCE DEPENDS ON REDUNDANT PF MDMS. DETECTION DEPENDS ON SEPARATE, REDUNDANT FEEDBACK SIGNALS. IF ALL REDUNDANCY FAILS, LOSE ABILITY TO RELEASE, OPEN, CLOSE, AND LATCH PAYLOAD BAY DOORS, AND ABILITY TO CRADLE AND LATCH RMS ARM WITHOUT AN EVA.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 142 ABORT: 3/3

ITEM: MDM PF1,PF2
FAILURE MODE: ERRONEOUS OUTPUT TO GPC

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) PAYLOAD FORWARD MDM (PF1..2)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2
PART NUMBER: MC615-0004-6710,5710

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS/BSS SETS COMMFAULT FLAG FOR THAT DATA. APPLICATION SW IGNORES THAT DATA. SYSTEM SOFTWARE BYPASSES MDM AFTER 2ND CONSECUTIVE COMMFAULT, AND DISPLAYS FAULT MSG ON CRTS. PORT MODING MAY NOT RECOVER MDM. IF ALL REDUNDANCY FAILS, LOSE ABILITY TO RELEASE, OPEN, CLOSE, AND LATCH PAYLOAD BAY DOORS, AND ABILITY TO CRADLE AND LATCH RMS ARM WITHOUT AN EVA.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 143 ABORT: 3/3

ITEM: MDM PF1,PF2
FAILURE MODE: ERRONEOUS OUTPUT TO LRU

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) PAYLOAD FORWARD MDM (PF1..2)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2
PART NUMBER: MC615-0004-6710,5710

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS/BSS DOES NOT DIRECTLY DETECT THIS ERROR VIA MDM RETURN WORD PROCESSING. FAULT TOLERANCE DEPENDS ON REDUNDANT PF MDMS. DETECTION DEPENDS ON SEPARATE, REDUNDANT FEEDBACK SIGNALS. IF ALL REDUNDANCY FAILS, LOSE ABILITY TO RELEASE, OPEN, CLOSE, AND LATCH PAYLOAD BAY DOORS, AND ABILITY TO CRADLE AND LATCH RMS ARM WITHOUT AN EVA.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 144 ABORT: 3/3

ITEM: MDM PF1,PF2
FAILURE MODE: PREMATURE OPERATION TO GPC

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) PAYLOAD FORWARD MDM (PF1..2)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2
PART NUMBER: MC615-0004-6710,5710

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
THIS FAILURE ON EITHER PORT CAN INTERFERE WITH FCOS/BSS RETURNING DATA FROM OTHER PF MDM AND CAUSE GOOD MDM TO BE BYPASSED. PORT MODING WILL NOT FIX A BLABBING MDM. POWER CYCLING MAY RESET ELECTRONICS, BUT WILL NOT ALWAYS STOP PREMATURE OPERATIONS. IF ALL REDUNDANCY FAILS, LOSE ABILITY TO RELEASE, OPEN, CLOSE, AND LATCH PAYLOAD BAY DOORS, AND ABILITY TO CRADLE AND LATCH RMS ARM WITHOUT AN EVA.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 145 ABORT: 3/3

ITEM: MDM PF1,PF2
FAILURE MODE: PREMATURE OPERATION TO LRU

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) PAYLOAD FORWARD MDM (PF1..2)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2
PART NUMBER: MC615-0004-6710,5710

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS/BSS DOES NOT DIRECTLY DETECT THIS ERROR VIA MDM RETURN WORD PROCESSING. FAULT TOLERANCE DEPENDS ON REDUNDANT PF MDMS. DETECTION DEPENDS ON SEPARATE, REDUNDANT FEEDBACK SIGNALS. IF ALL REDUNDANCY FAILS, LOSE ABILITY TO RELEASE, OPEN, CLOSE, AND LATCH PAYLOAD BAY DOORS, AND ABILITY TO CRADLE AND LATCH RMS ARM WITHOUT AN EVA.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 146 ABORT: 3/3

ITEM: MDM PF1,PF2
FAILURE MODE: SELECTED ALL CHANNELS WRONG

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) PAYLOAD FORWARD MDM (PF1..2)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2
PART NUMBER: MC615-0004-6710,5710

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
THE GPC'S FCOS AND THE LRUS WOULD REJECT ALL DATA FROM THAT MDM EXCEPT ANY DATA THAT HAPPENED TO BE IN THE SAME FORMAT AS THE EXPECTED DATA. REDUNDANCY MGT. SOON DETECTS AND BYPASSES THAT MDM, AND THE EFFECTS OF WRONG DATA INPUT OR OUTPUT IS MINIMIZED. IF ALL REDUNDANCY FAILS, LOSE ABILITY TO RELEASE, OPEN, CLOSE, AND LATCH PAYLOAD BAY DOORS, AND ABILITY TO CRADLE AND LATCH RMS ARM WITHOUT AN EVA.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 147 ABORT: 3/3

ITEM: MDM PF1,PF2
FAILURE MODE: STUCK ON A CONSTANT OUTPUT TO LRU

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) PAYLOAD FORWARD MDM (PF1..2)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2
PART NUMBER: MC615-0004-6710,5710

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS/BSS DOES NOT DIRECTLY DETECT THIS ERROR VIA MDM RETURN WORD PROCESSING. FAULT TOLERANCE DEPENDS ON REDUNDANT PF MDMS. DETECTION DEPENDS ON SEPARATE, REDUNDANT FEEDBACK SIGNALS. IF ALL REDUNDANCY FAILS, LOSE ABILITY TO RELEASE, OPEN, CLOSE, AND LATCH PAYLOAD BAY DOORS, AND ABILITY TO CRADLE AND LATCH RMS ARM WITHOUT AN EVA.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 148 ABORT: 3/3

ITEM: MDM PF1,PF2
FAILURE MODE: FALSELY STUCK ON BUSY MODE

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) PAYLOAD FORWARD MDM (PF1..2)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2
PART NUMBER: MC615-0004-6710,5710

CAUSES: VIBRATION, CORROSION, CONTAMINATION, SCU BUSY CROSS-STRAP STUCK HIGH

EFFECTS/RATIONALE:
FCOS/BSS SETS COMMFAULT FLAG FOR THAT DATA. APPLICATION SW IGNORES THAT DATA. SYSTEM SOFTWARE BYPASSES MDM AFTER 2ND CONSECUTIVE COMMFAULT, AND DISPLAYS FAULT MSG ON CRTS. PORT MODING MAY NOT RECOVER MDM. IF ALL REDUNDANCY FAILS, LOSE ABILITY TO RELEASE, OPEN, CLOSE, AND LATCH PAYLOAD BAY DOORS, AND ABILITY TO CRADLE AND LATCH RMS ARM WITHOUT AN EVA.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/2R
MDAC ID: 180 ABORT: /NA

ITEM: MDM LF1,LA1
FAILURE MODE: LOSS OF OUTPUT TO GPC

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) PRELAUNCH FORWARD & AFT MDM (LF,LA)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,6
PART NUMBER: MC615-0004-6610,5600

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS SETS COMMFAULT FLAG FOR THAT DATA. APPLICATION SW IGNORES THAT DATA. FCOS BYPASSES MDM AFTER 2ND CONSECUTIVE COMMFAULT, AND DISPLAYS FAULT MSG ON CRTS. PORT MODING MAY RECOVER MDM. IF ALL REDUNDANCY FAILS, LOSE ABILITY OF GSE TO MONITOR AND CONTROL SYSTEMS WHILE ATTACHED.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/2R
MDAC ID: 181 ABORT: /NA

ITEM: MDM LF1,LA1
FAILURE MODE: LOSS OF OUTPUT TO LRU

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) PRELAUNCH FORWARD & AFT MDM (LF,LA)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,6
PART NUMBER: MC615-0004-6610,5600

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS DOES NOT DIRECTLY DETECT THIS ERROR VIA MDM RETURN WORD PROCESSING. FAULT TOLERANCE DEPENDS ON REDUNDANT STRINGS TO VOTING LRUS. DETECTION DEPENDS ON SEPARATE, REDUNDANT FEEDBACK SIGNALS. IF ALL REDUNDANCY FAILS, LOSE ABILITY OF GSE TO MONITOR AND CONTROL SYSTEMS WHILE ATTACHED.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/2R
MDAC ID: 182 ABORT: /NA

ITEM: MDM LF1,LA1
FAILURE MODE: ERRONEOUS OUTPUT TO GPC

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) PRELAUNCH FORWARD & AFT MDM (LF,LA)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,6
PART NUMBER: MC615-0004-6610,5600

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS SETS COMMFAULT FLAG FOR THAT DATA. APPLICATION SW IGNORES THAT DATA. FCOS BYPASSES MDM AFTER 2ND CONSECUTIVE COMMFAULT, AND DISPLAYS FAULT MSG ON CRTS. PORT MODING MAY RECOVER MDM, BUT NOT ALLOWED DURING ASCENT UNTIL AFTER 2ND MDM FAILURE. IF ALL REDUNDANCY FAILS, LOSE ABILITY OF GSE TO MONITOR AND CONTROL SYSTEMS WHILE ATTACHED.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/2R
MDAC ID: 183 ABORT: /NA

ITEM: MDM LF1,LA1
FAILURE MODE: ERRONEOUS OUTPUT TO LRU

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) PRELAUNCH FORWARD & AFT MDM (LF,LA)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,6
PART NUMBER: MC615-0004-6610,5600

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS DOES NOT DIRECTLY DETECT THIS ERROR VIA MDM RETURN WORD PROCESSING. FAULT TOLERANCE DEPENDS ON REDUNDANT STRINGS TO VOTING LRUS. DETECTION DEPENDS ON SEPARATE, REDUNDANT FEEDBACK SIGNALS. IF ALL REDUNDANCY FAILS, LOSE ABILITY OF GSE TO MONITOR AND CONTROL SYSTEMS WHILE ATTACHED.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/2R
MDAC ID: 184 ABORT: /NA

ITEM: MDM LF1,LA1
FAILURE MODE: PREMATURE OPERATION TO GPC

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) PRELAUNCH FORWARD & AFT MDM (LF,LA)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,6
PART NUMBER: MC615-0004-6610,5600

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
THIS FAILURE ON EITHER PORT CAN INTERFERE WITH FCOS RETURNING DATA FROM OTHER BTU(S) AND CAUSE GOOD BTU(S) TO BE BYPASSED. PORT MODING WILL NOT FIX A BLABBING MDM. POWER CYCLING MAY RESET ELECTRONICS, BUT WILL NOT ALWAYS STOP PREMATURE OPERATIONS. IF ALL REDUNDANCY FAILS, LOSE ABILITY OF GSE TO MONITOR AND CONTROL SYSTEMS WHILE ATTACHED.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/2R
MDAC ID: 185 ABORT: /NA

ITEM: MDM LF1,LA1
FAILURE MODE: PREMATURE OPERATION TO LRU

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) PRELAUNCH FORWARD & AFT MDM (LF,LA)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,6
PART NUMBER: MC615-0004-6610,5600

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS DOES NOT DIRECTLY DETECT THIS ERROR VIA MDM RETURN WORD PROCESSING. FAULT TOLERANCE DEPENDS ON REDUNDANT STRINGS TO VOTING LRUS. DETECTION DEPENDS ON SEPARATE, REDUNDANT FEEDBACK SIGNALS. IF ALL REDUNDANCY FAILS, LOSE ABILITY OF GSE TO MONITOR AND CONTROL SYSTEMS WHILE ATTACHED.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/2R
MDAC ID: 186 ABORT: /NA

ITEM: MDM LF1,LA1
FAILURE MODE: SELECTED ALL CHANNELS WRONG

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) PRELAUNCH FORWARD & AFT MDM (LF,LA)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,6
PART NUMBER: MC615-0004-6610,5600

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
THE GPC'S FCOS AND THE LRUS WOULD REJECT ALL DATA FROM THAT MDM EXCEPT ANY DATA THAT HAPPENED TO BE IN THE SAME FORMAT AS THE EXPECTED DATA. REDUNDANCY MGT. SOON DETECTS AND BYPASSES THAT MDM, AND THE EFFECTS OF WRONG DATA INPUT OR OUTPUT IS MINIMIZED. IF ALL REDUNDANCY FAILS, LOSE ABILITY OF GSE TO MONITOR AND CONTROL SYSTEMS WHILE ATTACHED.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/2R
MDAC ID: 187 ABORT: /NA

ITEM: MDM LF1,LA1
FAILURE MODE: STUCK ON A CONSTANT OUTPUT TO LRU

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) PRELAUNCH FORWARD & AFT MDM (LF,LA)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,6
PART NUMBER: MC615-0004-6610,5600

CAUSES: VIBRATION, CORROSION, CONTAMINATION

EFFECTS/RATIONALE:
FCOS DOES NOT DIRECTLY DETECT THIS ERROR VIA MDM RETURN WORD PROCESSING. FAULT TOLERANCE DEPENDS ON REDUNDANT STRINGS TO VOTING LRUS. DETECTION DEPENDS ON SEPARATE, REDUNDANT FEEDBACK SIGNALS. IF ALL REDUNDANCY FAILS, LOSE ABILITY OF GSE TO MONITOR AND CONTROL SYSTEMS WHILE ATTACHED.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/2R
MDAC ID: 188 ABORT: /NA

ITEM: MDM LF1,LA1
FAILURE MODE: FALSELY STUCK ON BUSY MODE

LEAD ANALYST: W. A. HAUFLER SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIPLEXER-DEMULTIPLEXERS (MDM)
3) PRELAUNCH FORWARD & AFT MDM (LF,LA)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,6
PART NUMBER: MC615-0004-6610,5600

CAUSES: VIBRATION, CORROSION, CONTAMINATION, SCU BUSY CROSS-STRAP STUCK HIGH

EFFECTS/RATIONALE:
FCOS SETS COMMFAULT FLAG FOR THAT DATA. APPLICATION SW IGNORES THAT DATA. FCOS BYPASSES MDM AFTER 2ND CONSECUTIVE COMMFAULT, AND DISPLAYS FAULT MSG ON CRTS. PORT MODING MAY RECOVER MDM. IF ALL REDUNDANCY FAILS, LOSE ABILITY OF GSE TO MONITOR AND CONTROL SYSTEMS WHILE ATTACHED.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86
SUBSYSTEM: DPS
MDAC ID: 201

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

ITEM: INPUT/OUTPUT PROCESSOR (IOP)
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: T. B. CRIBBS SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) GENERAL PURPOSE COMPUTER (GPC)
3) INPUT/OUTPUT PROCESSOR (IOP)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAYS
PART NUMBER:

CAUSES: MIA FAILS TO OUTPUT TO DATA BUS DUE TO PIECE/PART FAILURE FROM CONTAMINATION OR MECHANICAL, THERMAL, OR ELECTRICAL OVERSTRESS, OR POWER FAILURE

EFFECTS/RATIONALE:
LOSS OF A BUS-COMMANDING MIA RESULTS IN LOSS OF A GPC'S ABILITY TO COMMUNICATE OVER THAT BUS, ATTACHED BUS TERMINAL UNITS (BTU'S), AND ALL INPUTS AND OUTPUTS CONNECTED TO THOSE BTU'S. IN DYNAMIC FLIGHT PHASES, WHERE A SINGLE BTU CONTROLS AN ACTUATOR, THE CREW WOULD HAVE TO MANUALLY INTERVENE ON A SINGLE FAILURE, AND SWITCHING TRANSIENTS COULD ARISE. LOSS OF ALL REDUNDANCY WOULD CAUSE LOSS OF VEHICLE CONTROL.

REFERENCES: JSC 18820, JSC 11174, JSC 12770

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 202 ABORT: 3/1R

ITEM: INPUT/OUTPUT PROCESSOR (IOP)
FAILURE MODE: ERRATIC/ERRONEOUS OUTPUT

LEAD ANALYST: T. B. CRIBBS SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) GENERAL PURPOSE COMPUTER (GPC)
3) INPUT/OUTPUT PROCESSOR (IOP)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAYS
PART NUMBER:

CAUSES: COMPONENT FAILURE DUE TO CONTAMINATION OR MECHANICAL, THERMAL, OR ELECTRICAL OVERSTRESS IN MIA, ALU, MUX, LOCAL STORE, OR MEMORY

EFFECTS/RATIONALE:
CRITICAL GPC OUTPUTS ARE VALIDATED BY SUMWORD COMPARISON; HOWEVER, ERRORS ARE DOWNLINKED AND LOGGED, BUT NOT CORRECTED. MDM/ACTUATOR HARDWARE CANCELS THE EFFECTS OF AN ERRONEOUS OUTPUT FROM A SINGLE CHANNEL BY "FORCE FIGHTING", BUT MULTIPLE FAILURES DURING CRITICAL FLIGHT PHASES WOULD LIKELY RESULT IN LOSS OF VEHICLE/LIFE.

REFERENCES: JSC 18820, JSC 11174, JSC 12770

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 2/1R
MDAC ID: 203 ABORT: 2/1R

ITEM: INPUT/OUTPUT PROCESSOR (IOP)
FAILURE MODE: PREMATURE OPERATION

LEAD ANALYST: T. B. CRIBBS SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) GENERAL PURPOSE COMPUTER (GPC)
3) INPUT/OUTPUT PROCESSOR (IOP)
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:	3/2R	AOA:	3/1R
DEORBIT:	2/1R	ATO:	3/1R
LANDING/SAFING:	2/1R		

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

LOCATION: AV BAYS
PART NUMBER:

CAUSES: CONTROL MONITOR, CHANNEL CONTROL, MSC, OR MICROCODE STORE FAILURE RESULTS IN INVALID EXECUTION OF PROGRAM. CAUSED BY PIECE/PART FAILURE.

EFFECTS/RATIONALE:
PREMATURE ISSUANCE OF CRITICAL OUTPUTS IS DETECTED BY OTHER GPC'S IN THE REDUNDANT SET. GPC FAILS TO SYNC AND STRINGS ARE BYPASSED BY OTHER GPC'S. FAULTY COMMANDS ARE STILL PASSED TO THE ACTUATOR BY FAILED GPC. PREMATURE COMMANDS TO ACTUATORS DURING DYNAMIC FLIGHT PHASES WOULD LIKELY RESULT IN LOSS OF VEHICLE/LIFE, IF ACTUATOR REDUNDANCY WAS LOST OR IF SIMULTANEOUS LOSS OF TWO OUTPUT CHANNELS.

REFERENCES: JSC 18820, JSC 11174, JSC 12770

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 204 ABORT: 3/1R

ITEM: INPUT/OUTPUT PROCESSOR (IOP)
FAILURE MODE: ERRONEOUS INPUT

LEAD ANALYST: T. B. CRIBBS SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) GENERAL PURPOSE COMPUTER (GPC)
3) INPUT/OUTPUT PROCESSOR (IOP)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAYS
PART NUMBER:

CAUSES: COMPONENT FAILURE DUE TO CONTAMINATION OR MECHANICAL, THERMAL, OR ELECTRICAL OVERSTRESS IN MIA, ALU, MUX, LOCAL STORE, MEMORY, OR DMA QUEUE

EFFECTS/RATIONALE:
CRITICAL GPC/IOP INPUTS ARE VALIDATED THRU PARITY CHECKING. RECURRING INPUT ERRORS RESULT IN EITHER GPC "FAIL-TO-SYNC" BRINGING DOWN AN ERRING GPC, OR IGNORING INPUTS FROM AN ERRING MDM VIA A GPC MASK. ERRONEOUS INPUTS, IF PROPAGATED THROUGH THE GPC, COULD RESULT IN ERRONEOUS COMMAND OUTPUTS AND LOSS OF VEHICLE/LIFE, IF COMPLETE FUNCTION WAS LOST.

REFERENCES: JSC 18820, JSC 11174, JSC 12770

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 205 ABORT: 3/1R

ITEM: CENTRAL PROCESSING UNIT (CPU)
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: T. B. CRIBBS SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) GENERAL PURPOSE COMPUTER (GPC)
3) CENTRAL PROCESSING UNIT (CPU)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAYS
PART NUMBER:

CAUSES: CPU FAILS TO FUNCTION DUE TO LOSS OF POWER OR FAILURE OF MEMORY TIMING PAGE

EFFECTS/RATIONALE:
IN DYNAMIC FLIGHT PHASES WHERE REDUNDANT SET (RS) IS OPERATING, OTHER GPC'S RECOGNIZE GPC FAILING TO SYNC AND ISSUE FAIL VOTES AGAINST IT. THE FAILING GPC'S VOTING LOGIC THEN REMOVES IT FROM THE RS. FOUR RS GPC'S CONTROL CRITICAL FLIGHT FUNCTIONS; IF AT LEAST THREE ARE LOST, THE 5TH GPC (BACKUP FLIGHT COMPUTER, BFS) IS ENGAGED. LOSS OF BFS WOULD RESULT IN LOSS OF VEHICLE/LIFE.

REFERENCES: JSC 18820, JSC 11174, JSC 12770

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 206 ABORT: 3/1R

ITEM: CENTRAL PROCESSING UNIT (CPU)
FAILURE MODE: ERRONEOUS/ERRATIC OUTPUT

LEAD ANALYST: T. B. CRIBBS SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) GENERAL PURPOSE COMPUTER (GPC)
3) CENTRAL PROCESSING UNIT (CPU)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAYS
PART NUMBER:

CAUSES: CPU OUTPUTS INVALID DATA TO IOP DUE TO MEMORY PARITY ERROR, OR FAILURE OF MASTER BUS CONTROL, ALU, DATA FLOW MUX, OR LOCAL STORE

EFFECTS/RATIONALE:
CRITICAL GPC OUTPUTS ARE VALIDATED BY SUMWORD COMPARISON TO OUTPUTS FROM REDUNDANT GPC'S; HOWEVER, DETECTED ERRORS ARE MERELY LOGGED AND DOWNLINKED WITHOUT CORRECTIVE ACTION. INVALID COMMAND OUTPUTS ARE PASSED THROUGH BUS TERMINAL UNITS (BTU'S) TO ACTUATORS WHICH "FORCE FIGHT" THE REDUNDANT COMMANDS IN ORDER TO VOTE OUT THE ERRONEOUS COMMAND. LOSS OF MORE THAN ONE OUTPUT CHANNEL TO THE SAME ACTUATOR WOULD REQUIRE CREW INTERVENTION, POSSIBLY CAUSING UNSTABLE SWITCHOVER TRANSIENTS.

REFERENCES: JSC 18820, JSC 11174, JSC 12770

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86
SUBSYSTEM: DPS
MDAC ID: 207

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

ITEM: CENTRAL PROCESSING UNIT (CPU)
FAILURE MODE: DELAYED/PREMATURE/INADVERTENT OPERATION

LEAD ANALYST: T. B. CRIBBS SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) GENERAL PURPOSE COMPUTER (GPC)
3) CENTRAL PROCESSING UNIT (CPU)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAYS
PART NUMBER:

CAUSES: CPU ATTEMPTS TO OUTPUT DATA AT INAPPROPRIATE TIME DUE TO PROCESSOR SLOW-DOWN WHILE SERVICING RECURRING I/O ERRORS, FAILURE OF INTERRUPT LOGIC, OR INTERMITTENCE IN TIMING PAGE.

EFFECTS/RATIONALE:
REDUNDANT SET GPC'S SYNC UP BY WAITING FOR SYNC POINT MESSAGES FROM OTHER GPC'S TO INDICATE COMPLETION OF IDENTICAL OPERATIONS. EXCESSIVE PROCESSOR LOAD COULD REQUIRE ALL GPC'S TO WAIT EXCESSIVELY, BUT EACH GPC WOULD RECOGNIZE THE SLOW DOWN AND ISSUE A FAIL-TO-SYNC VOTE, AND THE SLOW GPC'S VOTING LOGIC WOULD REMOVE IT FROM THE RS. IF PERFORMANCE OF ALL GPC'S WAS DEGRADED DURING DYNAMIC FLIGHT PHASES, VEHICLE INSTABILITY COULD OCCUR UNLESS CREW TOOK CONTROL.

REFERENCES: JSC 18820, JSC 11174, JSC 12770

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 2/1R
MDAC ID: 208 ABORT: 2/1R

ITEM: CENTRAL PROCESSING UNIT (CPU)
FAILURE MODE: INADVERTENT OPERATION

LEAD ANALYST: T. B. CRIBBS SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) GENERAL PURPOSE COMPUTER (GPC)
3) CENTRAL PROCESSING UNIT (CPU)
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:	3/3	AOA:	2/1R
DEORBIT:	2/1R	ATO:	2/1R
LANDING/SAFING:	2/1R		

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

LOCATION: AV BAYS
PART NUMBER:

CAUSES: CPU ATTEMPTS TO OUTPUT DATA ON INCORRECT DATA BUS DUE TO ERRORS IN MEMORY LOCATIONS CONTAINING CONFIGURATION OR BUS-STRINGING PARAMETERS.

EFFECTS/RATIONALE:
LOSS OF MEMORY IN BUS ASSIGNMENT TABLE (NBAT) COULD RESULT IN A GPC ATTEMPTING TO COMMAND A DATA BUS COMMANDED BY ANOTHER GPC. BOTH EXAMINE THEIR RESPECTIVE NBAT AND ASSUME NO ERROR CONDITION, AND CONTINUE TRANSMISSION ON THAT SAME BUS. THIS WOULD CAUSE ALL DATA ON THAT BUS TO BE ERRONEOUS. FURTHERMORE, IDLE BUS IS CREATED AND 2 COMMAND PATHS ARE LOST. POSSIBLE TO OUTVOTE GOOD COMMANDS: LOSS OF VEHICLE/LIFE.

REFERENCES: JSC 18820, JSC 11174, JSC 12770

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/3
MDAC ID: 209 ABORT: 3/3

ITEM: CPU POWER SWITCH
FAILURE MODE: FAILS CLOSED

LEAD ANALYST: T. B. CRIBBS SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) GENERAL PURPOSE COMPUTER (GPC)
3) CENTRAL PROCESSING UNIT (CPU)
4) CPU POWER SWITCH
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL O6
PART NUMBER:

CAUSES: CPU POWER SWITCH IS STUCK IN THE "ON" POSITION DUE TO CONTAMINATION

EFFECTS/RATIONALE:
FLIGHT RULES DICTATE THAT THE CREW SHOULD POWER OFF ANY GPC WHICH HAS RECURRING ERRORS DURING DYNAMIC FLIGHT PHASES, AS SOON AS POSSIBLE TO AVOID ERRONEOUS OUTPUTS BEING SENT TO ACTUATORS. IF THE CPU POWER SWITCH WERE STUCK IN THE "ON" POSITION AND ANOTHER GPC BEGAN SENDING ERRONEOUS DATA, THE ACTUATORS COULD NOT VOTE OUT THE ERRONEOUS COMMANDS AND THE CREW WOULD NEED TO TAKE MANUAL CONTROL.

REFERENCES: JSC 18820, JSC 11174, JSC 12770

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86
SUBSYSTEM: DPS
MDAC ID: 210

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

ITEM: GPC MODE SWITCH
FAILURE MODE: FAILS CLOSED

LEAD ANALYST: T. B. CRIBBS SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) GENERAL PURPOSE COMPUTER (GPC)
3) CENTRAL PROCESSING UNIT (CPU)
4) GPC MODE SWITCH
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL O6
PART NUMBER:

CAUSES: CPU MODE SWITCH IS STUCK IN THE "HALT" OR "STANDBY" POSITION DUE TO CONTAMINATION

EFFECTS/RATIONALE:
IF THE MODE SWITCH FOR A GPC WERE STUCK IN A NON-RUN POSITION THE GPC WOULD IN EFFECT BE DISABLED, SIMILAR TO FAILING TO HALT. THE REMAINING GPC'S WOULD IGNORE THIS GPC, AND THE GPC WOULD NOT BE AVAILABLE AS A BACKUP OR REDUNDANT MEMBER. IF ALL GPC'S WERE STUCK IN THE STANDBY MODE, THE CREW COULD NOT PERFORM CRITICAL FLIGHT CONTROL FUNCTIONS.

REFERENCES: JSC 18820, JSC 11174, JSC 12770

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 211 ABORT: 3/1R

ITEM: GPC OUTPUT SWITCH
FAILURE MODE: FAILS CLOSED

LEAD ANALYST: T. B. CRIBBS SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) GENERAL PURPOSE COMPUTER (GPC)
3) CENTRAL PROCESSING UNIT (CPU)
4) GPC OUTPUT SWITCH
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL O6
PART NUMBER:

CAUSES: CPU OUTPUT SWITCH IS STUCK IN THE "TERMINATE" OR "BACKUP" POSITION DUE TO CONTAMINATION

EFFECTS/RATIONALE:
IF THE OUTPUT SWITCH WERE STUCK IN THE "TERMINATE" POSITION, THIS WOULD HAVE THE SAME EFFECT OF DISABLING THE GPC'S OUTPUT; ALL SWITCHES IN THIS POSITION WOULD CAUSE LOSS OF VEHICLE CONTROL. IF THE SWITCH WERE STUCK IN THE "BACKUP" POSITION THIS GPC WOULD ONLY BE AVAILABLE AS BFS. IF ALL SWITCHES IN "BACKUP" GPC 5 WOULD BE BACKUP WHEN ENGAGED.

REFERENCES: JSC 18820, JSC 11174, JSC 12770

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/3
MDAC ID: 212 ABORT: 3/3

ITEM: IPL SOURCE SWITCH
FAILURE MODE: FAILS OPEN

LEAD ANALYST: T. B. CRIBBS SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) GENERAL PURPOSE COMPUTER (GPC)
3) CENTRAL PROCESSING UNIT (CPU)
4) MMU INITIAL PROGRAM LOAD (IPL) SOURCE SWITCH
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL O6
PART NUMBER:

CAUSES: IPL SELECTOR SWITCH IS SHORTED OR POWER SOURCE IS LOST DUE TO CONTAMINATION

EFFECTS/RATIONALE:
IPL SOURCE SWITCH IS USED AT PRE-LAUNCH TO INITIALIZE GPC'S. THIS FAILURE COULD CAUSE LOSS OF A MISSION OPPORTUNITY DUE TO LAUNCH DELAY. DURING FLIGHT THE GPC'S ARE NOT TYPICALLY RE-IPL'ED, EVEN THOUGH THE MMU IS USED TO RETRIEVE NEW MEMORY OVERLAYS (AS OPPOSED TO THE IPL LOADING THE ENTIRE SYSTEM SOFTWARE, INCLUDING MCDS INITIALIZATION).

REFERENCES: JSC 18820, JSC 11174, JSC 12770

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86
SUBSYSTEM: DPS
MDAC ID: 213

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

ITEM: GPC POWER SWITCH
FAILURE MODE: FAILS OPEN

LEAD ANALYST: T. B. CRIBBS SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) GENERAL PURPOSE COMPUTER (GPC)
3) CENTRAL PROCESSING UNIT (CPU)
4) GPC POWER SWITCH
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL O6
PART NUMBER:

CAUSES: CPU POWER SWITCH IS STUCK IN "OFF" POSITION, OR GPC POWER IS LOST

EFFECTS/RATIONALE:
IF THE GPC POWER SWITCH WERE STUCK IN THE "OFF" POSITION, THE GPC COULD NOT FUNCTION, SAME AS CPU LOSS OF OUTPUT.

REFERENCES: JSC 18820, JSC 11174, JSC 12770

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 300 ABORT: 3/1R

ITEM: KEYBOARD SWITCH
FAILURE MODE: OPEN/CLOSED

LEAD ANALYST: H J LOWERY SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIFUNCTION CRT DISPLAY SYSTEM (MCDS)
3) KEYBOARD
4) SWITCH
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: UPPER CREW AREA
PART NUMBER:

CAUSES: MECHANICAL FRACTURE/ CONTAMINATION/ DEBRIS

EFFECTS/RATIONALE:
LOSS OF INPUTTING COMMAND CAPABILITY. REDUNDANT HARDWARE WOULD NOT BE ACCESSIBLE DURING PERIODS OF ANTICIPATED HIGH ACCELERATION/DEACCELERATION FORCES. IE. 1. LIFT-OFF THROUGH MAIN ENGINE CUT-OFF - APPROXIMATELY 8 MIN 40 SEC; 2. ENTRY THROUGH SAFEING -APPROXIMATELY 400,000FT (TD -40 MIN) THROUGH SAFEING.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 301 ABORT: 3/1R

ITEM: X/Y DEFLECTION AMPLIFIERS
FAILURE MODE: NO OUTPUT/ERRONEOUS/ERRATIC OUTPUT

LEAD ANALYST: H J LOWERY SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIFUNCTION CRT DISPLAY SYSTEM (MCDS)
3) DISPLAY UNIT
4) X/Y DEFLECTION AMPLIFIERS
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: UPPER CREW AREA
PART NUMBER:

CAUSES: TEMPERATURE STRESS/ CONTAMINATION/ DEBRIS

EFFECTS/RATIONALE:
LOSS OF MONITORING CAPABILITY. REDUNDANT HARDWARE WOULD NOT BE ACCESSIBLE DURING PERIODS OF ANTICIPATED HIGH ACCELERATION/DEACCELERATION FORCES. IE. 1. LIFT-OFF THROUGH MAIN ENGINE CUT-OFF - APPROXIMATELY 8 MIN 40 SEC; 2. ENTRY THROUGH SAFEING -APPROXIMATELY 400,000FT (TD -40 MIN) THROUGH SAFEING.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	10/03/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	DPS	FLIGHT:	3/1R
MDAC ID:	302	ABORT:	3/1R

ITEM: VIDEO AMPLIFIER
FAILURE MODE: NO OUTPUT/ERRONEOUS/ERRATIC OUTPUT

LEAD ANALYST: H J LOWERY SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIFUNCTION CRT DISPLAY SYSTEM (MCDS)
3) DISPLAY UNIT
4) VIDEO AMPLIFIER
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: UPPER CREW AREA
PART NUMBER:

CAUSES: TEMPERATURE STRESS/ CONTAMINATION/ DEBRIS

EFFECTS/RATIONALE:
LOSS OF MONITORING CAPABILITY. REDUNDANT HARDWARE WOULD NOT BE ACCESSIBLE DURING PERIODS OF ANTICIPATED HIGH ACCELERATION/DEACCELERATION FORCES. IE. 1. LIFT-OFF THROUGH MAIN ENGINE CUT-OFF - APPROXIMATELY 8 MIN 40 SEC; 2. ENTRY THROUGH SAFEING -APPROXIMATELY 400,000FT (TD -40 MIN) THROUGH SAFEING.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 303 ABORT: 3/1R

ITEM: CATHODE-RAY TUBE
FAILURE MODE: NO OUTPUT/ERRONEOUS/ERRATIC OUTPUT

LEAD ANALYST: H J LOWERY SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIFUNCTION CRT DISPLAY SYSTEM (MCDS)
3) DISPLAY UNIT
4) CATHODE-RAY TUBE
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: UPPER CREW AREA
PART NUMBER:

CAUSES: SHOCK/ TEMPERATURE STRESS/ MECHANICAL FRACTURE/ VIBRATION/ CONTAMINATION/ DEBRIS

EFFECTS/RATIONALE:
LOSS OF MONITORING CAPABILITY. REDUNDANT HARDWARE WOULD NOT BE ACCESSIBLE DURING PERIODS OF ANTICIPATED HIGH ACCELERATION/DEACCELERATION FORCES. IE. 1. LIFT-OFF THROUGH MAIN ENGINE CUT-OFF - APPROXIMATELY 8 MIN 40 SEC; 2. ENTRY THROUGH SAFEING -APPROXIMATELY 400,000FT (TD -40 MIN) THROUGH SAFEING.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 304 ABORT: 3/1R

ITEM: HI AND LOW VOLTAGE POWER SUPPLIES
FAILURE MODE: NO OUTPUT/ERRONEOUS/ERRATIC OUTPUT

LEAD ANALYST: H J LOWERY SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIFUNCTION CRT DISPLAY SYSTEM (MCDS)
3) DISPLAY UNIT
4) HIGH AND LOW (+/-5, 15, 28 & 80 VDC) VOLTAGE POWER SUPPLIES
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: UPPER CREW AREA
PART NUMBER:

CAUSES: MECHANICAL FRACTURES/ CONTAMINATION/ DEBRIS

EFFECTS/RATIONALE:
LOSS OF MONITORING CAPABILITY. REDUNDANT HARDWARE WOULD NOT BE ACCESSIBLE DURING PERIODS OF ANTICIPATED HIGH ACCELERATION/DEACCELERATION FORCES. IE. 1. LIFT-OFF THROUGH MAIN ENGINE CUT-OFF - APPROXIMATELY 8 MIN 40 SEC; 2. ENTRY THROUGH SAFEING -APPROXIMATELY 400,000FT (TD -40 MIN) THROUGH SAFEING.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 305 ABORT: 3/1R

ITEM: RPC
FAILURE MODE: OPEN/CLOSED/PREMATURE OPERATION

LEAD ANALYST: H J LOWERY SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIFUNCTION CRT DISPLAY SYSTEM (MCDS)
3) DISPLAY UNIT
4) RPC
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: UPPER CREA AREA
PART NUMBER:

CAUSES: MECHANICAL FRACTURE/ CONTAMINATION/ DEBRIS

EFFECTS/RATIONALE:
LOSS OF MONITORING CAPABILITY. REDUNDANT HARDWARE WOULD NOT BE ACCESSIBLE DURING PERIODS OF ANTICIPATED HIGH ACCELERATION/DEACCELERATION FORCES. IE. 1. LIFT-OFF THROUGH MAIN ENGINE CUT-OFF - APPROXIMATELY 8 MIN 40 SEC; 2. ENTRY THROUGH SAFEING -APPROXIMATELY 400,000FT (TD -40 MIN) THROUGH SAFEING.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 306 ABORT: 3/1R

ITEM: MEMORY
FAILURE MODE: NO OUTPUT/ERRONEOUS/ERRATIC OUTPUT

LEAD ANALYST: H J LOWERY SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIFUNCTION CRT DISPLAY SYSTEM (MCDS)
3) DEU
4) MEMORY
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: UPPER CREW AREA
PART NUMBER:

CAUSES: CONTAMINATION/ DEBRIS

EFFECTS/RATIONALE:
LOSS OF MONITORING CAPABILITY. REDUNDANT HARDWARE WOULD NOT BE ACCESSIBLE DURING PERIODS OF ANTICIPATED HIGH ACCELERATION/DEACCELERATION FORCES. IE. 1. LIFT-OFF THROUGH MAIN ENGINE CUT-OFF - APPROXIMATELY 8 MIN 40 SEC; 2. ENTRY THROUGH SAFEING -APPROXIMATELY 400,000FT (TD -40 MIN) THROUGH SAFEING.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 307 ABORT: 3/1R

ITEM: KEYBOARD ADAPTER
FAILURE MODE: NO OUTPUT/ERRONEOUS/ERRATIC OUTPUT

LEAD ANALYST: H J LOWERY SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIFUNCTION CRT DISPLAY SYSTEM (MCDS)
3) DEU
4) KEYBOARD ADAPTER
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: UPPER CREW AREA
PART NUMBER:

CAUSES: CONTAMINATION/ DEBRIS

EFFECTS/RATIONALE:
LOSS OF INPUTTING COMMAND CAPABILITY. REDUNDANT HARDWARE WOULD NOT BE ACCESSIBLE DURING PERIODS OF ANTICIPATED HIGH ACCELERATION/DEACCELERATION FORCES. IE. 1. LIFT-OFF THROUGH MAIN ENGINE CUT-OFF - APPROXIMATELY 8 MIN 40 SEC; 2. ENTRY THROUGH SAFEING -APPROXIMATELY 400,000FT (TD -40 MIN) THROUGH SAFEING.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 308 ABORT: 3/1R

ITEM: SYMBOL GENERATOR
FAILURE MODE: NO OUTPUT/ERRONEOUS/ERRATIC OUTPUT

LEAD ANALYST: H J LOWERY SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIFUNCTION CRT DISPLAY SYSTEM (MCDS)
3) DEU
4) SYMBOL GENERATOR
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: UPPER CREW AREA
PART NUMBER:

CAUSES: CONTAMINATION/ DEBRIS

EFFECTS/RATIONALE:
LOSS OF MONITORING CAPABILITY. REDUNDANT HARDWARE WOULD NOT BE ACCESSIBLE DURING PERIODS OF ANTICIPATED HIGH ACCELERATION/DEACCELERATION FORCES. IE. 1. LIFT-OFF THROUGH MAIN ENGINE CUT-OFF - APPROXIMATELY 8 MIN 40 SEC; 2. ENTRY THROUGH SAFEING -APPROXIMATELY 400,000FT (TD -40 MIN) THROUGH SAFEING.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 309 ABORT: 3/1R

ITEM: MIA
FAILURE MODE: NO OUTPUT/ERRONEOUS/ERRATIC OUTPUT

LEAD ANALYST: H J LOWERY SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIFUNCTION CRT DISPLAY SYSTEM (MCDS)
3) DEU
4) MIA
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: UPPER CREW AREA
PART NUMBER:

CAUSES: CONTAMINATION/ DEBRIS

EFFECTS/RATIONALE:
LOSS OF MONITORING CAPABILITY. REDUNDANT HARDWARE WOULD NOT BE ACCESSIBLE DURING PERIODS OF ANTICIPATED HIGH ACCELERATION/DEACCELERATION FORCES. IE. 1. LIFT-OFF THROUGH MAIN ENGINE CUT-OFF - APPROXIMATELY 8 MIN 40 SEC; 2. ENTRY THROUGH SAFEING -APPROXIMATELY 400,000FT (TD -40 MIN) THROUGH SAFEING.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 310 ABORT: 3/1R

ITEM: CONTROL LOGIC
FAILURE MODE: NO OUTPUT/ERRONEOUS/ERRATIC OUTPUT

LEAD ANALYST: H J LOWERY SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIFUNCTION CRT DISPLAY SYSTEM (MCDS)
3) DEU
4) CONTROL LOGIC
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: UPPER CREW AREA
PART NUMBER:

CAUSES: CONTAMINATION/ DEBRIS

EFFECTS/RATIONALE:
LOSS OF MONITORING CAPABILITY. REDUNDANT HARDWARE WOULD NOT BE ACCESSIBLE DURING PERIODS OF ANTICIPATED HIGH ACCELERATION/DEACCELERATION FORCES. IE. 1. LIFT-OFF THROUGH MAIN ENGINE CUT-OFF - APPROXIMATELY 8 MIN 40 SEC; 2. ENTRY THROUGH SAFEING -APPROXIMATELY 400,000FT (TD -40 MIN) THROUGH SAFEING.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 311 ABORT: 3/1R

ITEM: POWER SUPPLIES
FAILURE MODE: NO OUTPUT/ERRONEOUS/ERRATIC OUTPUT

LEAD ANALYST: H J LOWERY SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIFUNCTION CRT DISPLAY SYSTEM (MCDS)
3) DEU
4) POWER SUPPLIES (+/-5, 12 & 15 VDC)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: UPPER CREW AREA
PART NUMBER:

CAUSES: CONTAMINATION/ DEBRIS

EFFECTS/RATIONALE:
LOSS OF MONITORING CAPABILITY. REDUNDANT HARDWARE WOULD NOT BE ACCESSIBLE DURING PERIODS OF ANTICIPATED HIGH ACCELERATION/DEACCELERATION FORCES. IE. 1. LIFT-OFF THROUGH MAIN ENGINE CUT-OFF - APPROXIMATELY 8 MIN 40 SEC; 2. ENTRY THROUGH SAFEING -APPROXIMATELY 400,000FT (TD -40 MIN) THROUGH SAFEING.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 312 ABORT: 3/1R

ITEM: RPC
FAILURE MODE: OPEN/CLOSED/PREMATURE OPERATION

LEAD ANALYST: H J LOWERY SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIFUNCTION CRT DISPLAY SYSTEM (MCDS)
3) DEU
4) RPC
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: UPPER CREW AREA
PART NUMBER:

CAUSES: TEMPERATURE STRESS/ MECHANICAL FRACTURE/ CONTAMINATION/ DEBRIS

EFFECTS/RATIONALE:
LOSS OF MONITORING CAPABILITY. REDUNDANT HARDWARE WOULD NOT BE ACCESSIBLE DURING PERIODS OF ANTICIPATED HIGH ACCELERATION/DEACCELERATION FORCES. IE. 1. LIFT-OFF THROUGH MAIN ENGINE CUT-OFF - APPROXIMATELY 8 MIN 40 SEC; 2. ENTRY THROUGH SAFEING -APPROXIMATELY 400,000FT (TD -40 MIN) THROUGH SAFEING.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/3
MDAC ID: 313 ABORT: 3/3

ITEM: LOAD SWITCH
FAILURE MODE: OPEN/CLOSED/PREMATURE OPERATION

LEAD ANALYST: H J LOWERY SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIFUNCTION CRT DISPLAY SYSTEM (MCDS)
3) DEU
4) LOAD SWITCH
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: UPPER CREW AREA
PART NUMBER:

CAUSES: MECHANICAL FRACTURE/ CONTAMINATION/ DEBRIS

EFFECTS/RATIONALE:
DEUS ARE NOT NORMALLY RELOADED DURING A MISSION. SWITCH IS NOT NEEDED.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 314 ABORT: 3/1R

ITEM: FUNCTION SWITCH
FAILURE MODE: OPEN/CLOSED/PREMATURE OPERATION

LEAD ANALYST: H J LOWERY SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIFUNCTION CRT DISPLAY SYSTEM (MCDS)
3) DEU
4) FUNCTION SWITCH
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: UPPER CREW AREA
PART NUMBER:

CAUSES: MECHANICAL FRACTURE/ CONTAMINATION/ DEBRIS

EFFECTS/RATIONALE:
IMPROPER MAJOR FUNCTION IDENTIFICATION.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 315 ABORT: 3/1R

ITEM: DATA BUS COUPLER (DBC)
FAILURE MODE: OPEN/SHORT

LEAD ANALYST: H J LOWERY SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIFUNCTION CRT DISPLAY SYSTEM (MCDS)
3) DBC
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: ALL AV BAYS
PART NUMBER:

CAUSES: MECHANICAL FRACTURE/ CONTAMINATION/ DEBRIS

EFFECTS/RATIONALE:
LOSS OF DATA BUS. REDUNDANT HARDWARE WOULD NOT BE ACCESSIBLE DURING PERIODS OF ANTICIPATED HIGH ACCELERATION/DEACCELERATION FORCES. IE. 1. LIFT-OFF THROUGH MAIN ENGINE CUT-OFF - APPROXIMATELY 8 MIN 40 SEC; 2. ENTRY THROUGH SAFEING - APPROXIMATELY 400,000FT (TD -40 MIN) THROUGH SAFEING.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/2R
MDAC ID: 316 ABORT: /NA

ITEM: DBIA
FAILURE MODE: OPEN/SHORT/ERRONEOUS/ERRATIC OUTPUT

LEAD ANALYST: H J LOWERY SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MULTIFUNCTION CRT DISPLAY SYSTEM (MCDS)
3) DBIA
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 5
PART NUMBER:

CAUSES: MECHANICAL FRACTURE/ CONTAMINATION/ DEBRIS

EFFECTS/RATIONALE:
LOSS OF ONE COMMAND/DATA PATH.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/2R
MDAC ID: 400 ABORT: 3/2R

ITEM: TAPE TRANSPORT MECHANISM
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: K. PIETZ SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MASS MEMORY UNITS (MMU)
3) TAPE TRANSPORT MECHANISM
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2
PART NUMBER: MC 615-0005

CAUSES: WORN TAPE OR FOREIGN MATTER ON TAPE, MOTOR FAILURE (WORN BRUSHES, ETC.), WORN HEADS, FAILURE OF NEGATOR SPRING CAUSING TAPE SLIPPAGE DUE TO INCORRECT TENSION.

EFFECTS/RATIONALE:
IF BOTH MMUS FAIL, OPS 2 AND 3 SOFTWARE CANNOT BE LOADED. HOWEVER, OPS 3 CAN BE UPLINKED OR BFS ENGAGED FOR ENTRY.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/2R
MDAC ID: 401 ABORT: 3/2R

ITEM: TAPE TRANSPORT MECHANISM
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: K. PIETZ SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MASS MEMORY UNITS (MMU)
3) TAPE TRANSPORT MECHANISM
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2
PART NUMBER: MC 615-0005

CAUSES: WORN TAPE OR FOREIGN MATTER ON TAPE, TAPE SLIPPAGE DUE TO INCORRECT TENSION.

EFFECTS/RATIONALE:
IF BOTH MMUS FAIL, OPS 2 AND 3 SOFTWARE CANNOT BE LOADED. HOWEVER, OPS 3 CAN BE UPLINKED OR BFS ENGAGED FOR ENTRY.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/2R
MDAC ID: 402 ABORT: 3/2R

ITEM: READ ELECTRONICS
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: K. PIETZ SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MASS MEMORY UNITS (MMU)
3) READ ELECTRONICS
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2
PART NUMBER: MC 615-0005

CAUSES: ELECTRICAL FAILURE

EFFECTS/RATIONALE:
IF BOTH MMUS FAIL, OPS 2 AND 3 SOFTWARE CANNOT BE LOADED.
HOWEVER, OPS 3 CAN BE UPLINKED OR BFS ENGAGED FOR ENTRY.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/2R
MDAC ID: 403 ABORT: 3/2R

ITEM: READ ELECTRONICS
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: K. PIETZ SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MASS MEMORY UNITS (MMU)
3) READ ELECTRONICS
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2
PART NUMBER: MC 615-0005

CAUSES: ELECTRICAL FAILURE

EFFECTS/RATIONALE:
IF BOTH MMUS FAIL, OPS 2 AND 3 SOFTWARE CANNOT BE LOADED.
HOWEVER, OPS 3 CAN BE UPLINKED OR BFS ENGAGED FOR ENTRY.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/2R
MDAC ID: 404 ABORT: 3/2R

ITEM: MIA
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: K. PIETZ SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MASS MEMORY UNITS (MMU)
3) MIA
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2
PART NUMBER: MC 615-0005

CAUSES: ELECTRICAL FAILURE

EFFECTS/RATIONALE:
IF BOTH MMUS FAIL, OPS 2 AND 3 SOFTWARE CANNOT BE LOADED.
HOWEVER, OPS 3 CAN BE UPLINKED OR BFS ENGAGED FOR ENTRY.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/2R
MDAC ID: 405 ABORT: 3/2R

ITEM: MIA
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: K. PIETZ SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MASS MEMORY UNITS (MMU)
3) MIA
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2
PART NUMBER: MC 615-0005

CAUSES: ELECTRICAL FAILURE

EFFECTS/RATIONALE:
IF BOTH MMUS FAIL, OPS 2 AND 3 SOFTWARE CANNOT BE LOADED.
HOWEVER, OPS 3 CAN BE UPLINKED OR BFS ENGAGED FOR ENTRY.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/2R
MDAC ID: 406 ABORT: 3/2R

ITEM: WRITE ELECTRONICS
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: K. PIETZ SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MASS MEMORY UNITS (MMU)
3) WRITE ELECTRONICS
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2
PART NUMBER: MC 615-0005

CAUSES: ELECTRICAL FAILURE

EFFECTS/RATIONALE:
IF THE ABILITY TO WRITE TO MMUS WERE LOST, THE MISSION COULD BE TERMINATED EARLY. NO DANGER TO CREW OR VEHICLE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/2R
MDAC ID: 407 ABORT: 3/2R

ITEM: RPC
FAILURE MODE: FAILED OPEN

LEAD ANALYST: K. PIETZ SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MASS MEMORY UNITS (MMU)
3) POWER SUPPLY
4) RPC
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2
PART NUMBER: MC 615-0005

CAUSES: BROKEN CONTACT

EFFECTS/RATIONALE:
IF BOTH MMUS FAIL, OPS 2 AND 3 SOFTWARE CANNOT BE LOADED.
HOWEVER, OPS 3 CAN BE UPLINKED OR BFS ENGAGED FOR ENTRY.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86
SUBSYSTEM: DPS
MDAC ID: 408

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

ITEM: SWITCH
FAILURE MODE: FAILED OPEN

LEAD ANALYST: K. PIETZ SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MASS MEMORY UNITS (MMU)
3) POWER SUPPLY
4) SWITCH
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2
PART NUMBER: MC 615-0005

CAUSES: BROKEN CONTACT

EFFECTS/RATIONALE:
IF BOTH MMUS FAIL, OPS 2 AND 3 SOFTWARE CANNOT BE LOADED.
HOWEVER, OPS 3 CAN BE UPLINKED OR BFS ENGAGED FOR ENTRY.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/3
MDAC ID: 409 ABORT: 3/3

ITEM: SWITCH
FAILURE MODE: FAILED CLOSED (ON)

LEAD ANALYST: K. PIETZ SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MASS MEMORY UNITS (MMU)
3) POWER SUPPLY
4) SWITCH
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2
PART NUMBER: MC 615-0005

CAUSES: STRAY PARTICLE

EFFECTS/RATIONALE:
NONE

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/2R
MDAC ID: 410 ABORT: 3/2R

ITEM: CONTROL LOGIC
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: K. PIETZ SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MASS MEMORY UNITS (MMU)
3) CONTROL LOGIC
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2
PART NUMBER: MC 615-0005

CAUSES: ELECTRICAL FAILURE

EFFECTS/RATIONALE:
IF BOTH MMUS FAIL, OPS 2 OR 3 SOFTWARE CANNOT BE LOADED.
HOWEVER, OPS 3 CAN BE UPLINKED OR BFS ENGAGED FOR ENTRY.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/2R
MDAC ID: 411 ABORT: 3/2R

ITEM: CONTROL LOGIC
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: K. PIETZ SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MASS MEMORY UNITS (MMU)
3) CONTROL LOGIC
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2
PART NUMBER: MC 615-0005

CAUSES: ELECTRICAL FAILURE

EFFECTS/RATIONALE:
IF BOTH MMUS FAIL, OPS 2 OR 3 SOFTWARE CANNOT BE LOADED.
HOWEVER, OPS 3 CAN BE UPLINKED OR BFS ENGAGED FOR ENTRY.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/2R
MDAC ID: 412 ABORT: 3/2R

ITEM: POWER SUPPLY
FAILURE MODE: FAILS OUT OF TOLERANCE OR INTERRUPT

LEAD ANALYST: K. PIETZ SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) MASS MEMORY UNITS (MMU)
3) POWER SUPPLY
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 1,2
PART NUMBER: MC 615-0005

CAUSES: ELECTRICAL FAILURE

EFFECTS/RATIONALE:
IF BOTH MMUS FAIL, OPS 2 AND 3 SOFTWARE CANNOT BE LOADED. HOWEVER, OPS 3 CAN BE UPLINKED OR BFS ENGAGED FOR ENTRY. NEITHER OF THESE OPTIONS REQUIRE THE USE OF MMUS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 501 ABORT: 3/1R

ITEM: CIA
FAILURE MODE: LOSS OF OUTPUT TO MAIN ENGINE ON ONE CHANNEL

LEAD ANALYST: B. ROBB SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) ENGINE INTERFACE UNIT (EIU)
3) CONTROLLER INTERFACE ADAPTER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 4,5,6
PART NUMBER:

CAUSES: CONTROLLER INTERFACE ADAPTER FAILS

EFFECTS/RATIONALE:
LOSS OF THROTTLE COMMANDS, SHUTDOWN COMMANDS, LIMIT INHIBIT/ENABLE COMMANDS, GPC SHUTDOWN COMMANDS, AND MPS DUMP COMMANDS. LOSS OF ONE OF THREE COMMAND PATHS WILL BE VOTED INVALID. NO EFFECT ON ENGINE OPERATIONS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 502 ABORT: 3/1R

ITEM: MIA
FAILURE MODE: LOSS OF OUTPUT TO MAIN ENGINE ON ONE CHANNEL

LEAD ANALYST: B. ROBB SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) ENGINE INTERFACE UNIT (EIU)
3) MULTIPLEXER INTERFACE ADAPTER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 4,5,6
PART NUMBER:

CAUSES: MULTIPLEXER INTERFACE ADAPTER FAILS

EFFECTS/RATIONALE:
LOSS OF THROTTLE COMMANDS, SHUTDOWN COMMANDS, LIMIT INHIBIT/ENABLE COMMANDS, GPC SHUTDOWN COMMANDS, AND MPS DUMP COMMANDS. LOSS OF ONE OF THREE COMMAND PATHS WILL BE VOTED INVALID. NO EFFECT ON ENGINE OPERATIONS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 503 ABORT: 3/1R

ITEM: POWER CONTROL SWITCH
FAILURE MODE: LOSS OF OUTPUT TO MAIN ENGINE ON ANY OF THREE COMMAND CHANNELS

LEAD ANALYST: B. ROBB SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) ENGINE INTERFACE UNIT (EIU)
3) POWER CONTROL SWITCH
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 4,5,6
PART NUMBER:

CAUSES: EIU POWER CONTROL SWITCH FAILS OPEN

EFFECTS/RATIONALE:
LOSS OF ALL COMMANDS AND STATUS OF THE ENGINE FOR THIS FAILURE MODE THE LOSS OF THE ENTIRE EIU WILL RESULT IN ENGINE SHUTDOWN BY CREW BY SWITCHING AC POWER TO THE ENGINE TO OFF POSITION.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 504 ABORT: 3/1R

ITEM: INTERNAL POWER SUPPLIES
FAILURE MODE: LOSS OF OUTPUT TO MAIN ENGINE ON ANY OF THREE COMMAND CHANNELS

LEAD ANALYST: B. ROBB SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) ENGINE INTERFACE UNIT (EIU)
3) INTERNAL POWER SUPPLIES
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 4,5,6
PART NUMBER:

CAUSES: INTERNAL POWER SUPPLIES FAIL

EFFECTS/RATIONALE:
LOSS OF THROTTLE COMMANDS, SHUTDOWN COMMANDS, LIMIT INHIBIT/ENABLE COMMANDS, GPC SHUTDOWN COMMANDS, AND MPS DUMP COMMANDS. THE LOSS OF THE ENTIRE EIU WILL RESULT IN ENGINE SHUTDOWN BY CREW BY SWITCHING AC POWER TO THE ENGINE TO OFF POSITION.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/1R
MDAC ID: 505 ABORT: 3/1R

ITEM: CONTROLLER INTERFACE ADAPTER
FAILURE MODE: LOSS OF OUTPUT TO ONE OR THREE GPC ON STATUS OF ENGINES.

LEAD ANALYST: B. ROBB SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) ENGINE INTERFACE UNIT (EIU)
3) CONTROLLER INTERFACE ADAPTER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 4,5,6
PART NUMBER:

CAUSES: CONTROLLER INTERFACE ADAPTER FAILURE

EFFECTS/RATIONALE:
NO MAIN ENGINE MONITORING BY ONE OR THREE OF FOUR GPCS. MCC CONFIRMS COMMAND PATH GOOD BY MONITORING 3-G THROTTLE CONTROL. IF ENGINE IS NOT OPERATING, THE PUSHBUTTON FOR THE ENGINE MUST BE USED TO INFORM GUIDANCE FOR PREVALVE CLOSURES. FLIGHT RULE 2-17 PRECLUDES RESTRINGING DURING POWERED ASCENT THROUGH MECO.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: DPS FLIGHT: 3/3
MDAC ID: 506 ABORT: 3/1R

ITEM: OIE
FAILURE MODE: LOSS OF OUTPUT TO S-BAND, MAINTENANCE RECORDER, OR LPS T-0 UMBILICAL

LEAD ANALYST: B. ROBB SUBSYS LEAD: B. ROBB

BREAKDOWN HIERARCHY:
1) DPS
2) ENGINE INTERFACE UNIT (EIU)
3) OPERATIONAL INTERFACE ELEMENT
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 4,5,6
PART NUMBER:

CAUSES: OPERATIONAL INTERFACE ELEMENT FAILURE

EFFECTS/RATIONALE:
NO FM DATA RECORDING, NO MCC STATUS MONITORING OF ENGINE EXCEPT IN DOWNLIST DATA FROM GPC.

REFERENCES:

APPENDIX D
POTENTIAL CRITICAL ITEMS

MDAC ID	ITEM	FAILURE MODE
203	IOP	Premature Operation
208	CPU	Inadvertent Operation