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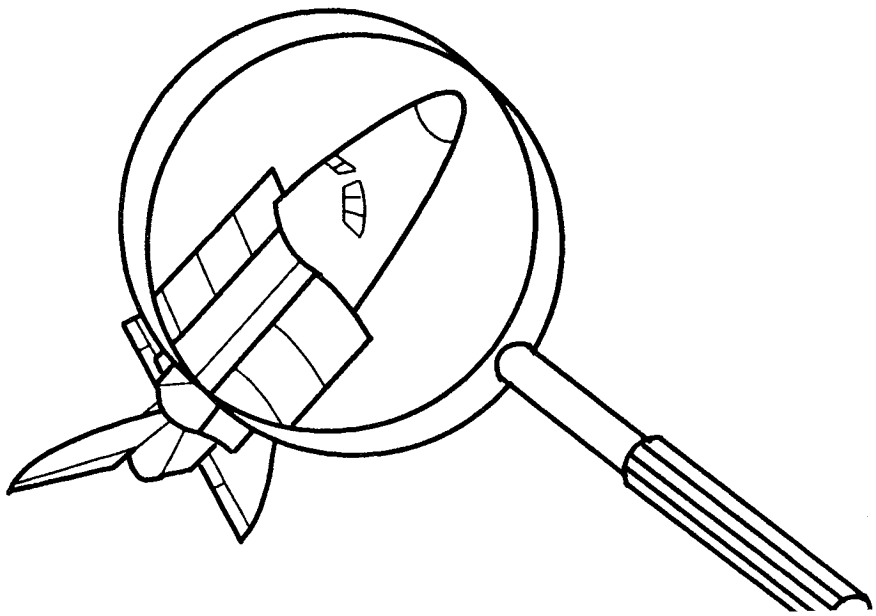
INDEPENDENT ORBITER ASSESSMENT

ANALYSIS OF THE INSTRUMENTATION SUBSYSTEM



MCDONNELL DOUGLAS

INDEPENDENT ORBITER ASSESSMENT

ANALYSIS
OF THE
INSTRUMENTATION
SUBSYSTEM

12 DECEMBER 1986

MCDONNELL DOUGLAS ASTRONAUTICS COMPANY
HOUSTON DIVISION

SPACE TRANSPORTATION SYSTEM ENGINEERING AND OPERATIONS SUPPORT

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INDEPENDENT ORBITER ASSESSMENT ANALYSIS OF THE INSTRUMENTATION SUBSYSTEM

12 December 1986

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Independent Orbiter Assessment
Analysis of the Instrumentation Subsystem

1.0 EXECUTIVE SUMMARY

The McDonnell Douglas Astronautics Company (MDAC) was selected in June 1986 to perform an Independent Orbiter Assessment (IOA) of the Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL). Direction was given by the STS Orbiter and GFE Projects Office to perform the hardware analysis using the instructions and ground rules defined in NSTS 22206, Instructions for Preparation of FMEA and CIL, 10 October 1986. The IOA approach features a top-down analysis of the hardware to determine failure modes, criticality, and potential critical items. To preserve independence, this analysis was accomplished without reliance upon the results contained within the NASA FMEA/CIL documentation. This report documents (Appendix C) the independent analysis results for the Instrumentation Subsystem.

The Instrumentation Subsystem (hereafter referred to as the subsystem or SS) consists of transducers, signal conditioning equipment, pulse code modulation (PCM) encoding equipment, tape recorders, frequency division multiplexers, and timing equipment. For this analysis, the SS is broken into two major groupings: Operational Instrumentation (OI) equipment and Modular Auxiliary Data System (MADS) equipment.

The OI equipment is required to acquire, condition, scale, digitize, interleave/multiplex, format, and distribute operational Orbiter and payload data and voice for display, recording, telemetry, and checkout. It also must provide accurate timing for time-critical functions for crew and payload specialist use.

The MADS provides additional instrumentation to measure and record selected pressure, temperature, strain, vibration, and event data for post-flight playback and analysis. There is no real-time telemetry of MADS data. MADS data is used to assess vehicle responses to the flight environment and to permit correlation of such data from flight to flight, as well as with the Development Flight Instrumentation (DFI) data gathered by OV102 during Orbital Flight Test (OFT).

The IOA analysis utilized available SS hardware drawings and schematics for identifying hardware assemblies and components and their interfaces. Criticality for each item was assigned on the basis of the worst-case effect of the failure modes identified.

Figure 1 presents a summary by category of the failure criticalities for the SS, and individually for the two major groupings of the SS (OI and MADS). Figure 2 gives details on the OI group. Because all failure modes for MADS are 3/3, it is not broken down by element as is the OI in Figure 2. A tabular summary is also presented below, giving total count for each of the modes identified, and an overall count.

Summary of IOA Failure Modes By Criticality (HW/F)							
Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
Number :	-	1	7	6	20	54	88

For each failure mode identified, the criticality and redundancy screens were examined to identify candidate items for the Critical Items List (CIL). A summary of potential CIL items is presented below:

Summary of IOA Potential Critical Items (HW/F)						
Criticality:	1/1	2/1R	2/2	3/1R	3/2R	TOTAL
Number :	-	1	7	-	-	8

Potential CIL items identified for the SS were the MTU, the PCMMU format control switch, the PCMMU power switch, and MDMs OA1, OA2, and OA3.

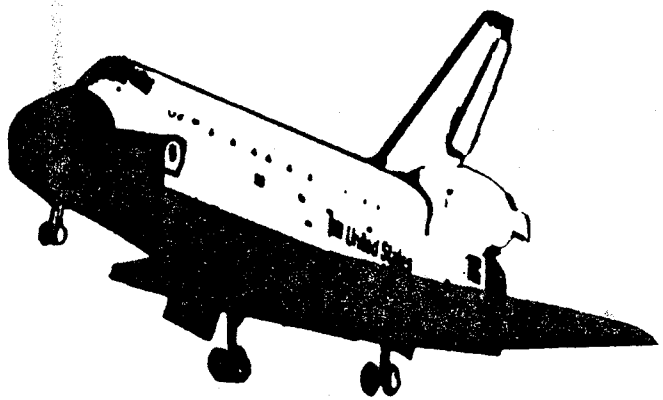
IOA
INSTRUMENTATION OVERVIEW ANALYSIS SUMMARY

INSTRUMENTATION ANALYSIS SUMMARY

CRITICALITY	#FM	#PCI
1/1	0	0
2/1R	1	1
2/2	7	7
3/1R	6	0
3/2R	20	0
3/3	54	0

OI

CRITICALITY	#FM	#PCI
1/1	0	0
2/1R	1	1
2/2	7	7
3/1R	6	0
3/2R	20	0
3/3	22	0



MADS

CRITICALITY	#FM	#PCI
3/3	32	0

FIGURE 1

IOA
OI OVERVIEW ANALYSIS SUMMARY

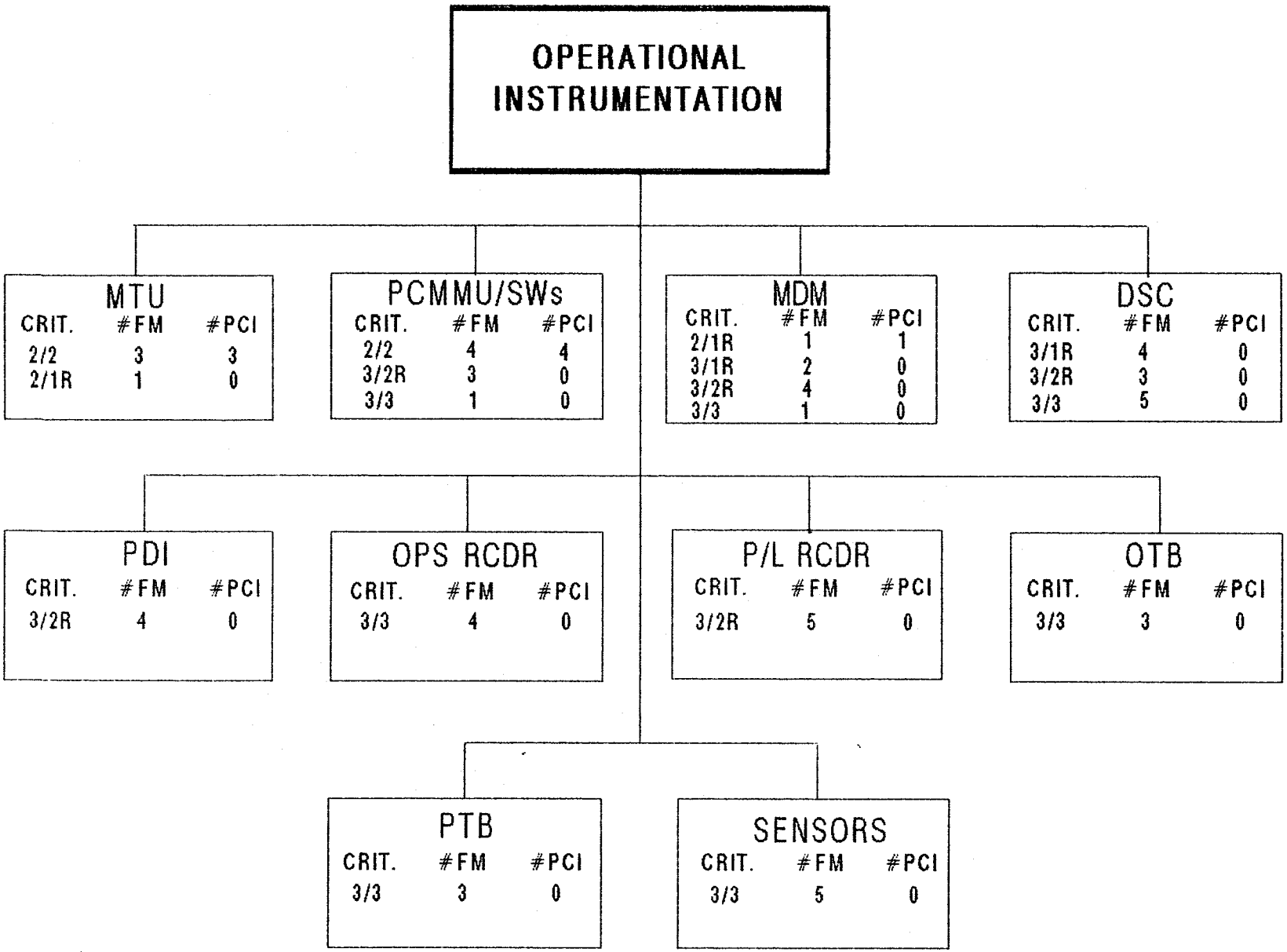


FIGURE 2

2.0 INTRODUCTION

2.1 Purpose

The 51-L Challenger accident prompted the NASA to readdress safety policies, concepts, and rationale being used in the National Space Transportation System (NSTS). The NSTS Office has undertaken the task of reevaluating the FMEA/CIL for the Space Shuttle design. The MDAC is providing an independent assessment of the Orbiter FMEA/CIL for completeness and technical accuracy.

2.2 Scope

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 approach is to use a top-down analysis utilizing available drawings and other documentation to break the subsystem down into major components and lower-level subassembly or hardware items. That documentation is listed in the individual failure mode analysis sheets, and supplementary documentation is shown in Section 5. The detailed steps in the analysis are summarized in Steps 1, 2, and 3 below. Step 4 will be used in the assessment to be performed at a later date, wherein the results of the analysis will be compared with the NASA and Prime Contractor FMEAs/CIL, and any residual unresolved issues will be reported.

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

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

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

Step 4.0 Compare IOA analysis data to NASA FMEA/CIL
- 4.1 Resolve differences
- 4.2 Review in-house
- 4.3 Document assessment issues
- 4.4 Forward findings to Project Manager

2.4 Instrumentation Subsystem Ground Rules and Assumptions

The ground rules and assumptions used in the SS analysis and assignment of criticalities are given in Appendix B. Subsystem-specific ground rules were set up to limit the analysis to single-point failures for each failure mode.

3.0 SUBSYSTEM DESCRIPTION

3.1 Design and Function

The subsystem consists of the hardware required for data acquisition, conditioning, timing, formatting, and routing for checkout and display as needed, and for recording or downlinking by telemetry as required.

3.1.1 Operational Instrumentation

1. Sensors and transducers acquire data representing measurements or status of individual parameters throughout the vehicle and convert quantities sensed to electrical signals.

2. Signal conditioners normalize or standardize the sensor outputs either to a range for analog measurements or to set levels for discretes (ON/OFF, HIGH/LOW). There are 13 Dedicated Signal Conditioners (DSCs) handling approximately 1200 individual measurement channels.

3. Reference junctions provide a reference potential for a known temperature for thermocouple sensors.

4. The seven OI Multiplexer/Demultiplexers (MDMs) format incoming data from signal conditioners and feed it into the OI data buses, which in turn route the formatted data to the active PCMMU.

5. The active Pulse Code Modulation Master Unit (PCMMU) accepts incoming data from the OI MDMs, combines that data with GPC downlist data and payload data (if any) from the PDI. The PCMMU formats the data into a serial bit stream and routes it to the communications subsystem for further processing/routing. (A "cold-standby" PCMMU is available as backup).

6. The Master Timing Unit (MTU) is a very stable and accurate source of timing for Orbiter and payload operations. It provides time in IRIG B GMT and IRIG B MET formats, and also provides synchronizing/timing signals for many Orbiter LRUs.

7. The Orbiter Timing Buffer (OTB) amplifies and splits one IRIG B GMT signal and one IRIG B MET signal to produce eight GMT and four MET outputs for use by the Orbiter.

8. The Payload Timing Buffer (PTB) performs the same functions as the OTB, but for payload users.

9. Two operational tape recorders are used to alternately record and dump OI data and voice. They are identical 14-track wideband units capable of recording analog or digital data and voice.

10. The Payload Recorder (PLR) is identical to the two Ops recorders, and is used to record payload data.

3.1.2 Modular Auxiliary Data System

1. Sensors and transducers perform the same function for MADS as for OI.

2. Strain Gage Signal Conditioners (SGSCs) accept the outputs of completion bridges and condition the signals for handover to the MADS PCM Mux.

3. The PCMU accepts outputs from the SGSCs and multiplexes, encodes, and formats the data for output to the T-O umbilical or to the MADS Control Module (MCM) for further routing to the MADS recorder.

4. Wideband Signal Conditioners (WBSCs) handle high-frequency signals and with wide variations in output amplitude, such as from transducers sensing vibratory, acoustic, and POGO phenomena.

5. The Frequency Division Multiplexer (FDM) accepts WBSC outputs. Each individual channel measurement signal modulates a voltage-controlled oscillator (VCO) subcarrier signal. The individual modulated VCO subcarriers are summed and the composite FDM output is passed to the MADS Control Module (MCM) for eventual routing to the MADS recorder.

6. The MCM controls power to the various MADS LRUs and selects recorder speeds, modes, tape direction, tape tracks, and PCM Mux formats and data rates.

3.2 Interfaces and Locations

The SS hardware is located throughout the Orbiter. OI and MADs equipment locations are shown in Figures 3 and 4. Refer to Table I for an overview of equipment locations. Figures 5 and 6 show subsystem interfaces for OI and MADS, respectively.

TABLE I – INSTRUMENTATION EQUIPMENT LOCATION

OI

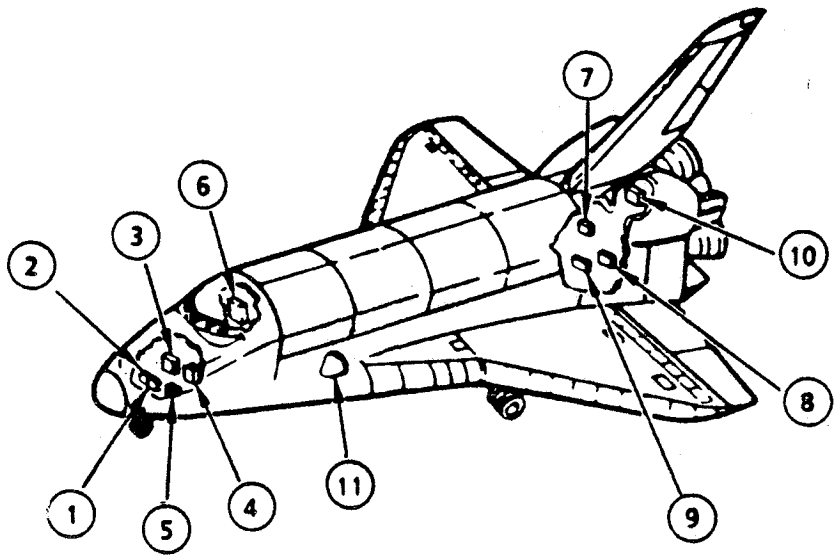
OI NOMENCLATURE		INSTALLED LOCATION
DSCs	OF1	AV BAY 1
	OF2	AV BAY 2
	OF3	AV BAY 3
	OF4	FWD RCS MODULE
	OA1	AV BAY 4
	OA2	AV BAY 5
	OA3	AV BAY 6
	OM1	MID FUSELAGE
	OM2	MID FUSELAGE
	OL1	LEFT OMS POD
	OL2	LEFT OMS POD
	OR1	RIGHT OMS POD
	OR2	RIGHT OMS POD
MDMs	OF1	AV BAY 1
	OF2	AV BAY 2
	OF3	AV BAY 3
	OF4	FLT DECK
	OA1	AV BAY 4
	OA2	AV BAY 5
	OA3	AV BAY 6

OI NOMENCLATURE		INSTALLED LOCATION
PDI		AV BAY 1
PCMMUs	1	AV BAY 1
	2	AV BAY 2
MTU		AV BAY 3B
RCDRs	OPS 1	AV BAY 2
	OPS 2	AV BAY 2
	P/L	AV BAY 1
OTB		BEHIND PANEL L16
PTB		BEHIND PANEL L16

MADS

MADS NOMENCLATURE	INSTALLED LOCATION
WBSC	MID BODY
SGSC	MID BODY
PCMU	MID BODY
FDM	MID BODY
PDA	MID BODY
MCM	CABIN MIDDECK
RCDR	CABIN MIDDECK

OPERATIONAL INSTRUMENTATION EQUIPMENT LOCATION



1 FWD AVIONICS BAY 1
- DSC OM1
- MDM OF1
- PCMMU NO. 1
- P/L RCDR
- P/L DATA INTERLEAVER

2 FWD AVIONICS BAY 2
- DSC OF2
- MDM OF2
- PCMMU NO. 2
- OPS RCDR 1
- OPS RCDR 2

3 FWD AVIONICS BAY 3A
- DSC OF3
- MDM OF3

4 FWD AVIONICS BAY 3B
- MTU

5 FWD RCS
- DSC OF4

6 FLT DECK
- MDM OF4

7 AFT AVIONICS BAY 4
- DSC OA1
- MDM OA1

8 AFT AVIONICS BAY 5
- DSC OA2
- MDM OA2

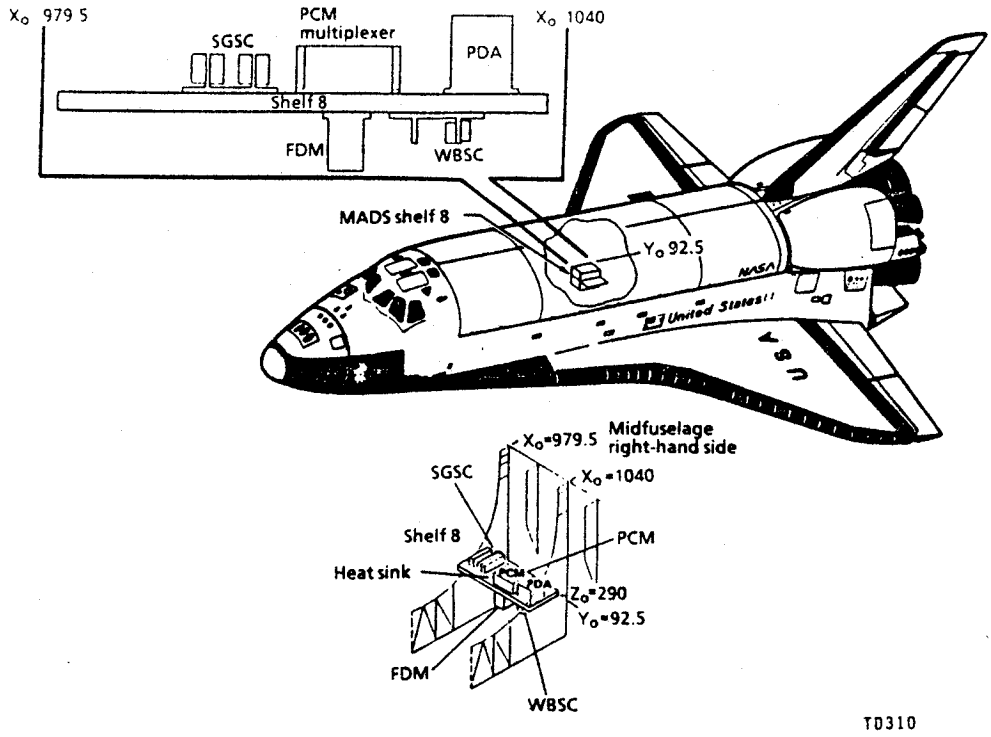
9 AFT AVIONICS BAY 6
- DSC OA3
- MDM OA3

10 LEFT/RIGHT OMS PODS
- DSC OL1
- DSC OL2
- DSC OR1
- DSC OR2

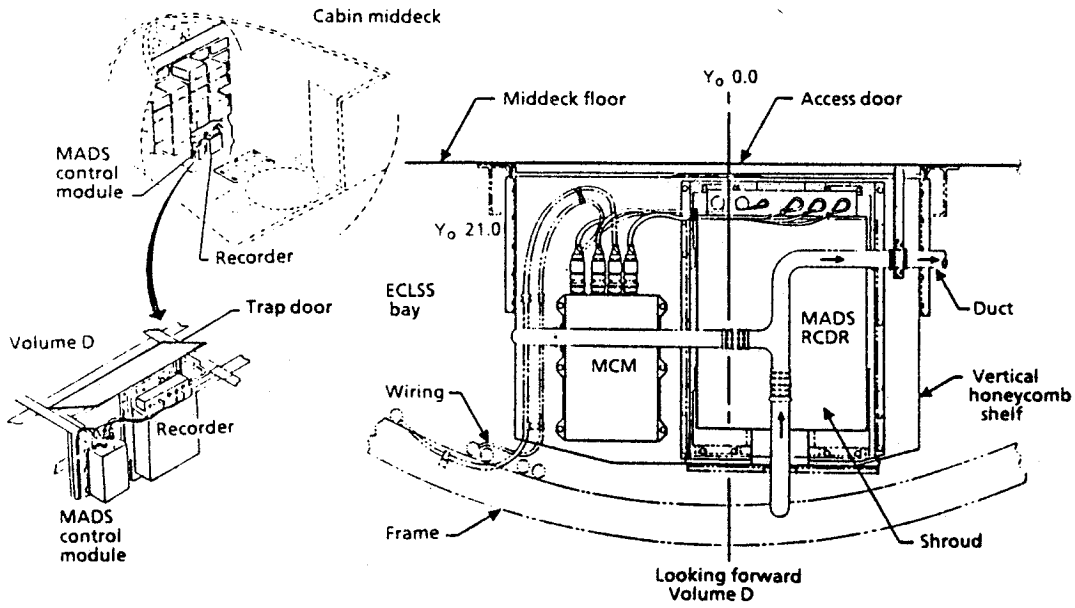
11 MID BODY
- DSC OM1
- DSC OM2

FIGURE 3

MADS EQUIPMENT INSTALLATION



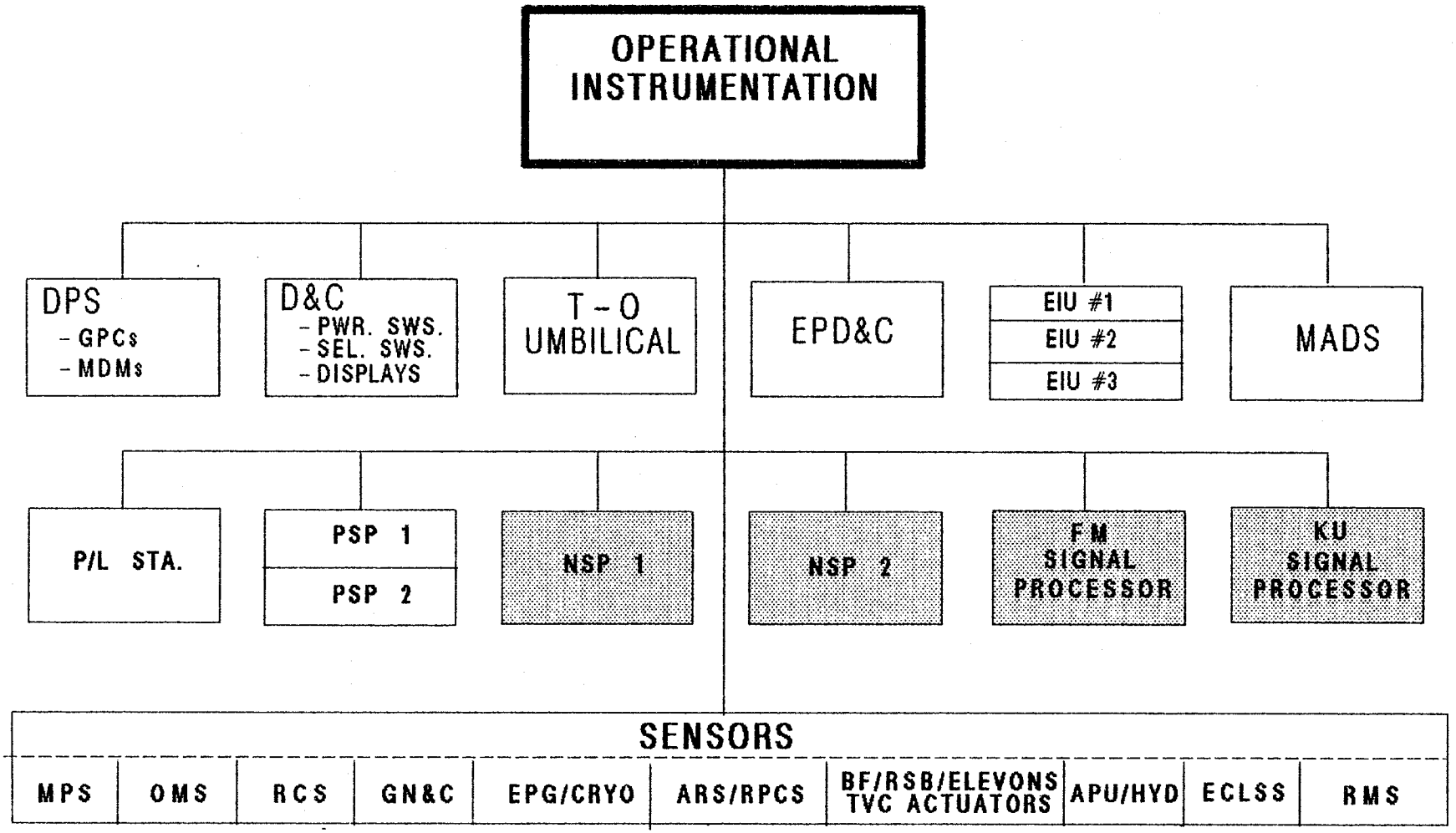
MID BODY MADS LOCATIONS



CABIN MIDDECK MADS LOCATIONS

FIGURE 4

IOA
OPERATIONAL INSTRUMENTATION INTERFACES



NOTE: SHADED AREAS NOT INCLUDED IN IOA

FIGURE 5

IOA
MODULAR AUXILIARY DATA SYSTEM INTERFACES

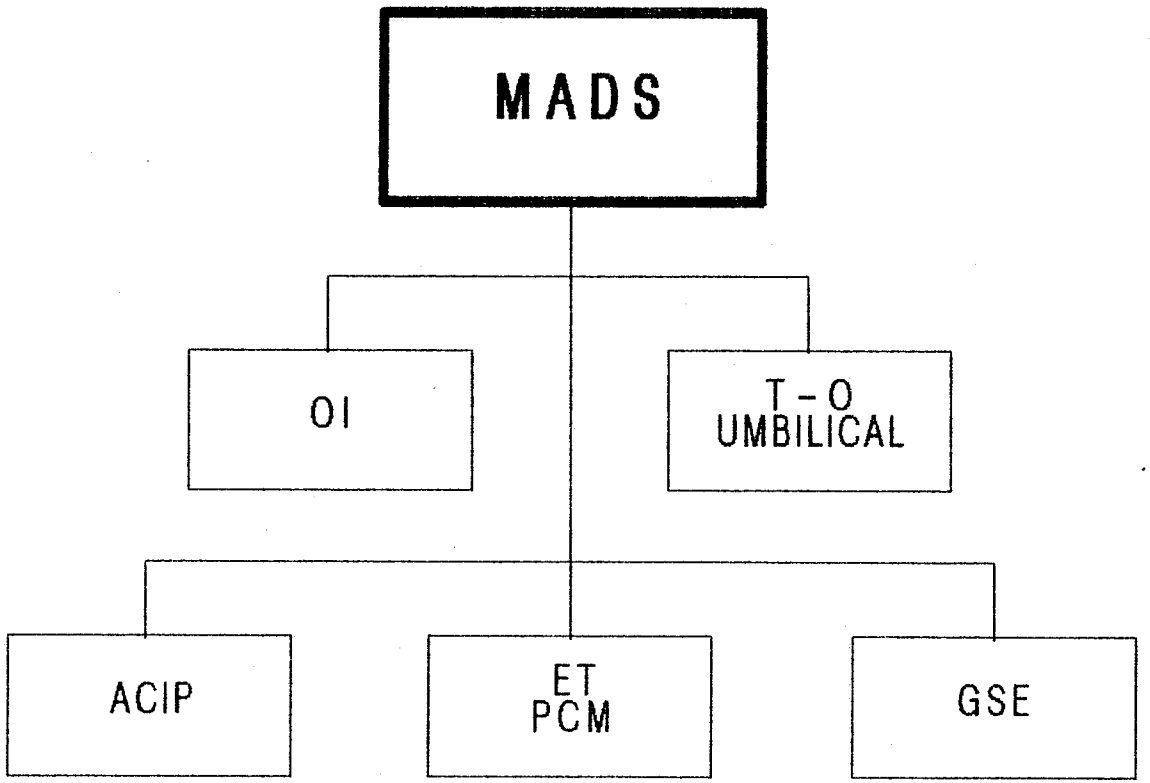


FIGURE 6

3.3 Hierarchy

Figures 7, 8 and 9 depict the hierarchy of the major SS LRUs and the related subassemblies. Figures 10 through 15 give detailed subsystem LRU representations. Functional block diagrams for OI and MADS are given in Figures 16 and 17.

IOA
INSTRUMENTATION SUBSYSTEM OVERVIEW

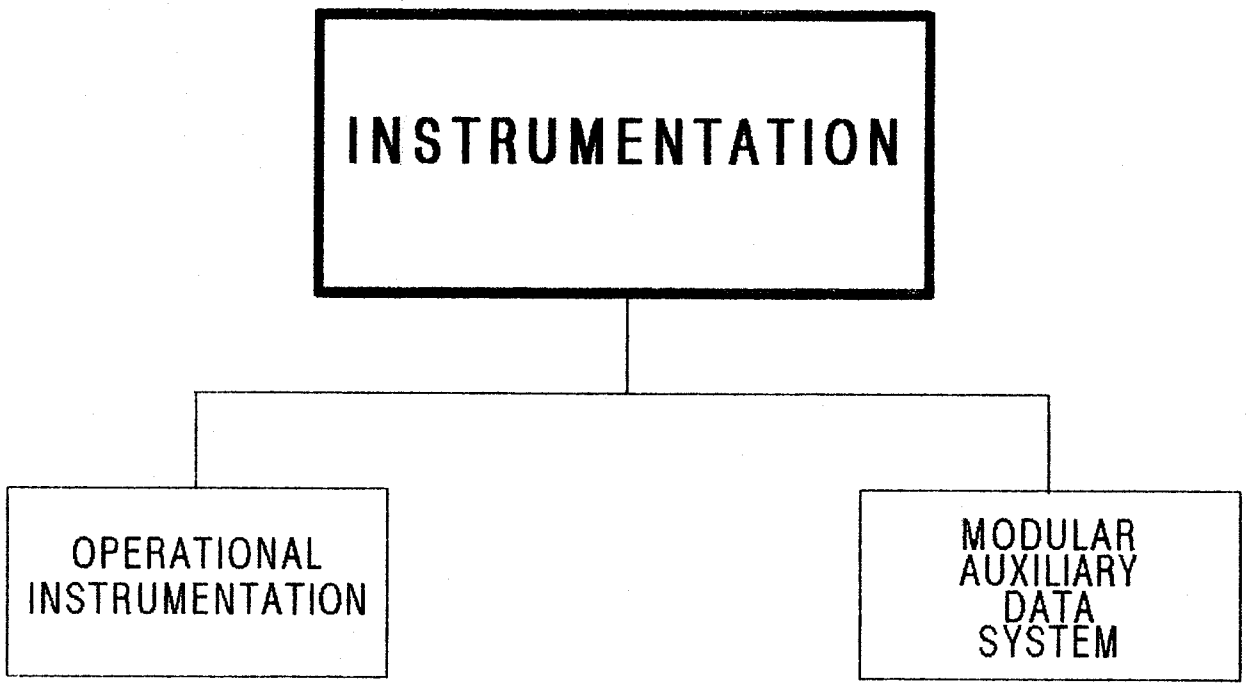


FIGURE 7

IOA
OPERATIONAL INSTRUMENTATION DETAILED SYSTEM REPRESENTATION OVERVIEW

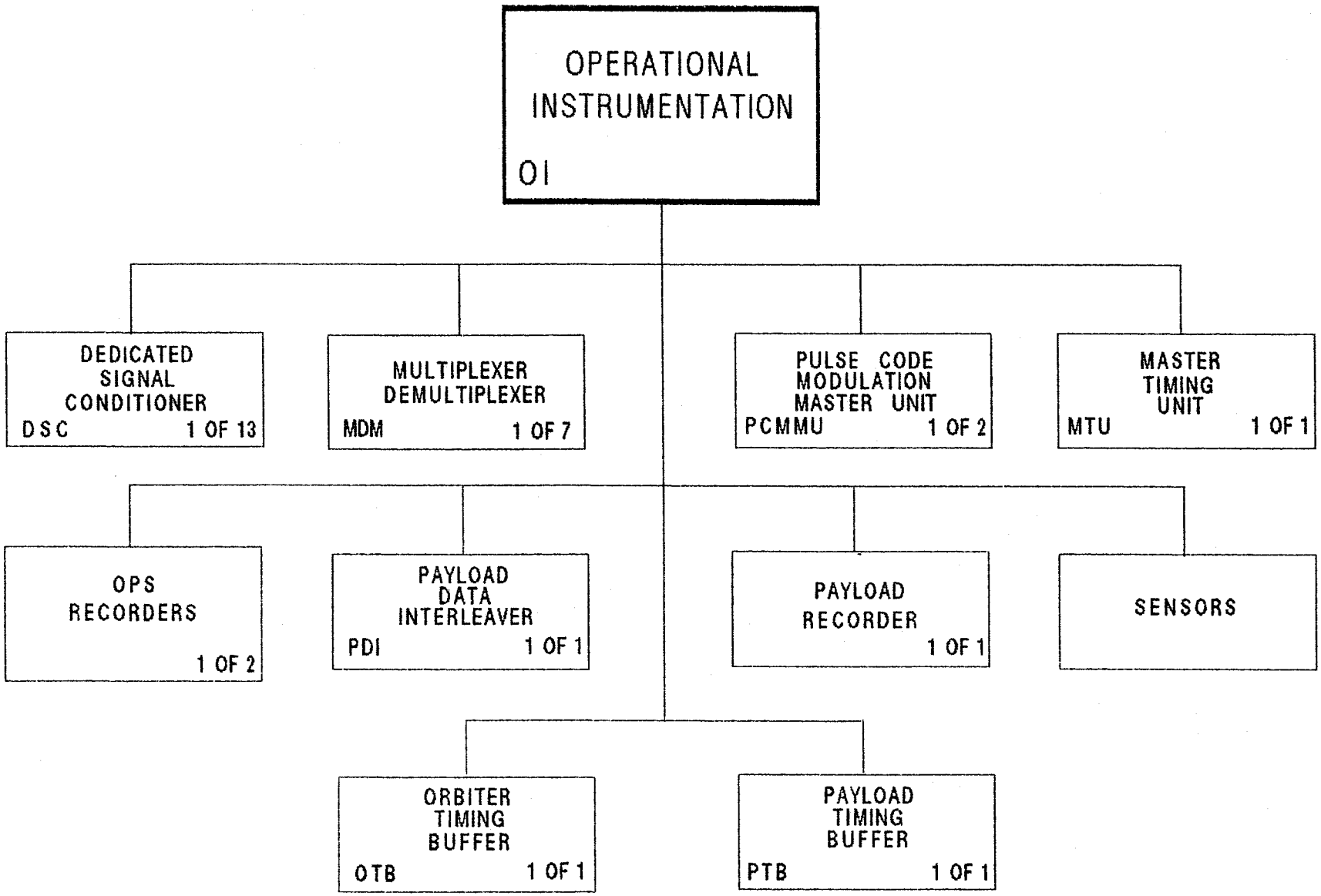
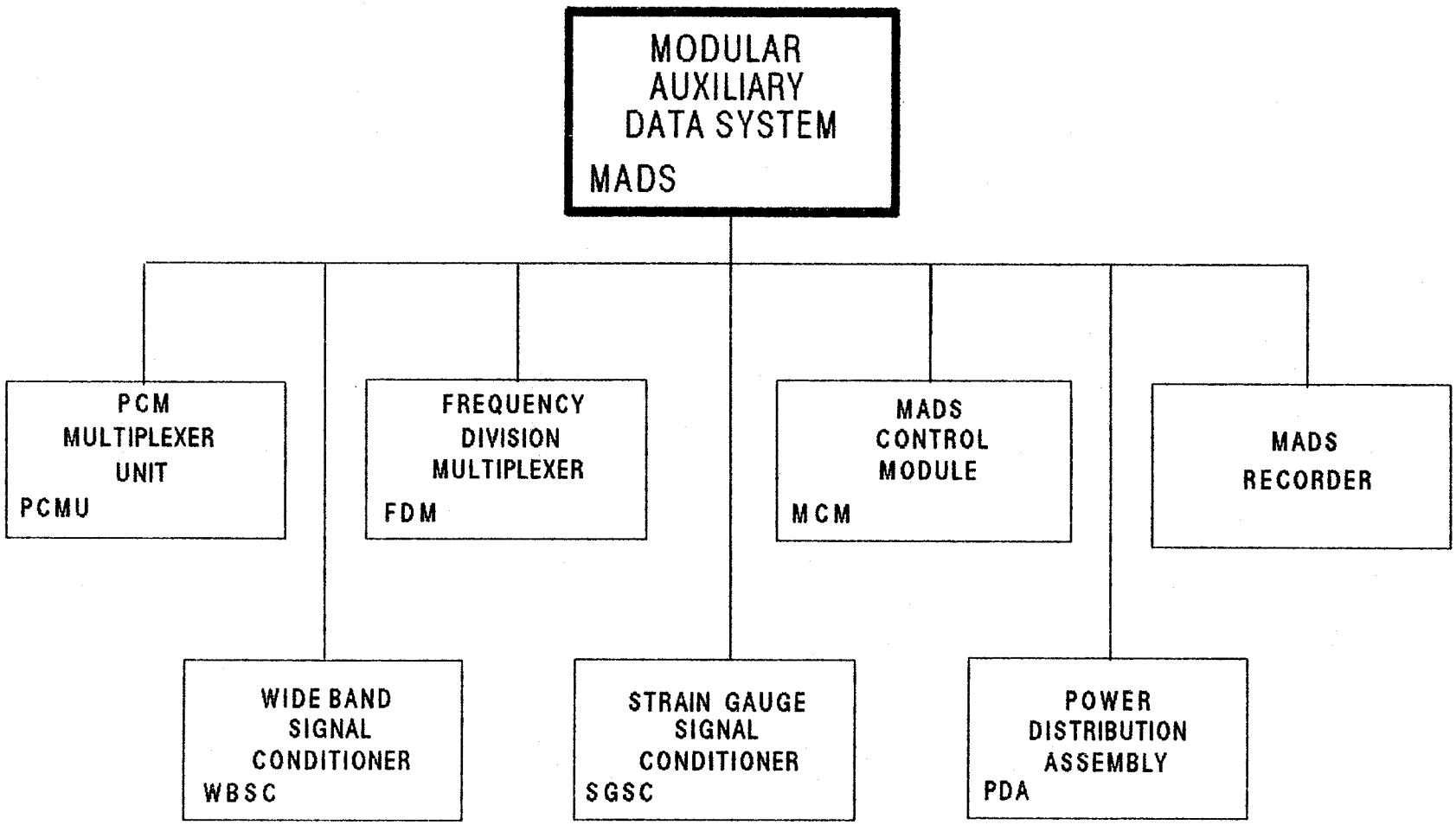


FIGURE 8

IOA
MADS DETAIL SYSTEM REPRESENTATION OVERVIEW



VEHICLE	PCMU	FDM	MCM	RCDR	WBSC	SGSC	PDA
OV - 102	2	2	1	1	3	2	1
OV - 103/104	1	1	1	1	1	1	1

FIGURE 9

IOA
MTU DETAIL SYSTEM REPRESENTATION

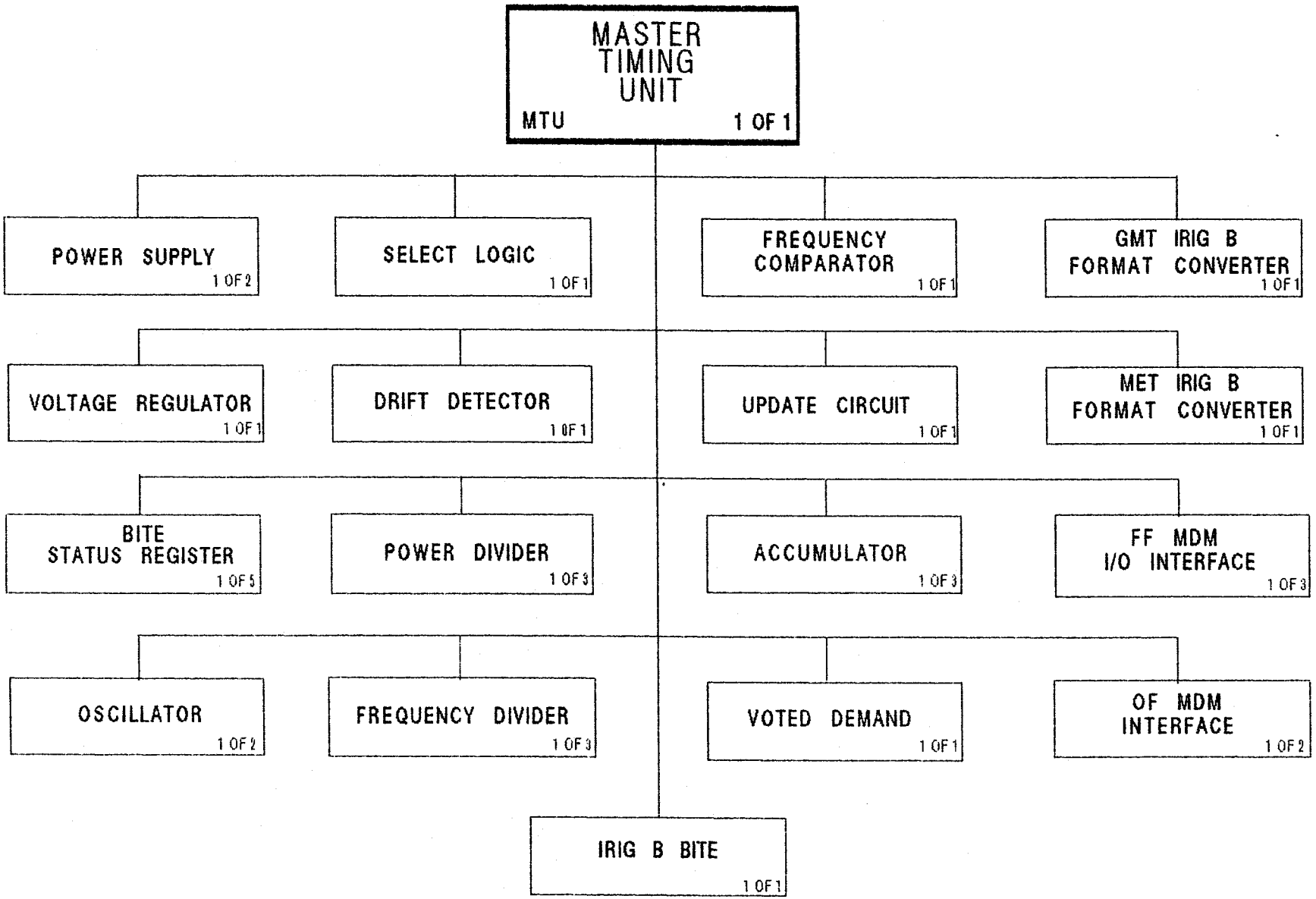


FIGURE 10

IOA
PCMMU DETAIL SYSTEM REPRESENTATION

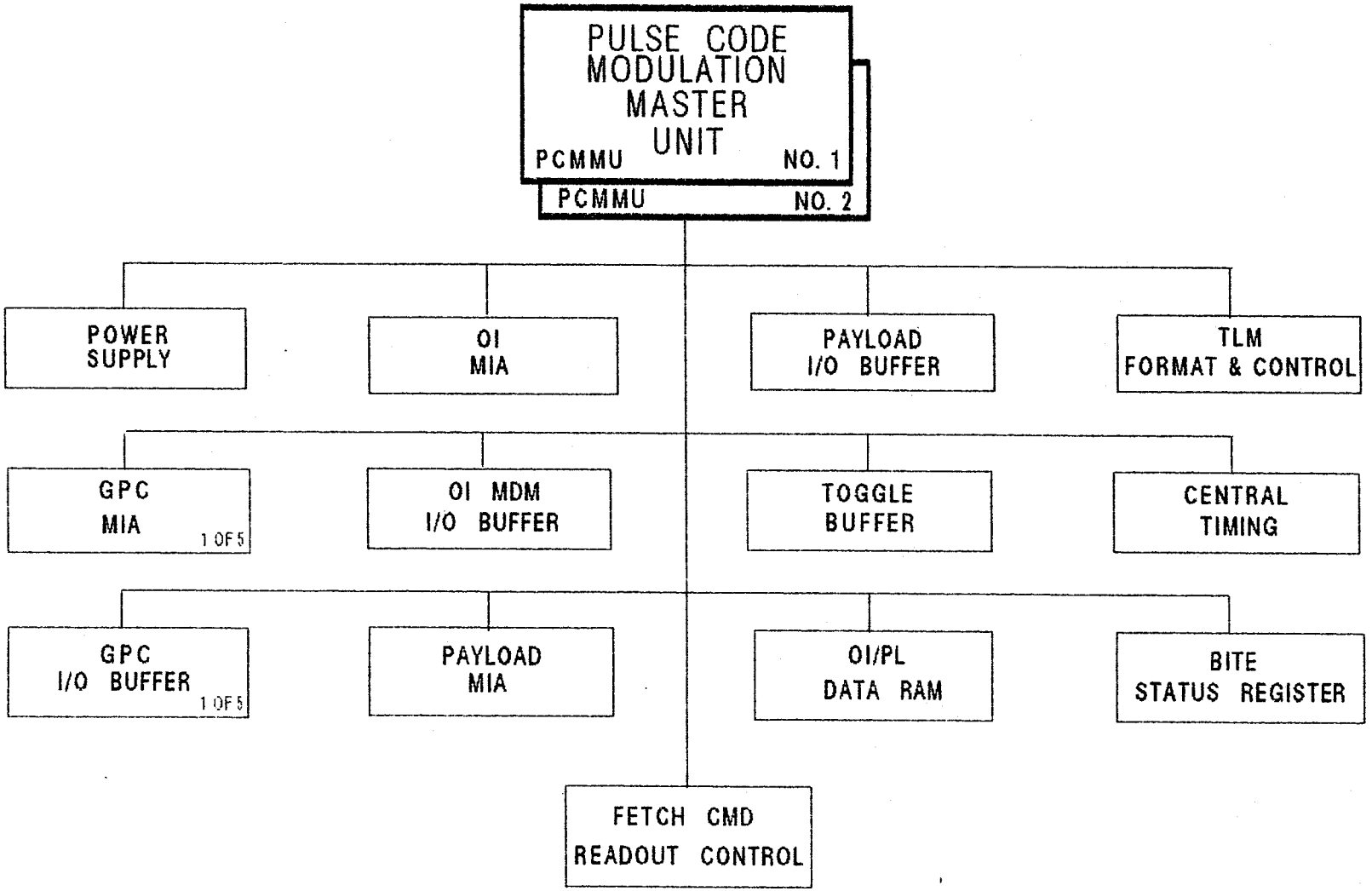


FIGURE 11

IOA

OI MDM DETAILED SYSTEM REPRESENTATION

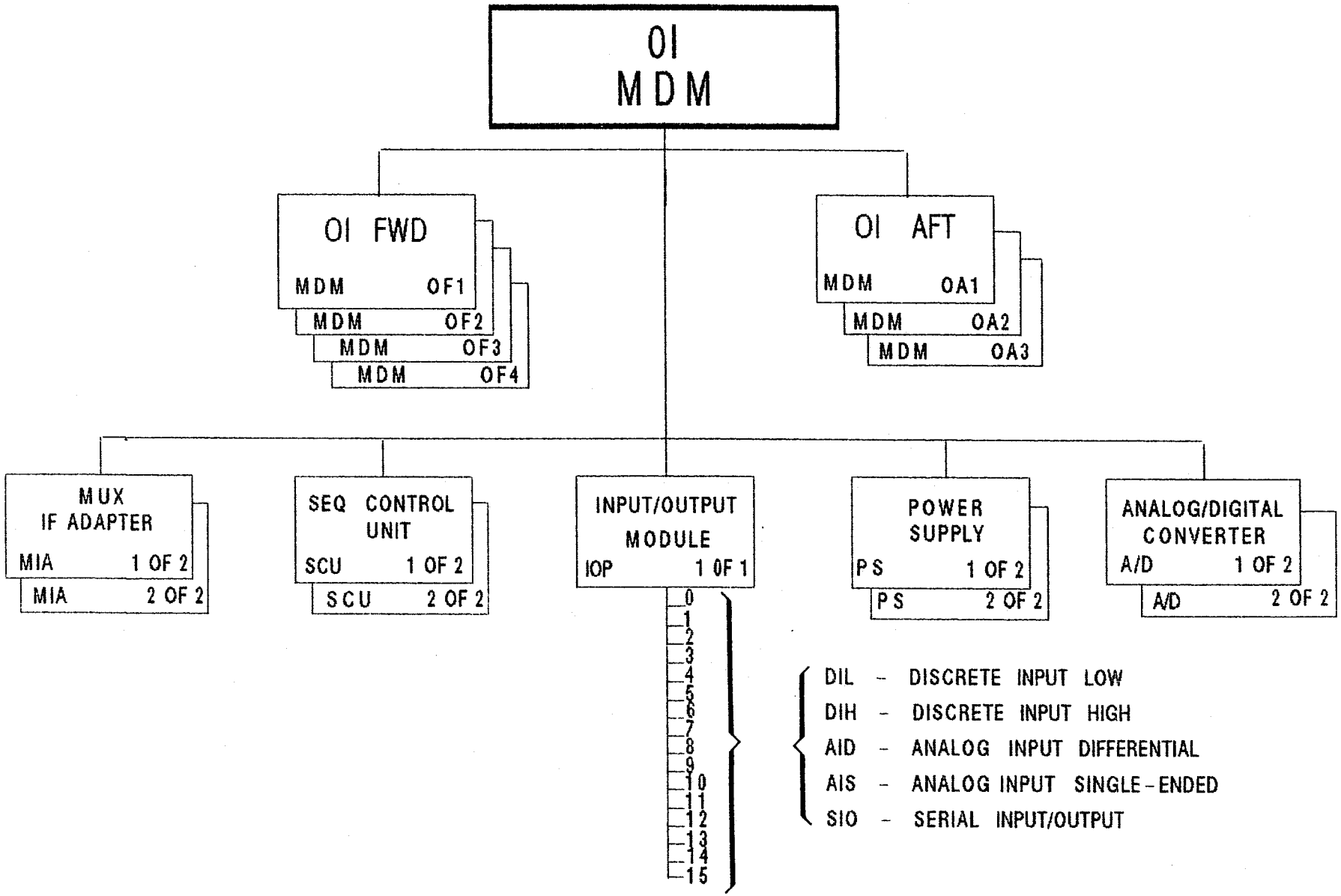
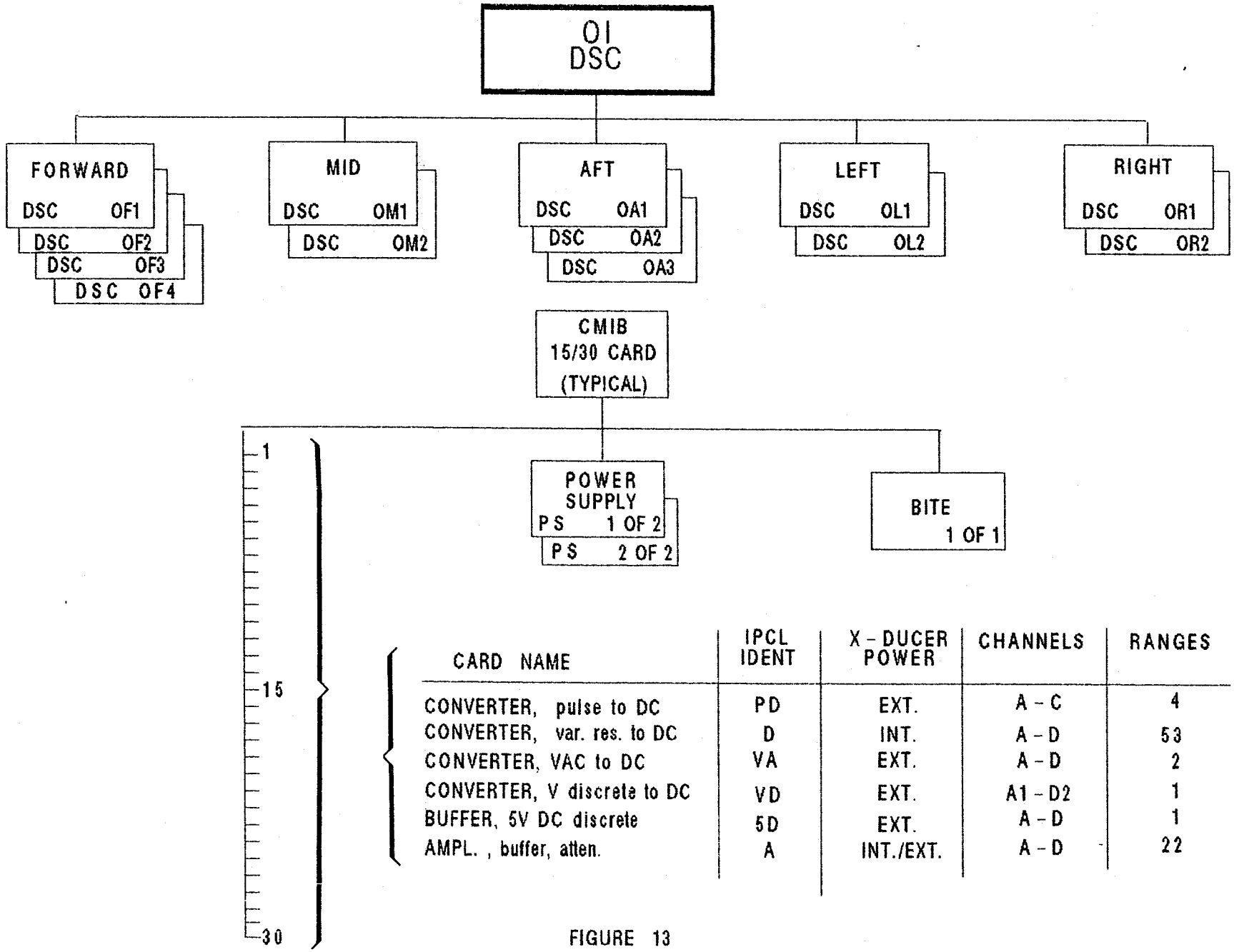


FIGURE 12

IOA
OI DSC DETAILED SYSTEM REPRESENTATION



CARD NAME	IPCL IDENT	X-DUCER POWER	CHANNELS	RANGES
CONVERTER, pulse to DC	PD	EXT.	A - C	4
CONVERTER, var. res. to DC	D	INT.	A - D	53
CONVERTER, VAC to DC	VA	EXT.	A - D	2
CONVERTER, V discrete to DC	VD	EXT.	A1 - D2	1
BUFFER, 5V DC discrete	5D	EXT.	A - D	1
AMPL., buffer, atten.	A	INT./EXT.	A - D	22

FIGURE 13

IOA
PDI DETAIL SYSTEM REPRESENTATION

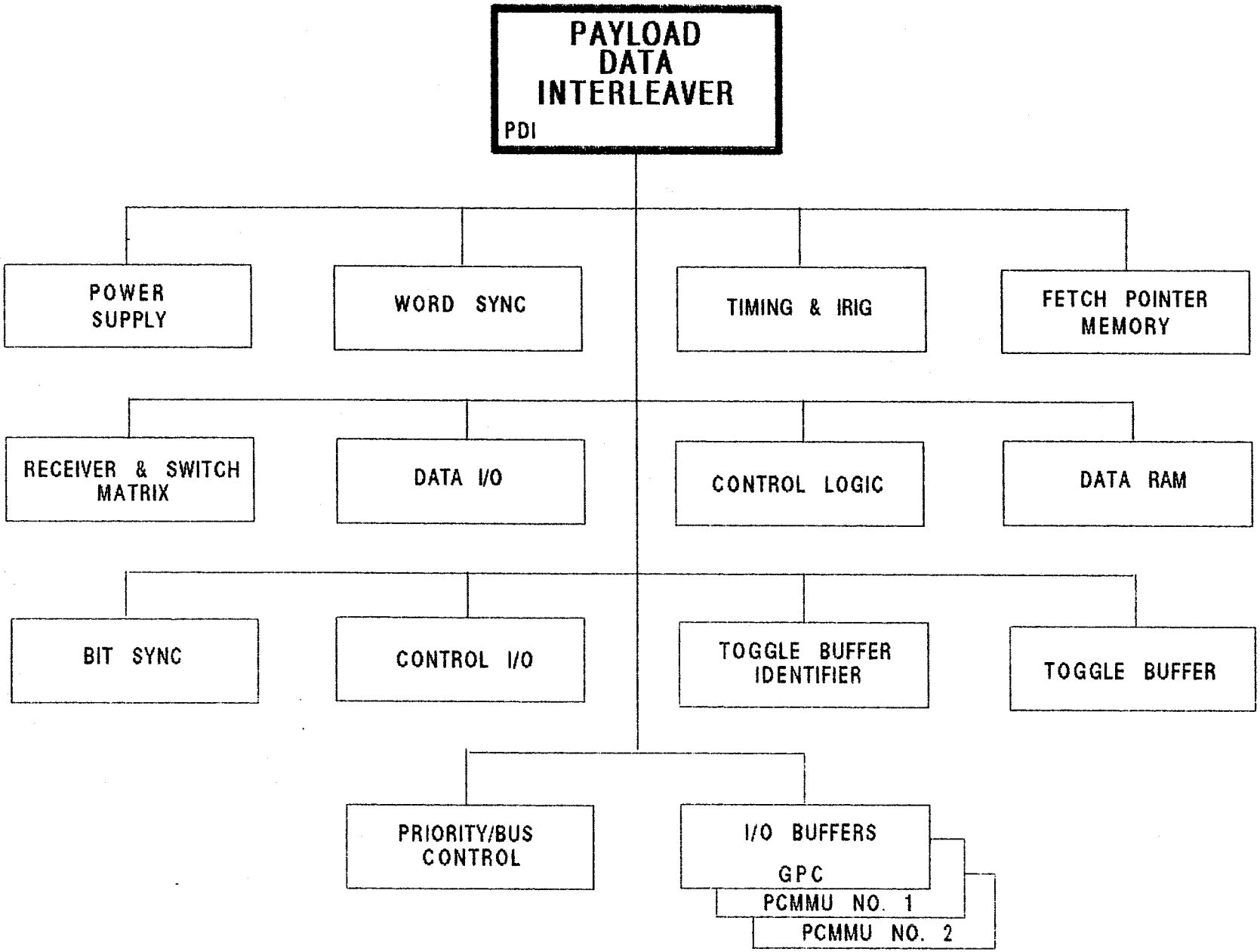


FIGURE 14

IOA
STR DETAILED SYSTEM REPRESENTATION

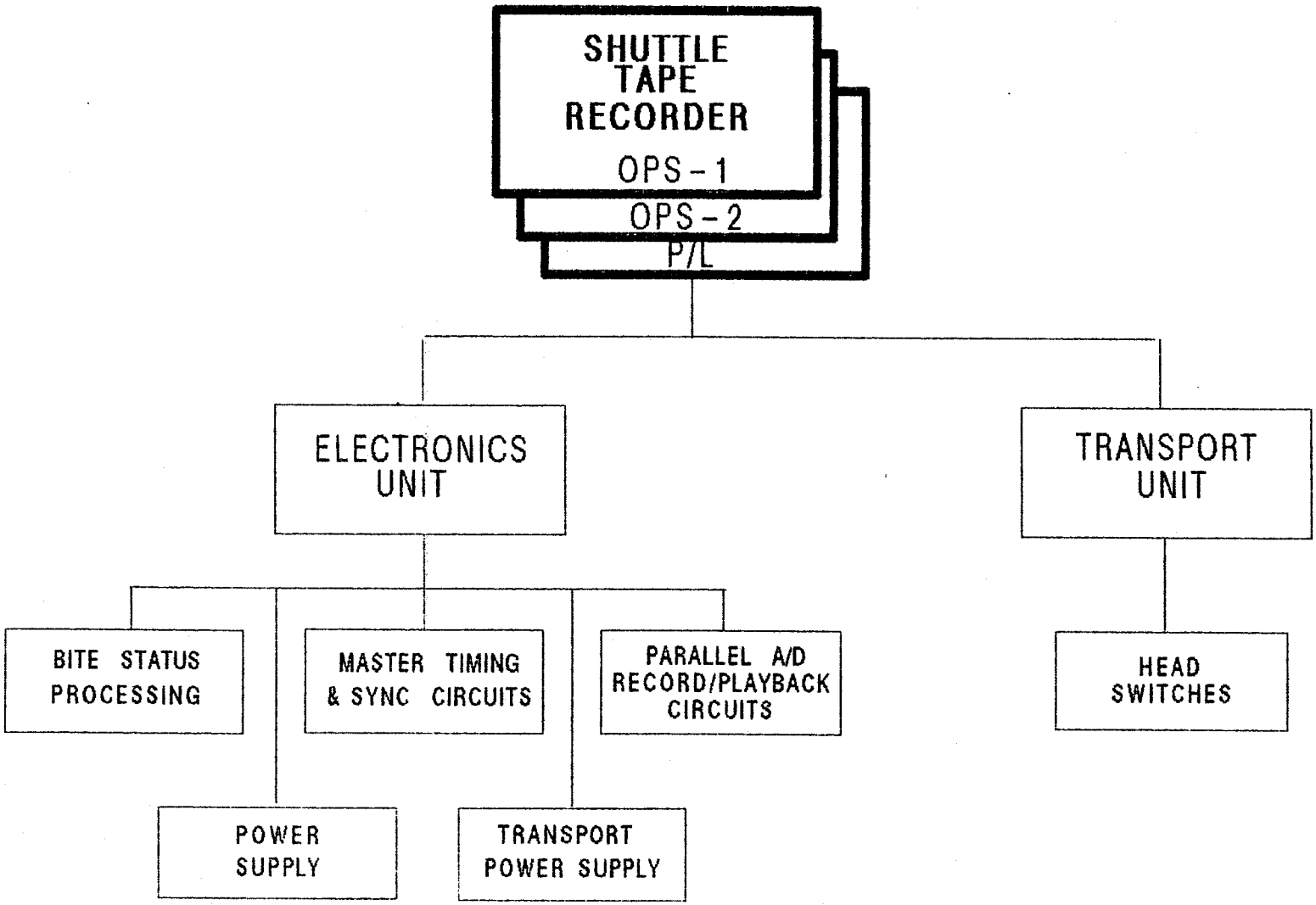


FIGURE 15

IOA
INSTRUMENTATION SUBSYSTEM OI BLOCK DIAGRAM

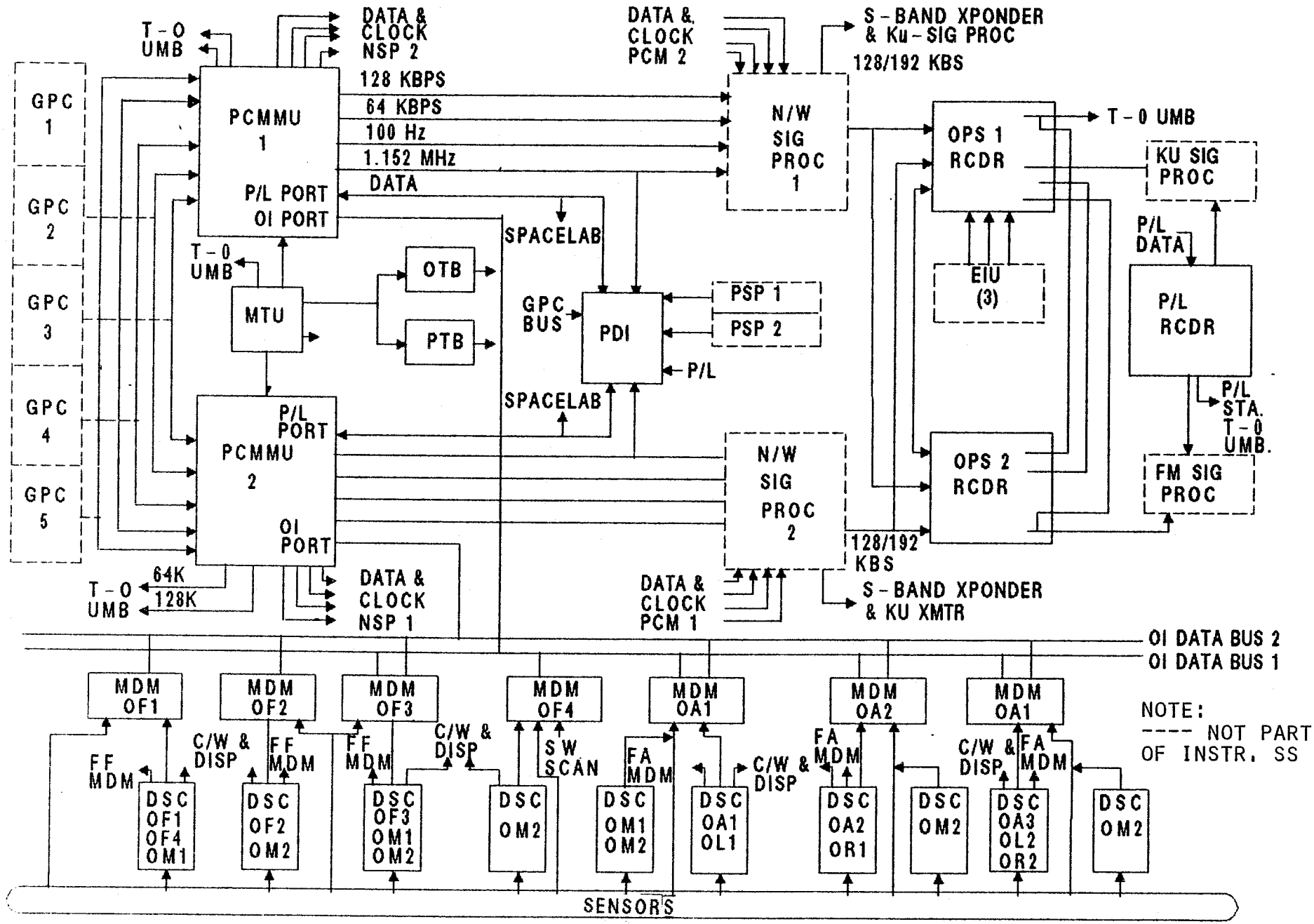


FIGURE 16

IOA
INSTRUMENTATION SUBSYSYTEM MADS BLOCK DIAGRAM

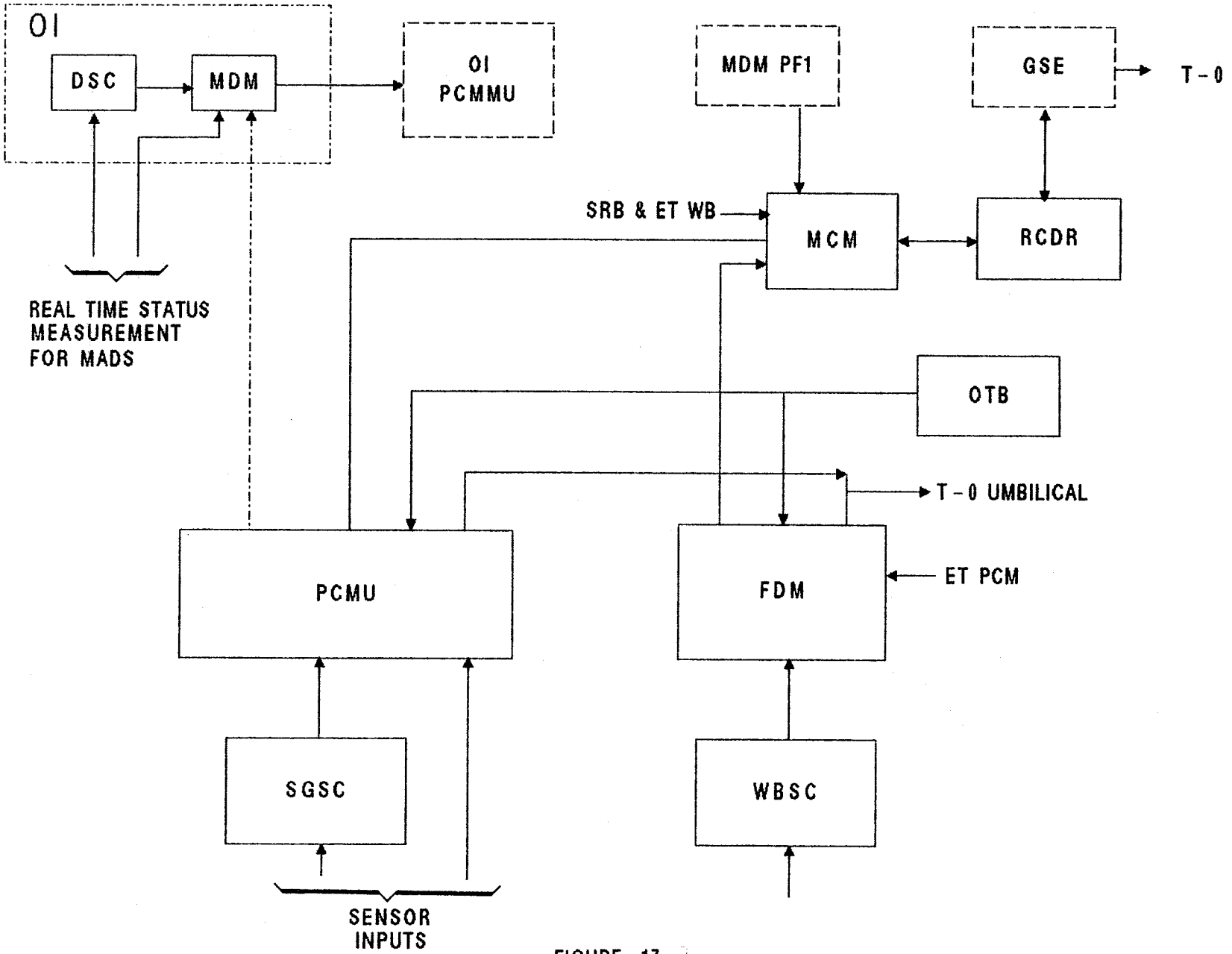


FIGURE 17

4.0 ANALYSIS RESULTS

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

TABLE II Summary of IOA Failure Modes and Criticalities

Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
MTU	-	-	3	-	1	-	4
PCMMU/SWITCHES	-	-	4	-	3	1	8
MDMs	-	1	-	2	4	1	8
DSCs	-	-	-	4	3	5	12
PDI	-	-	-	-	4	-	4
OPS RCDR	-	-	-	-	-	4	4
PL RCDR	-	-	-	-	5	-	5
OTB	-	-	-	-	-	3	3
PTB	-	-	-	-	-	3	3
MADS	-	-	-	-	-	32	32
SENSORS	-	-	-	-	-	5	5
TOTAL	-	1	7	6	20	54	88

Of the 86 failure modes analyzed, 8 failures were determined to be Potential Critical Items (PCIs) A summary of the PCIs is presented in Table III. Appendix D presents a cross reference between each PCI and a specific worksheet in Appendix C.

TABLE III Summary of IOA Potential Critical Items

Criticality:	1/1	2/1R	2/2	3/1R	3/2R	TOTAL
MTU	-	-	3	-	-	3
PCMMU FORMAT SWITCH	-	-	3	-	-	3
PCMMU PWR SWITCH	-	-	1	-	-	1
MDM	-	1	-	-	-	1
TOTAL	-	1	7	-	-	8

4.1 Analysis Results, MTU

The MTU analysis considered four failure modes, of which three modes were criticality 2/2. The MTU therefore is placed on the PCI list.

4.2 Analysis Results, PCMMU Power and Mode Control Switches

Eight failure modes were considered for the PCMMU and associated switches. Three failure modes concerned the PCMMU format control switch and one the PCMMU power switch; all are criticality 2/2, placing the two switches on the PCI list.

4.3 Analysis Results, MDMs

The analysis performed on the MDMs considered eight modes. Critical fuel cell measurements place OA1, OA2, OA3 on the PCI list.

4.4 Analysis Results, DSCs

The DSC analysis considered twelve failure modes. No DSCs fell into the critical item category.

4.5 Analysis Results, PDI

Four failure modes were analyzed for the PDI, none of which put it on the PCI list.

4.6 Analysis Results, OPS Recorders

The OPS recorders analysis considered four failure modes. None placed the OPS recorders on the PCI list.

4.7 Analysis Results, P/L Recorder

Five failure modes were considered for the P/L recorder, none of which placed it on the PCI list.

4.8 Analysis Results, OTB

The OTB analysis considered three failure modes; none causes it to be a critical item.

4.9 Analysis Results, PTB

The PTB analysis considered three failure modes. None classified the PTB as critical.

4.10 Analysis Results, MADS

Thirty-two failure modes were analyzed for the MADS. All MADS failures are 3/3, exempting it from the PCI list.

4.11 Analysis Results, Sensors

The sensors considered are all related to instrumentation electrical power. Five failure modes were analyzed, none of which places any of the sensors on the PCI list.

5.0 REFERENCES

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

1. JSC-11174, Space Shuttle Systems Handbook, Rev. C, 9-12-85

2. JSC-18611, INCO/COMM Systems Brief, Rev. C, PCN-3, 8-15-83

3. Shuttle Flight Operations Manual Volume 4E - Instrumentation, 7-85

4. JSC-12820, STS Operational Flight Rules, PCN-1, 2-14-86

5. NSTS 22206, Instructions for Preparation of Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL), 10-10-86

6. Schematic VS70-974099 (OI)

7. Schematic VS72-978099, EO A14 (MADS)

8. Schematic VS72-978102 (MADS)

9. Schematic VS72-941102 (FASCOS)

10. Main Engine ICD 13M 15000 (FASCOS)

11. NSTS 08171, Operations and Maintenance Requirements and Specifications Document (OMRSD), 10-15-86

12. TD203, Communications/Instrument Workbook COM/IN2102, 2-85 (Crew Training Workbook)

13. MC476-0130, Specification, Master Unit, Pulse Code Modulation, Rev. D, 4-30-82

APPENDIX A
ACRONYMS

ACIP	Aerodynamics Coefficient Instrumentation Package
AOA	Abort Once Around
ARPCS	Atmospheric Revitalization Pressure Control System
AV	Avionics
BFS	Backup Flight System
Calibr	Calibration
CCTV	Closed Circuit Television
CIL	Critical Items List
CRIT	Criticality
DFI	Development Flight Instrumentation
DFL	Decommutator Format Load
Dk	Deck
DOD	Department of Defense
DSC	Dedicated Signal Conditioner
EIU	Engine Interface Unit
Ena	Enable
ET	External Tank
F	Functional
FASCOS	Flight Acceleration Safety Cutoff System
FDM	Frequency Division Multiplexer
Flt	Flight
FMEA	Failure Modes and Effects Analysis
Fwd	Forward
GMT	Greenwich Meridien Time
GPC	General Purpose Computer
GSE	Ground Support Equipment
IFM	In-Flight Maintenance
INCO/COMM	Instrumentation and Communication Officer - Communications
INST	Instrumentation
IOA	Independent Orbiter Assessment
ips	Inches per second
IRIG B	Interrange Instrumentation Group B-format
LRU	Line Replacement Unit
MADS	Modular Auxiliary Data System
Man	Manual
MCM	MADS Control Module
MDAC	McDonnell Douglas Astronautics Company
MDM	Multiplexer/Demultiplexer
MET	Mission Elapsed Time
MIA	Multiplexer Interface Adapter
MTU	Master Timing Unit
MUX	Multiplex
NA	Not Applicable
NASA	National Aeronautics and Space Administration
NSP	Network Signal Processor (Communications Subsystem)
OA	Operational Aft
OF	Operational Forward
OI	Operational Instrumentation
OMRSD	Operational Maintenance Requirements and

	Specifications Document
OMS	Orbital Maneuvering System
OPS	Operations, Operational
OTB	Orbiter Timing Buffer
PCI	Potential Critical Item
PCM	Pulse Code Modulation
PCMMU	PCM Master Unit (OI)
PCMU	PCM Multiplexer Unit (MADS)
PDA	Power Distribution Assembly
PDI	Payload Data Interleaver
PL,P/L	Payload
Pnl	Panel
POGO	Acceleration/Vibration Along Thrust Axis
PTB	Payload Timing Buffer
PWR	Power
QC	Quality Control
RTLS	Return to Launch Site
SFOM	Shuttle Flight Operations Manual
SGSC	Strain Gage Signal Conditioner
SM	Systems Management
SPF	Single Point of Failure
SRB	Solid Rocket Booster
SSSH	Space Shuttle Systems Handbook
STR	Shuttle Tape Recorder
STS	Space Transportation System
SW	Switch
SYS	System
T-O	Time Zero
TAL	Trans-Atlantic Abort Landing
TFL	Telemetry Format Load
TPS	Thermal Protection System
VCO	Voltage-Controlled Oscillator
WBSC	Wideband Signal Conditioner

APPENDIX B

DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.1 Definitions
B.2 Project Level Ground Rules and Assumptions
B.3 Subsystem-Specific Ground Rules and Assumptions

APPENDIX B
DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.1 Definitions

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

INTACT ABORT DEFINITIONS:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

OPS - software operational sequence

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

PHASE DEFINITIONS:

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

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

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

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

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

APPENDIX B
DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.2 IOA Project Level Ground Rules and Assumptions

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

B.3 Instrumentation Subsystem - Specific Ground Rules and Assumptions

1. Sensors and transducers and associated individual or integral signal conditioners used within a subsystem will be analyzed by specialists assessing that subsystem.

   Rationale: The subsystem analyst is the person best qualified to identify credible failure modes/causes and to assess the effects/ criticalities of those failures.

2. Human error (e.g., misconfiguration by crew or ground) will not be considered.

   Rationale: Possible misconfigurations are out of scope for this analysis.

3. Inadvertent misconfigurations (e.g., accidental body contact by crew member with a switch in zero-g operations) will not be considered.

   Rationale: Most critical switches have guards, or are lever-lock type. Possible inadvertent misconfigurations are out of scope for this analysis.

4. Hardware items have been properly qualified, have passed applicable acceptance testing, and have been properly installed in the Orbiter. Exception: if analysis of LRU/subassembly/piece-part failure history discloses multiple failures for a particular item, that item will be individually examined for design/QC deficiencies, and will be flagged for special attention.

   Rationale: Baseline assumption is that program controls have resulted in hardware that is properly qualified and installed.

5. The criticality of an Instrumentation SS hardware item will be assigned on the basis of the highest criticality of any parameter or measurement traversing it.

   Rationale: Instrumentation exists as a service to other subsystems and to give insight into their status; the criticality of any path(s) within it is determined by the criticality of measurements utilizing it.

APPENDIX C
DETAILED ANALYSIS

This section contains the IOA analysis worksheets generated during the analysis of this subsystem. The information on these worksheets is intentionally similar to the NASA FMEAs. Each of these sheets identifies the hardware item being analyzed, and parent assembly, as well as the function. For each failure mode, the possible causes are outlined, and the assessed hardware and functional criticality for each mission phase is listed, as described in the NSTS 22206, Instructions for Preparation of FMEA and CIL, 10 October 1986. 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 or next failure of any redundant item (like or unlike) could cause loss of life/vehicle
- 3 = All others

Functional Criticalities:

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

Redundancy Screen A:

- 1 = Is Checked Out PreFlight
- 2 = Is Capable of Check Out PreFlight
- 3 = Not Capable of Check Out PreFlight
- NA = Not Applicable

Redundancy Screens B and C:

- P = Passed Screen
- F = Failed Screen
- NA = Not Applicable

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	101	ABORT:	3/3

ITEM: DSC OF4, OM2, OL1/2, OR1/2
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: B. HOWARD SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OI
3) DSC
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: OF4-FWD RCS MODULE, OM2-MID FUSELAGE, OL1/2-LEFT OMS POD, OR1/2-RIGHT OMS POD
PART NUMBER: MC476-0131

CAUSES: TEMPERATURE (HIGH), VIBRATION, CONTAMINATION, LOSS OF OR IMPROPER INPUT, MECHANICAL SHOCK, PIECE-PART FAILURE.

EFFECTS/RATIONALE:
CONDITIONS SIGNALS FROM VEHICLE SUBSYSTEM SENSORS AND PROVIDES SENSOR EXCITATION SIGNALS, BUFFERING AND ISOLATION. NO MISSION CRITICAL SIGNALS ARE PROCESSED BY 6 SUBJECT DSCs. LOSS OF DATA DOES NOT EFFECT CREW/VEHICLE OR MISSION.

REFERENCES: SSSH OI DSC/MDM DWG. 17.1, INCO/COMM OI DSC BRIEF SB48, SFOM INSTR VOL. 4E

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: INSTRUMENTATION FLIGHT: 3/2R
MDAC ID: 102 ABORT: 3/3

ITEM: DSC OF1, OF2, OF3
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: B. HOWARD SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OI
3) DSC
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: OF1-AV BAY 1, OF2-AV BAY 2, OF3-AV BAY3
PART NUMBER: MC476-0131

CAUSES: TEMPERATURE (HIGH), VIBRATION, CONTAMINATION, LOSS OF OR IMPROPER INPUT, MECHANICAL SHOCK, PIECE-PART FAILURE

EFFECTS/RATIONALE:
CONDITIONS SIGNALS FROM VEHICLE SUBSYSTEM SENSORS AND PROVIDES SENSOR EXCITATION SIGNALS, BUFFERING AND ISOLATION. MISSION CRITICAL ARPCS MEASUREMENTS ARE PROCESSED BY THE 3 SUBJECT DSCs. LOSS OF DATA DOES NOT AFFECT CREW/VEHICLE OR MISSION.
LOSS OF FUNCTION AFTER SECOND FAILURE COULD AFFECT MISSION IF ARPCS MEASUREMENT WAS OUT OF TOLERANCE AND WENT UNDETECTED.

REFERENCES: SSSH OI DSC/MDM DWG 17.1, INCO/COMM BRIEF SB48, SFOM INSTR VOL. 4E

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	103	ABORT:	3/3

ITEM: DSC OF1, OF2, OF3
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: B. HOWARD SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OI
3) DSC
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: OF1-AV BAY 1, OF2-AV BAY 2, OF3-AV BAY3
PART NUMBER: MC476-0131

CAUSES: TEMPERATURE (HIGH), VIBRATION, CONTAMINATION, LOSS OF OR IMPROPER INPUT, MECHANICAL SHOCK, PIECE-PART FAILURE

EFFECTS/RATIONALE:
CONDITIONS SIGNALS FROM VEHICLE SUBSYSTEM SENSORS AND PROVIDES SENSOR EXCITATION SIGNALS, BUFFERING AND ISOLATION. LOSS OF DATA DOES NOT AFFECT CREW/VEHICLE OR MISSION.

REFERENCES: SSSH OI DSC/MDM DWG 17.1, INCO/COMM BRIEF SB48, SFOM INSTR VOL. 4E

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/1R
MDAC ID:	104	ABORT:	3/1R

ITEM: DSC OA1, OA2, OA3, OM1
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: B. HOWARD SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OI
3) DSC
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: OA1-AV BAY 4, OA2-AV BAY 5, OA3-AV BAY 6, OM1-MID FUSELAGE
PART NUMBER: MC476-0131

CAUSES: TEMPERATURE (HIGH), VIBRATION, CONTAMINATION, LOSS OF OR IMPROPER INPUT, MECHANICAL SHOCK, PIECE-PART FAILURE

EFFECTS/RATIONALE:
CONDITIONS SIGNALS FROM VEHICLE SUBSYSTEM SENSORS AND PROVIDES SENSOR EXCITATION SIGNALS, BUFFERING AND ISOLATION. CRITICAL APU MEASUREMENTS ARE PROCESSED BY THE 4 SUBJECT DSCs.
LOSS OF FUNCTION AFTER SECOND FAILURE COULD AFFECT CREW/VEHICLE IF SUBSYSTEM MEASUREMENT WAS OUT OF TOLERANCE AND WENT UNDETECTED.

REFERENCES: SSSH OI DSC/MDM DWG 17.1, INCO/COMM BRIEF SB48, SFOM INSTR VOL. 4E

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: INSTRUMENTATION FLIGHT: 3/1R
MDAC ID: 105 ABORT: 3/1R

ITEM: DSC OA1, OA2, OA3, OM1
FAILURE MODE: LOSS OF OUTPUT, OPEN, SHORTED

LEAD ANALYST: B. HOWARD SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OI
3) DSC
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: OA1-AV BAY 4, OA2-AV BAY 5, OA3-AV BAY 6, OM1-MID FUSELAGE
PART NUMBER: MC476-0131

CAUSES: TEMPERATURE (HIGH), VIBRATION, CONTAMINATION, LOSS OF OR IMPROPER INPUT, MECHANICAL SHOCK, PIECE-PART FAILURE

EFFECTS/RATIONALE:
CONDITIONS SIGNALS FROM VEHICLE SUBSYSTEM SENSORS AND PROVIDES SENSOR EXCITATION SIGNALS, BUFFERING AND ISOLATION. CRITICAL APU MEASUREMENTS ARE PROCESSED BY THE 4 SUBJECT DSCs.
LOSS OF FUNCTION AFTER SECOND FAILURE COULD AFFECT CREW/VEHICLE IF SUBSYSTEM MEASUREMENT WAS OUT OF TOLERANCE AND WENT UNDETECTED.

REFERENCES: SSSH OI DSC/MDM DWG 17.1, INCO/COMM BRIEF SB48, SFOM INSTR VOL. 4E

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	106	ABORT:	3/3

ITEM: DSC 0F4, OM2, OL1/2, OR1/2
FAILURE MODE: LOSS OF OUTPUT, OPEN, SHORTED

LEAD ANALYST: B. HOWARD SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OI
3) DSC
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: OF4-FWD RCS MODULE, OM2-MID FUSELAGE, OL1/2-LEFT OMS POD, OR1/2-RIGHT OMS POD
PART NUMBER: MC476-0131

CAUSES: TEMPERATURE (HIGH), VIBRATION, CONTAMINATION, LOSS OF OR IMPROPER INPUT, MECHANICAL SHOCK, PIECE-PART FAILURE

EFFECTS/RATIONALE:
CONDITIONS SIGNALS FROM VEHICLE SUBSYSTEM SENSORS, PROVIDES SENSOR EXCITATION SIGNALS, BUFFERING AND ISOLATION. NO MISSION CRITICAL SIGNALS ARE PROCESSED BY 6 SUBJECT DSCs. LOSS OF DATA DOES NOT AFFECT CREW/VEHICLE OR MISSION.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: INSTRUMENTATION FLIGHT: 3/2R
MDAC ID: 112 ABORT: 3/3

ITEM: MDM OF1, OF2
FAILURE MODE: LOSS OF OUTPUT, OPEN, SHORTED

LEAD ANALYST: B. HOWARD SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OI
3) MDM
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: OF1 AV BAY 1, OF2 AV BAY 2
PART NUMBER: MC615-0004-54,-6410

CAUSES: TEMPERATURE (HIGH), VIBRATION, CONTAMINATION, LOSS OF OR IMPROPER INPUT, MECHANICAL SHOCK, PIECE-PART FAILURE.

EFFECTS/RATIONALE:
INSTRUMENTATION MDMs RECEIVE ANALOG, DISCRETE OR SERIAL DIGITAL INFORMATION FROM SUBSYSTEMS AND CONVERT AND FORMAT DATA FOR TRANSMISSION TO THE PCMMU. CRITICAL ARPCS MEASUREMENTS ARE PROCESSED BY THE 3 SUBJECT MDMs.
LOSS OF FUNCTION AFTER SECOND FAILURE COULD AFFECT MISSION IF SUBSYSTEM MEASUREMENT WAS OUT OF TOLERANCE AND WENT UNDETECTED.

REFERENCES: SSSH OI/DSC/MDM DWG. 17.1, INCO/COMM MDM BRIEF SB28, SFOM INSTR VOL. 4E

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: INSTRUMENTATION FLIGHT: 3/1R
MDAC ID: 113 ABORT: 3/1R

ITEM: MDM OF4, OA1, OA2, OA3
FAILURE MODE: LOSS OF OUTPUT, OPEN, SHORTED

LEAD ANALYST: B. HOWARD SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OI
3) MDM
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: OF4-FLIGHT DECK, OA1-AV BAY 4, OA2-AV BAY 5, OA3-AV BAY 6
PART NUMBER: MC615-0004-5400,-6410

CAUSES: TEMPERATURE (HIGH), VIBRATION, CONTAMINATION, LOSS OF OR IMPROPER INPUT, MECHANICAL SHOCK, PIECE-PART FAILURE

EFFECTS/RATIONALE:
INSTRUMENTATION MDMs RECEIVE ANALOG, DISCRETE, OR SERIAL DIGITAL INFORMATION FROM SUBSYSTEMS AND CONVERT AND FORMAT DATA FOR TRANSMISSION TO THE PCMMU. CRITICAL APU MEASUREMENTS ARE PROCESSED BY THE 4 SUBJECT MDMs.
LOSS OF FUNCTION AFTER SECOND FAILURE COULD AFFECT CREW/VEHICLE IF SUBSYSTEM MEASUREMENT WAS LOST.

REFERENCES: SSSH OI DSC/MDM DWG. 17.1, INCO/COMM BRIEF SB28, SFOM INSTR. VOL. 4E

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/2R
MDAC ID:	114	ABORT:	3/3

ITEM: MDM OF3
FAILURE MODE: LOSS OF OUTPUT, OPEN, SHORTED

LEAD ANALYST: B. HOWARD SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OI
3) MDM
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AV BAY 3
PART NUMBER: MC615-0004-5400,-6400

CAUSES: TEMPERATURE (HIGH), VIBRATION, CONTAMINATION, LOSS OF OR IMPROPER INPUT, MECHANICAL SHOCK, PIECE-PART FAILURE

EFFECTS/RATIONALE:
INSTRUMENTATION MDMs RECEIVE ANALOG, DISCRETE OR SERIAL DIGITAL INFORMATION FROM SUBSYSTEMS AND CONVERT AND FORMAT DATA FOR TRANSMISSION TO THE PCMMU. CRITICAL ARPCS MEASUREMENTS ARE PROCESSED BY SUBJECT MDM.
LOSS OF FUNCTION AFTER SECOND FAILURE DOES NOT AFFECT CREW/VEHICLE BUT COULD AFFECT MISSION IF SUBSYSTEM MEASUREMENT WAS LOST.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	12/18/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	2/1R
MDAC ID:	115	ABORT:	2/1R

ITEM: MDM OA1, OA2, OA3
FAILURE MODE: LOSS OF OUTPUT, OPEN, SHORTED

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OI
3) MDM
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: OA1 - AVBAY 4 OA2 - AVBAY 5 OA3 - AV BAY 6
PART NUMBER: MC615-0004-5400

CAUSES: TEMPERATURE, VIBRATION, CONTAMINATION, LOSS OF OR IMPROPER INPUT, MECHANICAL SHOCK, PIECE-PART FAILURE

EFFECTS/RATIONALE:
THESE MDMs HANDLE CRITICAL FUEL CELL/ELECTRIC POWER GENERATION MEASUREMENTS. HEATER ELEMENT FAILED ON COULD CAUSE CATASTROPHIC FUEL CELL FAILURE. LOSS OF THE CRITICAL MEASUREMENTS INDICATING SUCH CONDITION COULD BE CRITICAL. REFERENCE EPD&C/EPG 2207.

REFERENCES: SSSH OI DSC/MDM DWG 17.1, INCO/COMM OI DSC BRIEF SB48, SFOM VOL 4E

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: INSTRUMENTATION FLIGHT: 3/2R
MDAC ID: 121 ABORT: 3/3

ITEM: PULSE CODE MODULATION MASTER UNIT (PCMMU)
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OPERATIONAL INSTRUMENTATION
3) PULSE CODE MODULATION MASTER UNIT
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AVIONICS BAYS 1, 2
PART NUMBER: MC476-0130

CAUSES: TEMPERATURE, VIBRATION, LOSS OF INPUT, PIECE-PART STRUCTURAL FAILURE, MISHANDLING

EFFECTS/RATIONALE:
THE PCMMU ACCEPTS GPC DOWNLIST DATA, OPERATIONAL INSTRUMENTATION DATA, AND PAYLOAD DATA. IT ASSEMBLES AND FORMATS THE DATA AND ROUTES IT TO THE COMM SYSTEM FOR TELEMETRY TO GROUND, EITHER REAL-TIME OR PLAYBACK.
LOSS OF OUTPUT FOR FIRST LRU WOULD INVOKE PRIORITY FLIGHT BECAUSE NEXT PCMMU FAILURE WOULD MEAN LOSS OF ALL DATA. REDUNDANT UNIT WOULD BE ACTIVATED AND FORMAT INSTRUCTIONS LOADED. LOSS OF SECOND UNIT WOULD REQUIRE RETURN TO NEXT PRIMARY LANDING SITE.

REFERENCES: SCHEMATIC VS70-974099, SSSH 17.2, INCO/COMM SYS BRIEF 22, OMRSD, PCMMU SPECIFICATION MC476-0130

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/2R
MDAC ID:	122	ABORT:	3/3

ITEM: PULSE CODE MODULATION MASTER UNIT (PCMMU)
FAILURE MODE: ERRATIC OPERATION

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OPERATIONAL INSTRUMENTATION
3) PULSE CODE MODULATION MASTER UNIT
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AVIONICS BAYS 1, 2
PART NUMBER: MC476-0130

CAUSES: TEMPERATURE (HIGH), VIBRATION, PIECE-PART STRUCTURAL FAILURE, MISHANDLING

EFFECTS/RATIONALE:
THE PCMMU ACCEPTS GPC DOWNLIST DATA, OPERATIONAL INSTRUMENTATION DATA, AND PAYLOAD DATA. IT ASSEMBLES AND FORMATS THE DATA AND ROUTES IT TO THE COMM SYSTEM FOR TELEMETRY TO GROUND, EITHER REAL-TIME OR PLAYBACK. ERRATIC OPERATION OF THE FIRST LRU WOULD INVOKE PRIORITY FLIGHT BECAUSE NEXT PCMMU FAILURE WOULD MEAN LOSS OF ALL DATA. REDUNDANT UNIT WOULD BE ACTIVATED AND FORMAT INSTRUCTIONS LOADED. LOSS OF SECOND UNIT WOULD REQUIRE RETURN TO NEXT PRIMARY LANDING SITE.

REFERENCES: SCHEMATIC VS70-974099, SSSH 17.2, INCO/COMM SYS BRIEF 22, OMRSD, PCMMU SPECIFICATION MC476-0130

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: INSTRUMENTATION FLIGHT: 3/2R
MDAC ID: 123 ABORT: 3/3

ITEM: PULSE CODE MODULATION MASTER UNIT (PCMMU)
FAILURE MODE: INTERMITTENT OPERATION

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OPERATIONAL INSTRUMENTATION
3) PULSE CODE MODULATION MASTER UNIT
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AVIONICS BAYS 1, 2
PART NUMBER: MC476-0130

CAUSES: TEMPERATURE, VIBRATION, PIECE-PART STRUCTURAL FAILURE, MISHANDLING

EFFECTS/RATIONALE:
THE PCMMU ACCEPTS GPC DOWNLIST DATA, OPERATIONAL INSTRUMENTATION DATA, AND PAYLOAD DATA. IT ASSEMBLES AND FORMATS THE DATA AND ROUTES IT TO THE COMM SYSTEM FOR TELEMETRY TO GROUND, EITHER REAL-TIME OR PLAYBACK. INTERMITTENT OPERATION OF THE ACTIVE LRU WOULD INVOKE PRIORITY FLIGHT BECAUSE NEXT PCMMU FAILURE WOULD MEAN LOSS OF ALL DATA. REDUNDANT UNIT WOULD BE ACTIVATED AND FORMAT INSTRUCTIONS LOADED. LOSS OF SECOND UNIT WOULD REQUIRE RETURN TO NEXT PRIMARY LANDING SITE.

REFERENCES: SCHEMATIC VS70-974099, SSSH 17.2, INCO/COMM SYS BRIEF 22, OMRSD, PCMMU SPECIFICATION MC476-0130

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	2/2
MDAC ID:	124	ABORT:	3/3

ITEM: PCMMU FORMAT CONTROL SWITCH
FAILURE MODE: PHYSICAL BINDING/JAMMING

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OPERATIONAL INSTRUMENTATION
3) PCMMU
4) FORMAT CONTROL 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:	2/2	AOA:	3/3
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING:	3/3		

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

LOCATION: PANEL C3
PART NUMBER: ME452-0102-7203

CAUSES: PIECE-PART STRUCTURAL FAILURE, CONTAMINATION

EFFECTS/RATIONALE:
THE FORMAT CONTROL SWITCH PERMITS MANUAL SELECTION OF THREE CLASSES OF DONWLINK DATA FORMATTING BY THE PCMMU: FIXED, GPC, AND PROGRAM. EFFECTS OF ITS BEING BLOCKED IN EACH OF THESE POSITIONS ARE:
FIXED - USED FOR LAUNCH AND LANDING, AND DURING TIME NEW FORMAT IS BEING LOADED. BINDING IN FIXED DURING ON-ORBIT WOULD RESULT IN LOSS OF PAYLOAD AND SM2 SYSTEMS MANAGEMENT.
GPC - NO FIXED FORMAT AVAILABLE. PROGRAM - LOCKED IN PCMMU AND PDI TELEMETRY FORMATS WHEN FAILURE OCCURRED. CANNOT CHANGE PCMMU TFL OR PDI DFL. WORST-CASE EFFECT WOULD BE LOSS OF MISSION BECAUSE OF INABILITY TO LOAD APPROPRIATE TFLs.

REFERENCES: SCHEMATIC VS70-974099, SSSH 17.2, INCO/COMM SYS BRIEF, OMRSD, PCMMU SPECIFICATION MC476-0130

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: INSTRUMENTATION FLIGHT: 2/2
MDAC ID: 125 ABORT: 3/3

ITEM: PCMMU FORMAT CONTROL SWITCH
FAILURE MODE: SHORTED

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OPERATIONAL INSTRUMENTATION
3) PCMMU
4) FORMAT CONTROL 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:	2/2	AOA:	3/3
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING:	3/3		

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

LOCATION: PANEL C3
PART NUMBER: ME452-0102-7203

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION, MISHANDLING, CONTAMINATION

EFFECTS/RATIONALE:
THE FORMAT CONTROL SWITCH PERMITS MANUAL SELECTION OF THREE CLASSES OF DOWNLINK DATA FORMATTING BY THE PCMMU: FIXED, GPC, AND PROGRAM. INABILITY TO LOAD APPROPRIATE TFLs WOULD CAUSE LOSS OF MISSION.

REFERENCES: SCHEMATIC VS70-974099, SSSH 17.2, INCO/COMM SYS BRIEF, OMRSD, PCMMU SPECIFICATION MC476-0130

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	2/2
MDAC ID:	126	ABORT:	3/3

ITEM: PCMMU FORMAT CONTROL SWITCH
FAILURE MODE: OPEN

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OPERATIONAL INSTRUMENTATION
3) PCMMU
4) FORMAT CONTROL 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:	2/2	AOA:	3/3
DEORBIT:	3/3	ATO:	3/3
LANDING/SAFING:	3/3		

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

LOCATION: PANEL C3
PART NUMBER: ME452-0102-7203

CAUSES: PIECE-PART STRUCTURAL FAILURE, VIBRATION, MISHANDLING

EFFECTS/RATIONALE:
THE FORMAT CONTROL SWITCH PERMITS MANUAL SELECTION OF THREE CLASSES OF DOWNLINK DATA FORMATTING BY THE PCMMU: FIXED, GPC, PROGRAM. INABILITY TO LOAD APPROPRIATE TFLs WOULD CAUSE LOSS OF MISSION.

REFERENCES: SCHEMATIC VS70-974099, SSSH 17.2, INCO/COMM SYS BRIEF, OMRSD, PCMMU SPECIFICATION MC476-0130

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	2/2
MDAC ID:	131	ABORT:	3/3

ITEM: MASTER TIMING UNIT (MTU)
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OPERATIONAL INSTRUMENTATION
3) MASTER TIMING UNIT
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: FWD AVIONICS BAY 3B
PART NUMBER: MC456-0051-0005

CAUSES: TEMPERATURE, VIBRATION, MISHANDLING, PIECE-PART STRUCTURAL FAILURE, MECHANICAL SHOCK, CORROSION/CONTAMINATION

EFFECTS/RATIONALE:
THE MTU PROVIDES TIME TO MANY ORBITER SYSTEMS/LRU'S, INCLUDING THE GPC'S AND ACTIVE PCMMU. SOME MTU SUBASSEMBLIES ARE DUAL, OTHERS TRIPLY REDUNDANT, BUT THERE ARE SOME SPF'S THAT CAN CAUSE LOSS OF OUTPUT WHICH WOULD NOT BE SENSED TO CAUSE SWITCHOVER. ON LOSS OF MTU TIMING, THE REDUNDANT-SET GPC'S AND ACTIVE PCMMU WOULD DEFAULT TO THEIR INTERNAL CLOCKS. LOSS OF MTU OUTPUT WOULD NOT AFFECT CREW/VEHICLE BUT COULD CAUSE LOSS OF MISSION, BECAUSE MTU TIME IS USED BY ORBITER FOR AUTHENTICATION OF ENCRYPTED COMMANDS.

REFERENCES: SCHEMATIC VS70-974099, SSSH 8.9, INCO/COMM SYS BRIEF 4.0, OMRSD

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	2/2
MDAC ID:	132	ABORT:	3/3

ITEM: MASTER TIMING UNIT (MTU)
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OPERATIONAL INSTRUMENTATION
3) MASTER TIMING UNIT
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: FWD AVIONICS BAY 3B
PART NUMBER: MC456-0051-0005

CAUSES: TEMPERATURE, OVERVOLTAGE, VIBRATION, PIECE-PART FAILURE

EFFECTS/RATIONALE:
THE MTU PROVIDES TIME TO MANY ORIBITER SYSTEMS/LRU'S, INCLUDING GPC'S AND ACTIVE PCMMU. SOME MTU SUBASSEMBLIES ARE DUAL, OTHERS TRIPLY REDUNDANT, BUT THERE ARE SOME SPF'S THAT COULD CAUSE FREQUENCY SHIFTS AND ERRONEOUS TIME OUTPUTS.
ON LOSS OF MTU TIMING, THE ACTIVE PCMMU AND THE REDUNDANT-SET GPC'S WOULD DEFAULT TO THEIR INTERNAL CLOCKS. ERRONEOUS MTU OUTPUT WOULD NOT AFFECT CREW/VEHICLE BUT COULD CAUSE LOSS OF MISSION, BECAUSE MTU TIME IS USED BY ORBITER FOR AUTHENTICATION OF ENCRYPTED COMMANDS.

REFERENCES: SCHEMATIC VS70-974099, SSSH 8.9, INCO/COMM SYS BRIEF 4.0, OMRSD

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: INSTRUMENTATION FLIGHT: 2/2
MDAC ID: 133 ABORT: 3/3

ITEM: MASTER TIMING UNIT (MTU)
FAILURE MODE: ERRATIC OPERATION

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OPERATIONAL INSTRUMENTATION
3) MASTER TIMING UNIT
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: MC456-0051-0005

CAUSES: CONTAMINATION, TEMPERATURE, VIBRATION, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
THE MTU PROVIDES TIME TO MANY ORBITER SYSTEMS/LRU'S INCLUDING THE ACTIVE PCMMU AND THE GPC'S. SOME MTU SUBASSEMBLIES ARE DUAL, OTHERS TRIPLY REDUNDANT, BUT THERE ARE SOME SPF'S THAT COULD CAUSE OSCILLATOR FREQUENCY SHIFTS AND ERRATIC TIME OUTPUTS. ON LOSS OF MTU TIMING, THE REDUNDANT SET GPC'S AND ACTIVE PCMMU WOULD DEFAULT TO THEIR INTERNAL CLOCKS. ERRATIC MTU OPERATION WOULD NOT AFFECT CREW/VEHICLE BUT COULD CAUSE LOSS OF MISSION, BECAUSE MTU TIME IS USED BY ORBITER FOR AUTHENTICATION OF ENCRYPTED COMMANDS.

REFERENCES: SCHEMATIC VS70-974099, SSSH 8.9, INCO/COMM SYS BRIEF 4.0, OMRSD

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: INSTRUMENTATION FLIGHT: 3/3
MDAC ID: 141 ABORT: 3/3

ITEM: PAYLOAD TIMING BUFFER (PTB)
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OPERATIONAL INSTRUMENTATION
3) PAYLOAD TIMING BUFFER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT FLT DK, BEHIND PNL L16
PART NUMBER: MC456-0060-0001, 0002

CAUSES: LOSS OF INPUT, VIBRATION, PIECE-PART STRUCTURAL FAILURE, TEMPERATURE, MISHANDLING

EFFECTS/RATIONALE:
THE PTB RECEIVES IRIG B GMT AND IRIG B MET SIGNALS FROM MTU AND PROVIDES DEDICATED TIMING SIGNALS TO PAYLOADS. LOSS OF TIMING FROM PTB WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION. IF PTB FAILS, IFM PROCEDURE CAN BE USED TO SWAP PTB AND OTB OUTPUTS TO PROVIDE TIMING SIGNAL TO PAYLOADS.

REFERENCES: SPACE SHUTTLE SYSTEMS HANDBOOK, INCO/COMM SYSTEMS BRIEF, OMRSD

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: INSTRUMENTATION FLIGHT: 3/3
MDAC ID: 142 ABORT: 3/3

ITEM: PAYLOAD TIMING BUFFER (PTB)
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OPERATIONAL INSTRUMENTATION
3) PAYLOAD TIMING BUFFER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT FLT DK, BEHIND PNL L16
PART NUMBER: MC456-0060-0001, 0002

CAUSES: ERRONEOUS INPUT, TEMPERATURE, PARTIAL INPUT, PIECE-PART STRUCTURAL FAILURE, MISHANDLING

EFFECTS/RATIONALE:
THE PTB RECEIVES IRIG B GMT AND IRIG B MET SIGNALS FROM MTU AND PROVIDES DEDICATED TIMING SIGNALS TO PAYLOADS. LOSS OF TIMING FROM PTB WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION. IF PTB FAILS IFM PROCEDURE CAN BE USED TO SWAP OTB AND PTB OUTPUTS TO PROVIDE TIMING SIGNAL TO PAYLOADS.

REFERENCES: SPACE SHUTTLE SYSTEMS HANDBOOK, INCO/COMM SYSTEMS BRIEF, OMRSD

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: INSTRUMENTATION FLIGHT: 3/3
MDAC ID: 143 ABORT: 3/3

ITEM: PAYLOAD TIMING BUFFER (PTB)
FAILURE MODE: ERRATIC OPERATION

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OPERATIONAL INSTRUMENTATION
3) PAYLOAD TIMING BUFFER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT FLT DK, BEHIND PNL L16
PART NUMBER: MC456-0060-0001, 0002

CAUSES: ERRONEOUS INPUT, TEMPERATURE, MISHANDLING, PIECE-PART STRUCTURAL FAILURE, VIBRATION

EFFECTS/RATIONALE:
THE PTB RECEIVES IRIG B GMT AND IRIB B MET SIGNALS FROM MTU AND PROVIDES DEDICATED TIMING SIGNALS TO PAYLOADS. LOSS OF TIMING FROM PTB WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION. IF PTB FAILS, IFM PROCEDURE CAN BE USED TO SWAP OTB AND PTB OUTPUTS TO PROVIDE TIMING TO PAYLOADS.

REFERENCES: SPACE SHUTTLE SYSTEMS HANDBOOK, INCO/COMM SYSTEMS BRIEF, OMRSD

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	151	ABORT:	3/3

ITEM: ORBITER TIMING BUFFER (OTB)
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OPERATIONAL INSTRUMENTATION
3) ORBITER TIMING BUFFER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT FLT DK, BEHIND PNL L16
PART NUMBER: MC456-0060-001

CAUSES: LOSS OF INPUT, VIBRATION, PIECE-PART STRUCTURAL FAILURE, TEMPERATURE, MISHANDLING

EFFECTS/RATIONALE:
OTB RECEIVES IRIG B GMT AND IRIG B MET SIGNALS FROM MTU AND PROVIDES TIMING SIGNALS TO ORBITER AFT MISSION TIMER, MADS, CCTV, ACIP (AERODYNAMIC COEFFICIENT INSTRUMENTATION PACKAGE), AND SEPARATION CAMERAS.
LOSS OF TIMING FROM OTB WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION. IFM PROCEDURE MAY BE USED TO SWAP OTB AND PTB OUTPUTS.

REFERENCES: SPACE SHUTTLE SYSTEMS HANDBOOK, INCO/COMM SYSTEMS BRIEF, OMRSD

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	152	ABORT:	3/3

ITEM: ORBITER TIMING BUFFER (OTB)
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OPERATIONAL INSTRUMENTATION
3) ORBITER TIMING BUFFER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT FLT DK, BEHIND PNL L16
PART NUMBER: MC456-0060-001

CAUSES: ERRONEOUS INPUT, TEMPERATURE, PARTIAL INPUT, PIECE-PART STRUCTURAL FAILURE, MISHANDLING

EFFECTS/RATIONALE:
OTB RECEIVES IRIG B GMT AND IRIG B MET SIGNALS FROM MTU AND PROVIDES TIMING SIGNALS TO ORBITER AFT MISSION TIMER, MADS, CCTV, ACIP, AND SEPARATION CAMERAS.
LOSS OF TIMING FROM OTB WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION. IFM PROCEDURE MAY BE USED TO SWAP OTB AND PTB OUTPUTS.

REFERENCES: SPACE SHUTTLE SYSTEMS HANDBOOK, INCO/COMM SYSTEMS BRIEF, OMRSD

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	153	ABORT:	3/3

ITEM: ORBITER TIMING BUFFER (OTB)
FAILURE MODE: ERRATIC OPERATION

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OPERATIONAL INSTRUMENTATION
3) ORBITER TIMING BUFFER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT FLT DK, BEHIND PNL L16
PART NUMBER: MC456-0060-001

CAUSES: ERRONEOUS INPUT, TEMPERATURE, PIECE-PART STRUCTURAL FAILURE, VIBRATION, MISHANDLING

EFFECTS/RATIONALE:
OTB RECEIVES IRIG B GMT AND IRIG B MET SIGNALS FROM MTU AND PROVIDES TIMING SIGNALS TO ORBITER AFT MISSION TIMER, MADS, CCTV, ACIP AND SEPARATION CAMERAS.
LOSS OF TIMING FROM OTB WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION. IFM PROCEDURE MAY BE USED TO SWAP OTB AND PTB OUTPUTS.

REFERENCES: SPACE SHUTTLE SYSTEMS HANDBOOK, INCO/COMM SYSTEMS BRIEF, OMRSD

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/2R
MDAC ID:	161	ABORT:	3/3

ITEM: PAYLOAD DATA INTERLEAVER (PDI)
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OPERATIONAL INSTRUMENTATION
3) PAYLOAD DATA INTERLEAVER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: FWD AVIONICS BAY 1
PART NUMBER: MC476-0136

CAUSES: TEMPERATURE, VIBRATION, LOSS OF INPUT, PIECE-PART STRUCTURAL FAILURE, MISHANDLING

EFFECTS/RATIONALE:
THE PDI ASSEMBLES AND MULTIPLEXES SIMULTANEOUS DATA FROM MULTIPLE PAYLOADS AND ROUTES A COMBINED DATA BIT STREAM TO THE PCMMU FOR DOWNNLINK. FOR SOME MISSIONS A SPARE PDI IS REQUIRED TO BE CARRIED AS A REPLACEMENT.
LOSS OF PDI OUTPUT WOULD BE MISSION CRITICAL FOR PAYLOADS REQUIRING PRE-DEPLOY CHECKOUT TELEMETRY DATA.

REFERENCES: INCO/COMM SYS BRIEF, SSSH 17.3, SCHEMATIC VS70-974099, OMRSD

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: INSTRUMENTATION FLIGHT: 3/2R
MDAC ID: 162 ABORT: 3/3

ITEM: PAYLOAD DATA INTERLEAVER (PDI)
FAILURE MODE: ERRATIC OPERATION

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OPERATIONAL INSTRUMENTATION
3) PAYLOAD DATA INTERLEAVER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: FWD AVIONICS BAY 1
PART NUMBER: MC476-0136

CAUSES: VIBRATION, PARTIAL INPUT, PIECE-PART STRUCTURAL FAILURE, MISHANDLING, TEMPERATURE

EFFECTS/RATIONALE:
THE PDI ASSEMBLES AND MULTIPLEXES SIMULTANEOUS DATA FROM MULTIPLE PAYLOADS AND ROUTES A COMBINED DATA STREAM TO THE PCMMU FOR DOWNLINK. FOR SOME MISSIONS A SPARE PDI IS REQUIRED TO BE CARRIED AS A SPARE.
ERRATIC PDI OPERATION WOULD BE MISSION CRITICAL FOR PAYLOADS REQUIRING PRE-DEPLOY CHECKOUT TELEMETRY.

REFERENCES: INCO/COMM SYS BRIEF, SSSH 17.3, SCHEMATIC VS70-974099, OMRSD

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/2R
MDAC ID:	163	ABORT:	3/3

ITEM: PAYLOAD DATA INTERLEAVER (PDI)
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OPERATIONAL INSTRUMENTATION
3) PAYLOAD DATA INTERLEAVER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: FWD AVIONICS BAY 1
PART NUMBER: MC476-0136

CAUSES: TEMPERATURE, VIBRATION, PARTIAL INPUT, PIECE-PART STRUCTURAL FAILURE, MISHANDLING

EFFECTS/RATIONALE:
THE PDI ASSEMBLES AND MULTIPLEXES SIMULTANEOUS DATA FROM MULTIPLE PAYLOADS AND ROUTES A COMBINED BIT STREAM TO THE PCMMU FOR DOWNLINK. FOR SOME MISSIONS A SPARE PDI IS REQUIRED TO BE CARRIED AS A REPLACEMENT.
ERRONEOUS OUTPUT WOULD BE MISSION CRITICAL FOR PAYLOADS REQUIRING PRE-DEPLOY CHECKOUT TELEMETRY.

REFERENCES: SCHEMATIC V72-978099, INCO/COMM SYS BRIEF, SSSH 17.3, OMRSD

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: INSTRUMENTATION FLIGHT: 3/3
MDAC ID: 171 ABORT: 3/3

ITEM: SHUTTLE TAPE RECORDER OPS 1&2
FAILURE MODE: ALL CREDIBLE MODES: LOSS OF OUTPUT, FAILS TO SWITCH, FAILS TO START/STOP, PHYSICAL BINDING/JAMMING, ERRATIC OPERATION

LEAD ANALYST: B. HOWARD SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OI
3) SHUTTLE TAPE RECORDER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: FWD. AVIONICS BAY 2
PART NUMBER: 4411900-2,-3

CAUSES: LOSS OF OR IMPROPER INPUT, TEMPERATURE (HIGH), VIBRATION, MECHANICAL SHOCK, MISHANDLING/ABUSE, CONTAMINATION

EFFECTS/RATIONALE:
THE OPS 1 & 2 STR RECORD/PLAY BACK DIGITAL AND/OR ANALOG OPERATIONAL DATA AND VOICE. EIU DATA IS RECORDED ON OPS 1 ONLY. UNITS ARE USED ALTERNATELY; ONE RECORDS WHILE THE OTHER DUMPS PCM DATA TO THE GROUND.
LOSS OF ONE OR BOTH STRS WILL NOT AFFECT CREW/VEHICLE/MISSION.

REFERENCES: SSSH DWG. 16.18; INCO/COMM BRF 13.0: SFOM INSTR VOL. 4E

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	172	ABORT:	3/3

ITEM: SWITCH MODE RECORD/STANDBY/PLAYBACK FOR OPS 1 & OPS 2 STRS
FAILURE MODE: INADVERTENT OPERATION, LOSS OF OUTPUT, SHORTED, OPEN

LEAD ANALYST: B. HOWARD SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OI
3) OPS RCDR MODE CONTROL SWITCH
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT FLT STATION, PNL A1R
PART NUMBER: 36V73A1A3S5/6

CAUSES: CONTAMINATION, MECHANICAL SHOCK, MISHANDLING/ABUSE, TEMPERATURE, VIBRATION

EFFECTS/RATIONALE:
IN "PANEL" CONTROL MODE FOR OPS 1 AND 2 RECORDERS, MODE SWITCHES PROVIDE SIGNALS TO INITIATE PLAYBACK AND RECORDING OF DATA; "STANDBY" MODE CANCELS DIRECT COMMANDS AND STOPS TAPE MOTION. THESE FUNCTIONS ARE NORMALLY UNDER GROUND CONTROL AND CAN BE COMMANDED BY THE KEYBOARD. CRITICALITY IS 3; LOSS OF FUNCTION WILL NOT AFFECT CREW/VEHICLE OR MISSION.

REFERENCES: SSSH DWG. 16.18; INCO/COMM BRF 13.0: SFOM INSTR VOL. 4E

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: INSTRUMENTATION FLIGHT: /
MDAC ID: 173 ABORT: /

ITEM: SWITCH MODE, OPS 1 & 2 ANOMALY START/OFF/ERASE
FAILURE MODE: NOT CONSIDERED

LEAD ANALYST: B. HOWARD SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OI
3) PANEL A1R
4) SWITCH OPS 1/2 STR ANOMALY SEQ.
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: FLIGHT STATION
PART NUMBER: SWITCH, TOGGLE 36V73A1A3S7

CAUSES: NOT CONSIDERED

EFFECTS/RATIONALE:
INTENDED TO PROVIDE FOR PANEL SELECTION OF ANOMALY START/OFF/ERASE FUNCTIONS FOR OPS 1 & 2 STRS. THE SWITCH HAS NO FUNCTION AS IT RECEIVES POWER FROM THE LOOP/MAINT SWITCH, WHICH IS NOT USED.

REFERENCES: SSSH DWG. NO. 16.18, INCO/COMM SYST BRIEF SB 13.0; SFOM-INSTR VOL. 4E, COMM/INSTR WORKBOOK COM/IN 2102.

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	/
MDAC ID:	174	ABORT:	/

ITEM: SWITCH, MODE LOOP/MAINT OPS 1 & 2 STRS
FAILURE MODE: NOT CONSIDERED

LEAD ANALYST: B. HOWARD SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OI
3) OPS RCDR LOOP/MAINT MODE SWITCH
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT FLT STATION, PNL A1R
PART NUMBER: SWITCH ROTARY 36V73A1A3S8

CAUSES: NOT CONSIDERED

EFFECTS/RATIONALE:
PROVIDES FOR PANEL SELECTION OF LOOP/MAINT/MANUAL RECORDING FUNCTIONS FOR OI STR. THERE IS NO PLAN TO USE INDICATED MODES OF OPERATION. SOFTWARE WAS NEVER DEVELOPED TO IMPLEMENT SWITCH FUNCTIONS. SWITCH IS ALWAYS IN MANUAL POSITION.

REFERENCES: SSSH DWG. NO. 16.18: INCO/COMM SYSTEM BRIEF SB 13.0: SFOM INSTR. VOL 4E, COMM/INSTR WORKBOOK COM/IN2102.

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: INSTRUMENTATION FLIGHT: 3/2R
MDAC ID: 181 ABORT: 3/3

ITEM: SHUTTLE TAPE RECORDER-PAYLOAD
FAILURE MODE: ALL CREDIBLE MODES: LOSS OF OUTPUT, FAILS TO SWITCH, FAILS TO START/STOP, PHYSICAL BINDING/JAMMING, ERRATIC OPERATION

LEAD ANALYST: B. HOWARD SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OI
3) PAYLOAD RCDR
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: FWD. AVIONICS BAY 1
PART NUMBER: 4411700-1,-2

CAUSES: LOSS OF OR IMPROPER INPUT, TEMPERATURE (HIGH), VIBRATION, MECHANICAL SHOCK, MISHANDLING/ABUSE, CONTAMINATION

EFFECTS/RATIONALE:
THE PL STR RECORDS DIGITAL OR ANALOG PL DATA, SERIAL OR PARALLEL. EITHER OPS STR CAN BE SUBSTITUTED FOR PL STR BY IFM PROCEDURE. DIGITAL PL DATA CAN BE PLAYED BACK AND DOWNLINKED VIA S-BAND FM OF KU-BAND COMM, BUT ANALOG DATA CANNOT.
LOSS OF PL STR RECORD/PLAYBACK CAPABILITY WOULD NOT AFFECT CREW/VEHICLE, BUT COULD CAUSE MISSION LOSS FOR SOME MISSIONS.

REFERENCES: SSSH-DWG. NO. 16.19; INCO/COMM SYST. BRIEF SB13.0; SFOM - INSTR VOL 4E

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: INSTRUMENTATION FLIGHT: 3/2R
MDAC ID: 182 ABORT: 3/3

ITEM: SWITCH, ROTARY P/L STR MODE SELECT
FAILURE MODE: ALL CREDIBLE MODES - FAILS TO SWITCH, OPEN, SHORTED

LEAD ANALYST: B. HOWARD SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OI
3) PANEL A1R
4) SWITCH, P/L RCDR MODE SELECT
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: FLIGHT STATION
PART NUMBER: 36V73A1A3S10

CAUSES: CONTAMINATION, TEMPERATURE (HIGH), VIBRATION, LOSS OF OUTPUT

EFFECTS/RATIONALE:
PROVIDES P/L STR MODE SELECT FUNCTIONS; RECORD, PLAYBACK , FWD/REV SERIAL/PARALLEL AND ERASE. NO AFFECT ON CREW/VEHICLE. LOSS OF GROUND, KEYBOARD AND PANEL CONTROL OF P/L STR COULD CAUSE LOSS OF SOME MISSIONS.

REFERENCES: SSSH-DWG. NO. 16.19; INCO/COMM SYST BRF SB 13.0 SFOM-INSTRU VOL. 4E

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: INSTRUMENTATION FLIGHT: 3/2R
MDAC ID: 183 ABORT: 3/3

ITEM: SWITCH, OPERATE/ERASE-PAYLOAD STR
FAILURE MODE: ALL CREDIBLE MODES: INTERMITTENT OPERATION, LOSS OF OUTPUT, SHORTED, OPEN

LEAD ANALYST: B. HOWARD SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OI
3) PANEL A1R
4) SWITCH, OPERATE/ERASE
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: FLIGHT STATION
PART NUMBER: 36V73A1A3S9

CAUSES: CONTAMINATION, ABUSE, TEMPERATURE (HIGH), VIBRATION, INADVERTANT OPERATION, LOSS OF INPUT

EFFECTS/RATIONALE:
PROVIDES PANEL CONTROL OF OPERATE/ERASE SELECTION FOR THE PAYLOAD STR. NO AFFECT ON CREW/VEHICLE. LOSS OF GROUND, KEYBOARD AND PANEL CONTROL OF THE PAYLOAD STR COULD CAUSE LOSS OF SOME MISSIONS.

REFERENCES: SSSH-DWG. NO 16.19; INCO/COMM SYST BRF. SB 13.00; SFOM-INSTR VOL. 4E

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: INSTRUMENTATION FLIGHT: 3/2R
MDAC ID: 184 ABORT: 3/3

ITEM: SWITCH, ROTARY P/L STR SPEED CONTROL
FAILURE MODE: ALL CREDIBLE MODES: FAILS TO SWITCH, OPEN, SHORTED

LEAD ANALYST: B. HOWARD SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OI
3) PANEL A1R
4) SWITCH, STR SPEED
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: FLIGHT STATION
PART NUMBER: 36V73A1A3S14

CAUSES: CONTAMINATION, TEMPERATURE (HIGH), VIBRATION, LOSS OF INPUT

EFFECTS/RATIONALE:
PROVIDES PANEL CONTROL FOR SELECTION OF P/L RCDR SPEEDS DETERMINED BY THE PROGRAM PLUG. NO AFFECT ON CREW/VEHICLE. LOSS OF GROUND, KEYBOARD AND PANEL CONTROL COULD CAUSE LOSS OF SOME MISSIONS.

REFERENCES: SSSH-DWG NO 16.19, INCO/COMM SYST. BRIEF SB13.0; SFOM-INSTR VOL. 4E

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	201	ABORT:	3/3

ITEM: WIDE-BAND SIGNAL CONDITIONER (WBSC)
FAILURE MODE: LOSS OF OUTPUT, INTERMITTENT OUTPUT

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM
3) WIDE-BAND SIGNAL CONDITIONER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: MIDBODY, SHELF 8
PART NUMBER: MC476-0132

CAUSES: MISHANDLING, TEMPERATURE, VIBRATION, PIECE-PART STRUCTURAL FAILURE, LOSS OF INPUT

EFFECTS/RATIONALE:
WBSCs CONDITION INPUTS FROM PIEZO-ELECTRIC TRANSDUCERS TO MAKE MEASUREMENT DATA WITH WIDE DYNAMIC RANGE (E.G., VIBRATORY, ACOUSTICAL, POGO) COMPATIBLE WITH THE FREQUENCY-DIVISION MULTIPLEXER(S). LOSS OF OUTPUT WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: INCO/COMM SYS BRIEF, INSTRUMENTATION SFOM, SCHEMATIC VS72-978099

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	211	ABORT:	3/3

ITEM: WIDE BAND ACIP PCM SWITCH
FAILURE MODE: PHYSICAL BINDING/JAMMING

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM
3) WIDE BAND ACIP PCM
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL A7L
PART NUMBER: 36V73A7A255

CAUSES: PIECE-PART STRUCTURAL FAILURE, CONTAMINATION

EFFECTS/RATIONALE:
CONTROLS WIDEBAND DATA MODE, PROVIDES POWER TO FDM'S AND ACIP PCM EQUIPMENT VIA MCM OR VIA SWITCH.
EFFECTS OF JAMMING: CMD: WIDEBAND EQUIPMENT MODE AND POWER CONTROLLED ONLY BY COMMAND VIA MDM PFI; OFF: REMOVES POWER; ON: WIDEBAND EQUIPMENT MODE AND POWER CONTROLLED ONLY BY SWITCH (NO CMD CAPABILITY). LOSS OF FUNCTION WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: INCO/COMM SYS BRIEF, SCHEMATIC VS72-978099

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	212	ABORT:	3/3

ITEM: STRAIN GAGE SIGNAL CONDITIONERS (SGSC'S)
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM
3) STRAIN GAGE SIGNAL CONDITIONERS
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: MIDBODY, SHELF 8
PART NUMBER: MC476-0134

CAUSES: MISHANDLING, TEMPERATURE, VIBRATION, PIECE-PART STRUCTURAL FAILURE, LOSS OF INPUT

EFFECTS/RATIONALE:
SGSCs CONDITION INPUTS FROM INDIVIDUAL STRAIN GAGE TRANSDUCERS SENSING STRUCTURAL STRESSES. SGSC OUTPUTS ARE ROUTED TO THE MADS PCM MUX. LOSS OF OUTPUT WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: INCO/COMM SYS BRIEF, INSTRUMENTATION SFOM, SCHEMATIC V72-978099

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	213	ABORT:	3/3

ITEM: MADS STRAIN GAGE CONTROL SWITCH
FAILURE MODE: PHYSICAL BINDING/JAMMING

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM
3) STRAIN GAGE CONTROL SWITCH
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL A7L
PART NUMBER:

CAUSES: PIECE-PART STRUCTURAL FAILURE, CONTAMINATION

EFFECTS/RATIONALE:
STRAIN GAGE SWITCH CONTROLS POWER TO MADS STRAIN GAGE EQUIPMENT. BINDING IN THE THREE POSITIONS WOULD HAVE FOLLOWING EFFECTS: PCM ENA: STRAIN GAGE POWER CAN BE APPLIED VIA MCM ONLY; OFF: NO POWER TO STRAIN GAGE EQUIPMENT; ON: STRAIN GAGE POWER CAN ONLY BE APPLIED VIA SWITCH. LOSS OF CONTROL OF STRAIN GAGE POWER WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: SCHEMATIC VS72-978099, INCO/COMM SYS BRIEF

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	218	ABORT:	3/3

ITEM: FASCOS
FAILURE MODE: LOSS OF OUTPUT, SHORT, OPEN

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM
3) FLIGHT ACCELERATION SAFETY CUTOFF SYSTEM (FASCOS)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AT MAIN ENGINES
PART NUMBER: 477-1469-001

CAUSES: MISHANDLING, VIBRATION, PIECE-PART STRUCTURAL FAILURE, CONTAMINATION

EFFECTS/RATIONALE:
FASCOS IS A SIGNAL CONDITIONER PACKAGE THAT HANDLES MAIN ENGINE ACCELEROMETER DATA AND FORWARDS IT TO MADS FOR RECORDING. FASCOS DATA IS NOT DOWNLINKED REAL-TIME TO GROUND OR RECORDED ON OI OPS RECORDERS. LOSS OF MADS FASCOS DATA WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION. NOTE: THE "CO" IN FASCOS IS NOW A MISNOMER; THE ENGINE CUTOFF FUNCTION HAS BEEN DISABLED.

REFERENCES: MAIN ENGINE ICD 13M 15000, VS72-941102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	221	ABORT:	3/3

ITEM: FREQUENCY DIVISION MULTIPLEXER
FAILURE MODE: LOSS OF OUTPUT, SHORT, OPEN

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM (MADS)
3) FREQUENCY DIVISION MULTIPLEXER (FDM)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: MIDBODY, SHELF 8
PART NUMBER: MC409-0010

CAUSES: MISHANDLING, TEMPERATURE, VIBRATION, PIECE-PART STRUCTURAL FAILURE, LOSS OF INPUT

EFFECTS/RATIONALE:
EACH FDM HAS 15 CHANNELS. EACH CHANNEL HAS A VOLTAGE-CONTROLLED OSCILLATOR (VCO) MODULATED BY AN ANALOG SIGNAL REPRESENTING A MEASUREMENT. INDIVIDUAL VCO OUTPUTS ARE SUMMED INTO A COMPOSITE MULTIPLEXER OUTPUT THAT IS ROUTED TO MADS RECORDER OR TO T-0 UMBILICAL. LOSS OF OUTPUT WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: INCO/COMM SYS BRIEF, INSTRUMENTATION SFOM, SCHEMATIC V72-978099

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: INSTRUMENTATION FLIGHT: 3/3
MDAC ID: 222 ABORT: 3/3

ITEM: FDM CALIBRATION CONTROL
FAILURE MODE: LOSS OF OUTPUT, SHORT, OPEN

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM
3) FDM CALIBRATION CONTROL
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL A7L
PART NUMBER: V408-780209

CAUSES: CONTAMINATION, MISHANDLING, VIBRATION, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
CALIBRATE FUNCTION IS DONE PERIODICALLY TO ESTABLISH POINTS TO OBTAIN A CALIBRATION CURVE FOR EACH FDM VCO. AUTOMATIC FDM CALIBRATE CAN BE DONE VIA UPLINK COMMAND OR BY MANUALLY SELECTING THE "AUTO CALIBRATE" POSITION ON FDM CONTROL SWITCH ON PANEL ATL. MANUAL CALIBRATE CAN BE DONE BY PUTTING FDM CONTROL SWITCH IN "MANUAL" FOR EACH SELECTED CALIBRATION LEVEL ON THE "MAN CALIBR" ROTARY SWITCH ON PANEL A7L. LOSS OF CALIBRATION FUNCTION WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: INCO/COMM SYS BRIEF, INSTRUMENTATION SFOM, SCHEMATIC VS72-978099

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	231	ABORT:	3/3

ITEM: PCM MUX
FAILURE MODE: LOSS OF OUTPUT, INTERMITTENT OUTPUT

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM (MADS)
3) PULSE CODE MODULATION MULTIPLEXER (PCM MUX)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: MIDBODY, SHELF 8
PART NUMBER: MC476-0251

CAUSES: MISHANDLING, LOSS OF INPUT, TEMPERATURE, VIBRATION, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
PCM MUX CONDITIONS, DIGITIZES, MULTIPLEXES DISCRETES, HIGH AND LOW LEVEL ANALOG SIGNALS, AND BRIDGE COMPLETION DATA, AND FORMATS DATA FOR 32 KBPS OR 64 KBPS BIT STREAM TO MADS RECORDER OR TO T-O UMBILICAL. LOSS OF OUTPUT WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: INCO/COMM SYS BRIEF, INSTRUMENTATION SFOM, SCHEMATIC V72-978099

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: INSTRUMENTATION FLIGHT: 3/3
MDAC ID: 232 ABORT: 3/3

ITEM: PCM MODE CONTROL SWITCH
FAILURE MODE: PHYSICAL BINDING/JAMMING, SHORT, OPEN

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MADS
3) PCM MODE CONTROL SWITCH
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL ATL
PART NUMBER: 36V73A7A256

CAUSES: PIECE-PART STRUCTURAL FAILURE, CONTAMINATION

EFFECTS/RATIONALE:
PERMITS PCM EQUIPMENT TO BE CONTROLLED BY COMMAND OR MANUALLY. LOSS OF FUNCTION WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: INCO/COMM SYS BRIEF, SCHEMATIC VS72-978099

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	12/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	233	ABORT:	3/3

ITEM: PCM RECORD MODE SWITCH
FAILURE MODE: PHYSICAL BINDING/JAMMING, SHORT, OPEN

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MADS
3) PCM RECORD MODE SWITCH
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL ATL
PART NUMBER:

CAUSES: PIECE-PART STRUCTURAL FAILURE, CONTAMINATION

EFFECTS/RATIONALE:
PERMITS MANUAL SELECTION OF SAMPLE OR CONTINUOUS RECORD MODE. IN SAMPLE MODE PCM DATA IS SAMPLED FOR 10 SECONDS EACH 10 MINUTES; IN CONTINUOUS MODE DATA IS RECORDED CONTINUOUSLY. LOSS OF FUNCTION WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: INCO/COMMM SYS BRIEF, SCHEMATIC VS72-978099

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	241	ABORT:	3/3

ITEM: MADS CONTROL MODULE (MCM)
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM (MADS)
3) MADS CONTROL MODULE (MCM)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: CABIN MIDDECK
PART NUMBER: V408-763220

CAUSES: MISHANDLING, TEMPERATURE, VIBRATION, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
MCM SUPPLIES POWER TO RECORDER, FDM'S, PCM, STRAIN GAGES, AND SIGNAL CONDITIONERS. ALSO CONTROLS RECORDER SPEEDS, MODES, DIRECTION OF TAPE MOTION, TRACK SELECTION, AND PCM FORMAT/RATE. LOSS OF OUTPUT COULD DISABLE ALL OR PART OF MADS.
THE SYSTEM IS NOT CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: INCO/COMM SYS BRIEF, INSTRUMENTATION SFOM, SCHEMATIC V72-978099

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: INSTRUMENTATION FLIGHT: 3/3
MDAC ID: 251 ABORT: 3/3

ITEM: MADS RECORDER
FAILURE MODE: FAILS TO START/STOP

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM
3) MADS RECORDER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: CABIN MIDDECK
PART NUMBER: ME435-0053

CAUSES: LOSS OF CONTROL INPUT, MISHANDLING, VIBRATION, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
MADS RECORDER RECORDS SELECTED PRESSURE, TEMPERATURE, STRAIN, VIBRATION, EVENT DATA FROM MADS PCM MUX AND FDM, AND ALSO FROM SRB'S AND ET. FAILURE TO START/STOP WOULD CAUSE PARTIAL OR COMPLETE LOSS OF DATA. LOSS OF MADS DATA WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: INCO/COMM SYS BRIEF, INSTRUMENTATION SFOM, SCHEMATIC V72-978099

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	252	ABORT:	3/3

ITEM: MADS RECORDER
FAILURE MODE: PHYSICAL BINDING/JAMMING

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM
3) MADS RECORDER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: CABIN MIDDECK
PART NUMBER: ME435-0053

CAUSES: CONTAMINATION, MISHANDLING, VIBRATION, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
MADS RECORDER RECORDS SELECTED PRESSURE, TEMPERATURE, STRAIN, VIBRATION, EVENT DATA. BINDING/JAMMING WOULD CAUSE PARTIAL OR COMPLETE LOSS OF DATA.
LOSS OF MADS DATA WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: INCO/COMM SYS BRIEF, INSTRUMENTATION SFOM, SCHEMATIC V72-978099

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	253	ABORT:	3/3

ITEM: MADS RECORDER
FAILURE MODE: FAILS TO SWITCH

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM
3) MADS RECORDER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: CABIN MIDDECK
PART NUMBER: ME435-0053

CAUSES: LOSS OF CONTROL INPUT, MISHANDLING, VIBRATION, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
MADS RECORDER RECORDS SELECTED PRESSURE, TEMPERATURE, STRAIN, VIBRATION, EVENT DATA FROM MADS PCM MUX AND FDM, AND ALSO FROM SRB'S AND ET. FAILURE TO SWITCH TRACKS OR DIRECTION OF TAPE MOTION WOULD CAUSE PARTIAL LOSS OF DATA. LOSS OF MADS DATA WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: INCO/COMM SYS BRIEF, INSTRUMENTATION SFOM, SCHEMATIC V72-978099

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	254	ABORT:	3/3

ITEM: MADS RECORDER FORMAT CONTROL
FAILURE MODE: LOSS OF OUTPUT, SHORT, OPEN

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM
3) RECORDER FORMAT CONTROL
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL A7L
PART NUMBER: V408-780209

CAUSES: CONTAMINATION, MISHANDLING, VIBRATION, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
RECORDER FORMAT CONTROLS PERMIT SELECTION OF RECORDER TAPE SPEED FOR WIDEBAND RECORDING MODE (15 IPS) OR PCM MODE (3-3/4 IPS), AND DIRECTION OF TAPE MOTION. LOSS OF FORMAT CONTROL WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: INCO/COMM SYS BRIEF, INSTRUMENTATION SFOM, SCHEMATIC VS72-978099

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	255	ABORT:	3/3

ITEM: MADS RECORDER FORMAT CONTROL
FAILURE MODE: PHYSICAL BINDING/JAMMING

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM
3) RECORDER FORMAT CONTROL
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL A7L
PART NUMBER: V408-78029

CAUSES: PIECE-PART STRUCTURAL FAILURE, CONTAMINATION

EFFECTS/RATIONALE:
RECORDER FORMAT CONTROLS PERMIT SELECTION OF RECORDER TAPE SPEED FOR WIDEBAND RECORDING MODE (15 IPS) FOR PCM MODE (3-3/4 IPS), AND DIRECTION OF TAPE MOTION. LOSS OF FORMAT CONTROL WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: INCO/COMM SYS BRIEF, INSTRUMENTATION SFOM, SCHEMATIC VS72-978099

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: INSTRUMENTATION FLIGHT: 3/3
MDAC ID: 261 ABORT: 3/3

ITEM: REFERENCE JUNCTIONS
FAILURE MODE: OPEN

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM
3) THERMOCOUPLE REFERENCE JUNCTIONS
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: ME476-0133-0XXX

CAUSES: PIECE-PART STRUCTURAL FAILURE, MISHANDLING, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
A REFERENCE JUNCTION IS USED WITH A THERMOCOUPLE TEMPERATURE SENSOR TO PROVIDE A REFERENCE ELECTRICAL POTENTIAL AT A KNOWN TEMPERATURE OR SIMULATED TEMPERATURE FOR THAT THERMOCOUPLE. LOSS OF REFERENCE JUNCTION(S) WOULD CAUSE LOSS OF TEMPERATURE MEASUREMENT(S); HOWEVER, SUCH LOSS WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: INCO/COMM SYS BRIEF, INSTRUMENTATION SFOM, V72-978099

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	262	ABORT:	3/3

ITEM: REFERENCE JUNCTIONS
FAILURE MODE: SHORT

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM
3) THEMOCOUPLE REFERENCES JUNCTIONS
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: ME476-0133-0XXX

CAUSES: CONTAMINATION, MISHANDLING, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
REFERENCE JUNCTION IS USED TO PROVIDE A REFERENCE ELECTRICAL POTENTIAL BETWEEN DISSIMILAR METALS AT A JUNCTION AT KNOWN TEMPERATURE. SHORTING OF REFERENCE JUNCTION(S) WOULD CAUSE LOSS OF CALIBRATION OF WORKING THERMOCOUPLE MEASUREMENT JUNCTION(S). LOSS OF MEASUREMENT(S) WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: INCO/COMM SYS BRIEF, INSTRUMENTATION SFOM, V72-978099

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	263	ABORT:	3/3

ITEM: STRAIN GAGE TRANSDUCER
FAILURE MODE: LOSS OF OUTPUT, SHORT, OPEN, INTERMITTENT OPERATION

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM
3) STRAIN GAGE
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: VARIOUS LOCATIONS THROUGHOUT VEHICLE
PART NUMBER: ME449-0141

CAUSES: MISHANDLING, TEMPERATURE, LOSS OF INPUT, VIBRATION, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
USED TO MEASURE STRAIN AT POINTS THROUGHOUT VEHICLE. LOSS OF THESE MADS STRAIN GAGE MEASUREMENTS WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: SCHEMATIC VS72-978099, INCO/COMM SYS BRIEF, INSTRUMENTATION SFOM

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INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	264	ABORT:	3/3

ITEM: ACCELEROMETER
FAILURE MODE: LOSS OF OUTPUT, SHORT, OPEN

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM
3) ACCELEROMETER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: VARIOUS LOCATIONS THROUGHOUT VEHICLE
PART NUMBER: ME449-0150-0XXX

CAUSES: VIBRATION, MISHANDLING, CONTAMINATION, PIECE-PART STRUCTURAL FAILURE, CONTAMINATION

EFFECTS/RATIONALE:
THESE HIGH-FREQUENCY-RESPONSE ACCELEROMETERS PROVIDE ACCELERATION/VIBRATION DATA FROM SELECTED LOCATIONS THROUGHOUT THE VEHICLE. LOSS OF THESE MADS ACCELEROMETER MEASUREMENTS WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: SCHEMATIC VS72-978099, INCO/COMM SYS BRIEF, INSTRUMENTATION SFOM

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	265	ABORT:	3/3

ITEM: ACCELEROMETER
FAILURE MODE: LOSS OF OUTPUT, SHORT, OPEN

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM
3) ACCELEROMETER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: VARIOUS LOCATIONS THROUGHOUT VEHICLE
PART NUMBER: ME449-0150-0XXX

CAUSES: VIBRATION, MISHANDLING, CONTAMINATION, PIECE-PART STRUCTURAL FAILURE, CONTAMINATION

EFFECTS/RATIONALE:
THESE LOW-FREQUENCY-RESPONSE ACCELEROMETERS PROVIDE ACCELERATION/VIBRATION DATA FROM SELECTED LOCATIONS THROUGHOUT THE VEHICLE. LOSS OF THESE MADS ACCELEROMETER MEASUREMENTS WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: SCHEMATIC VS70-780089

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: INSTRUMENTATION FLIGHT: 3/3
MDAC ID: 266 ABORT: 3/3

ITEM: PRESSURE TRANSDUCERS
FAILURE MODE: LOSS OF OUTPUT, SHORT, OPEN, INTERMITTENT OUTPUT

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM
3) PRESSURE TRANSDUCERS
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: VARIOUS LOCATIONS
PART NUMBER: ME449-0178-0XXX

CAUSES: MISHANDLING, VIBRATION, CONTAMINATION, PIECE-PART STRUCTURAL FAILURE, LOSS OF INPUT

EFFECTS/RATIONALE:
USED TO SENSE/MEASURE DYNAMIC PRESSURES AT SELECTED LOCATIONS IN VEHICLE. LOSS OF THESE MADS MEASUREMENTS WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: SCHEMATIC VS72-978099

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	267	ABORT:	3/3

ITEM: RADIOMETER
FAILURE MODE: LOSS OF OUTPUT, SHORT, OPEN

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM
3) RADIOMETER
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: LEFT WING, LOWER LEFT FWD FUSELAGE
PART NUMBER: ME449-0189

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

EFFECTS/RATIONALE:
HIGH TEMPERATURE SENSOR USED TO MEASURE TEMPERATURES OF LEADING EDGE OF WING AND NOSE OF ORBITER DURING ENTRY. LOSS OF RADIOMETER MADS MEASUREMENTS WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: SCHEMATIC VS72-978099

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	268	ABORT:	3/3

ITEM: THERMOCOUPLE, FUSELAGE TPS
FAILURE MODE: LOSS OF OUTPUT, SHORT, OPEN, INTERMITTENT OPERATION

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM
3) THERMOCOUPLE, TPS
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: TPS, LOWER RIGHT FORWARD FUSELAGE
PART NUMBER: ME449-0204

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

EFFECTS/RATIONALE:
HIGH TEMPERATURE THERMOCOUPLE USED TO MEASURE TPS TEMPERATURES DURING ENTRY/LANDING OPERATIONS. LOSS OF THESE MADS MEASUREMENTS WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: SCHEMATIC VS72-978099

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	269	ABORT:	3/3

ITEM: THERMOCOUPLE, LEFT WING ELEVON
FAILURE MODE: LOSS OF OUTPUT, SHORT, OPEN, INTERMITTENT OPERATION

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM
3) THERMOCOUPLE, WING ELEVON
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: LEFT WING, ELEVON
PART NUMBER: ME449-0169

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

EFFECTS/RATIONALE:
HIGH-TEMPERATURE THERMOCOUPLE TO MEASURE TEMPERATURES TO WHICH WING ELEVON IS EXPOSED. LOSS OF THESE MADS MEAUSUREMENTS WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: SCHEMATIC VS72-978099

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	270	ABORT:	3/3

ITEM: TEMPERATURE SENSORS
FAILURE MODE: LOSS OF OUTPUT, SHORT, OPEN, INTERMITTENT OPERATION

LEAD ANALYST: A. W. ADDIS SUBSYS LEAD: A. W. ADDIS

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MODULAR AUXILIARY DATA SYSTEM
3) TEMPERATURE SENSORS
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: VARIOUS LOCATIONS THROUGHOUT VEHICLE
PART NUMBER: ME449-0160

CAUSES: MISHANDLING, VIBRATION, CONTAMINATION, PIECE-PART STRUCTURAL FAILURE, TEMPERATURE

EFFECTS/RATIONALE:
SENSORS ARE USED AT SELECTED LOCATIONS THROUGHOUT THE VEHICLE TO MEASURE TEMPERATURES FOR RECORDING ON THE MADS RECORDER. LOSS OF THESE MADS TEMPERATURE MEASUREMENTS WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISISON.

REFERENCES: SCHEMATIC VS72-978099

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPDC/INSTRUMENTATION FLIGHT: 3/2R
MDAC ID: 106 ABORT: 3/3

ITEM: CIRCUIT BREAKER, 5A, (2)
FAILURE MODE: OPEN, SHORTED, INADVERTENT OPERATION

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) PANEL, 014
3) MAIN BUS A&B
4) CIRCUIT BREAKER, 5A (2)
5)
6)
7)
8)
9) 05-6R

CRITICALITIES

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

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

LOCATION: 3373A14CB2, 15CB2
PART NUMBER: MC454-0026-2050

CAUSES: VIBRATION, TEMPERATURE, MECHANICAL SHOCK, CONTAMINATION, MISHANDLING/ABUSE

EFFECTS/RATIONALE:
PROVIDES MAIN BUS A AND B DISTRIBUTION CIRCUIT PROTECTION AND POWER FOR DEDICATED SIGNAL CONDITIONERS OF1 AND OF4. CRITICAL ARPCS MEASUREMENTS ARE PROCESSED BY THE SUBJECT DSCs. LOSS OF FUNCTION AFTER SECOND FAILURE COULD AFFECT MISSION IF SUBSYSTEM MEASUREMENT WAS OUT OF TOLERANCE AND WENT UNDETECTED.

REFERENCES: VS70-974102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPDC/INSTRUMENTATION FLIGHT: 3/2R
MDAC ID: 107 ABORT: 3/3

ITEM: CIRCUIT BREAKER, 5A, (2)
FAILURE MODE: OPEN, SHORTED, INADVERTENT OPERATION

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) PANEL, 014
3) MAIN BUS A&B
4) CIRCUIT BREAKER, 5A (2)
5)
6)
7)
8)
9) 05-6R

CRITICALITIES

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

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

LOCATION: 3373A14CB2, 15CB2
PART NUMBER: MC454-0026-2050

CAUSES: VIBRATION, TEMPERATURE, MECHANICAL SHOCK, CONTAMINATION, MISHANDLING/ABUSE

EFFECTS/RATIONALE:
PROVIDES MAIN BUS B AND C DISTRIBUTION CIRCUIT PROTECTION AND REDUNDANT POWER FOR DEDICATED SIGNAL CONDITIONERS OF2 AND OF3. ARPCS CRITICAL MEASUREMENTS ARE PROCESSED BY THE SUBJECT DSCs. LOSS OF FUNCTION AFTER SECOND FAILURE COULD AFFECT MISSION IF SUBSYSTEM MEASUREMENT WAS OUT OF TOLERANCE AND WENT UNDETECTED.

REFERENCES: VS70-974102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPDC/INSTRUMENTATION FLIGHT: 3/1R
MDAC ID: 108 ABORT: 3/1R

ITEM: POWER AND CONTROL CIRCUIT DSC OA1, 2, 3 (3)
FAILURE MODE: OPEN, SHORTED, LOSS OF OUTPUT, INDADVERTENT OPERATION, ERRONEOUS OUTPUT

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) PANEL, 33V73A17
3) AFT PCA 4, 5, 6
4) DSCOA1, 2, 3, POWER AND CONTROL CIRCUIT
5)
6)
7)
8)
9) 05-6R

CRITICALITIES

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

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

LOCATION:
PART NUMBER: VS70-974102

CAUSES: MISHANDLING/ABUSE, VIBRATION, TEMPERATURE, CONTAMINATION, MECHANICAL SHOCK

EFFECTS/RATIONALE:
CONTROL FOR DEDICATED SIGNAL CONDITIONERS OA1, OA2, OA3 AND NON REDUNDANT POWER TO 6 VIBRATION MONITOR SYSTEMS AND 4 TRANSDUCERS. CRITICAL APU MEASUREMENTS ARE PROECESSED BY THE SUBJECT DSCs. LOSS OF FUNCTION AFTER SECOND FAILURE COULD AFFECT IF SUBSYSTEM MEASUREMENT WAS OUT OF TOLERANCE AND WENT UNDETECTED.

REFERENCES: VS70-974102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPDC/INSTRUMENTATION FLIGHT: 3/1R
MDAC ID: 109 ABORT: 3/1R

ITEM: CIRCUIT BREAKER, 5A, (2)
FAILURE MODE: OPEN, SHORTED, INADVERTENT OPERATION

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) MAIN BUS A
3) PANEL 33V73A14, 15
4) CIRCUIT BREAKER, 5A
5)
6)
7)
8)
9) 05-6R

CRITICALITIES

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

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

LOCATION: 33V73A14CB3, 15CB4
PART NUMBER: MC545-0026-2050

CAUSES: VIBRATION, TEMPERATURE, MECHANICAL SHOCK, CONTAMINATION, MISHANDLING/ABUSE

EFFECTS/RATIONALE:
PROVIDES MAIN BUS A DISTRIBUTION CIRCUIT PROTECTION AND POWER FOR DEDICATED SIGNAL CONDITIONERS OM1 AND OM2. CRITICAL APU MEASUREMENTS ARE PROCESSED BY DSC OM1. LOSS OF FUNCTION AFTER SECOND FAILURE COULD AFFECT CREW/VEHICLE IF SUBSYSTEM MEASUREMENTS WERE OUT OF TOLERANCE AND WENT UNDETECTED.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPDC/INSTRUMENTATION FLIGHT: 3/3
MDAC ID: 110 ABORT: 3/3

ITEM: POWER AND CONTROL CIRCUIT DSC OR1 AND 2 (3)
FAILURE MODE: OPEN, SHORTED, INADVERTENT OPERATION

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) PANEL, 33V73A17
3) POWER AND CONTROL CIRCUIT
4)
5)
6)
7)
8)
9) 05-6R

CRITICALITIES

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

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

LOCATION:
PART NUMBER: VS70-974102

CAUSES: VIBRATION, CONTAMINATION, TEMPERATURE, MECHANICAL SHOCK, MISHANDLING/ABUSE

EFFECTS/RATIONALE:
PROVIDES REDUNDANT POWER AND CONTROL FOR DEDICATED SIGNAL CONDITIONERS OR1 AND OR2. LOSS OF DATA WILL NOT AFFECT CREW, VEHICLE OR MISSION

REFERENCES: VS70-974102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPDC/INSTRUMENTATION FLIGHT: 3/3
MDAC ID: 111 ABORT: 3/3

ITEM: POWER AND CONTROL CIRCUIT, DSC-OL1 & 2 (3)
FAILURE MODE: OPEN, SHORTED, INADVERTENT OPERATION

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) PANEL, 33V73A17
3) POWER AND CONTROL CIRCUIT
4)
5)
6)
7)
8)
9) 05-6R

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

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

LOCATION:
PART NUMBER: VS70-974102

CAUSES: VIBRATION, MECHANICAL SHOCK, CONTAMINATION, TEMPERATURE, MISHANDLING/ABUSE

EFFECTS/RATIONALE:
PROVIDES REDUNDANT POWER AND CONTROL FOR DEDICATED SIGNAL CONDITIONERS OL1 AND OL2. LOSS OF DATA WILL NOT AFFECT CREW, VEHICLE OR MISSION.

REFERENCES: VS70-974102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPDC/INSTRUMENTATION FLIGHT: 3/2R
MDAC ID: 115 ABORT: 3/3

ITEM: CIRCUIT BREAKER 7.5 A
FAILURE MODE: OPEN, SHORTED, INADVERTENT OPERATION

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) PANEL 015 & 014
3) MAIN BUS A AND B
4) CIRCUIT BREAKER, 7.5A
5)
6)
7)
8)
9) 05-6R

CRITICALITIES

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

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

LOCATION: 33V73A15CB5, 14CB4
PART NUMBER: MC454-0026-2075

CAUSES: CONTAMINATION, MECHANICAL SHOCK, MISHANDLING/ABUSE, TEMPERATURE, VIBRATION

EFFECTS/RATIONALE:
PROVIDES MAIN BUS A AND B CIRCUIT PROTECTION AND POWER FOR MDM OF1 AND OF2. CRITICAL ARPCS MEASUREMENTS ARE PROCESSED BY THE SUBJECT MDMs. LOSS OF FUNCTION AFTER SECOND FAILURE COULD AFFECT MISSION IF SUBSYSTEM MEASUREMENT WAS OUT OF TOLERANCE AND WENT UNDETECTED.

REFERENCES: VS70-974102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPDC/INSTRUMENTATION FLIGHT: 3/2R
MDAC ID: 116 ABORT: 3/3

ITEM: CIRCUIT BREAKER 7.5A (2)
FAILURE MODE: OPEN, SHORTED, INADVERTENT OPERATION

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) PANEL
3) MAIN BUS A AND B
4) CIRCUIT BREAKER, 7.5A
5)
6)
7)
8)
9) 05-6R

CRITICALITIES

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

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

LOCATION: 33V73A14CB5, 16CB3
PART NUMBER: MC454-0026-2075

CAUSES: CONTAMINATION, MECHANICAL SHOCK, MISHANDLING/ABUSE, TEMPERATURE, VIBRATION

EFFECTS/RATIONALE:
PROVIDES MAIN BUS A AND C DISTRIBUTION CIRCUIT PROTECTION AND POWER FOR MDM OF3 AND OF4. CRITICAL ARPCS MEASUREMENTS ARE PROCESSED BY MDM OF3. LOSS OF FUNCTION AFTER SECOND FAILURE COULD AFFECT CREW/VEHICLE IF SUBSYSTEM MEASUREMENT WERE LOST.

REFERENCES: VS70-974102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	EPDC/INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	117	ABORT:	3/3

ITEM: POWER AND CONTROL CIRCUIT MDM OA1, 2, 3, CRITICALITY 3 COMPONENTS
FAILURE MODE: OPEN, SHORTED, LOSS OF OUTPUT, INADVERTENT OPERATION, ERRONEOUS OUTPUT

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) PANEL 33V73A17
3) AFT PCA 4, 5, 6
4) MDM OA1, 2, 3 CONTROL CIRCUIT
5)
6)
7)
8)
9) 05-6R

CRITICALITIES

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

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

LOCATION:
PART NUMBER: VS70-974102

CAUSES: MISHANDLING/ABUSE, VIBRATION, TEMPERATURE, CONTAMINATION, MECHANICAL SHOCK

EFFECTS/RATIONALE:
PROVIDES REDUNDANT POWER AND CONTROL FOR MDM'S OA1, OA2 AND OA3. ALL COMPONENTS ARE CRITICALITY 3 EXCEPT FOR TOGGLE SWITCH ME452-0102-7301 WHICH IS COVERED IN MDAC ID 118. WILL NOT AFFECT CREW, VEHICLE OR MISSION.

REFERENCES: VS70-974102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPDC/INSTRUMENTATION FLIGHT: 3/1R
MDAC ID: 118 ABORT: 3/1R

ITEM: SWITCH, TOGGLE 3P2T
FAILURE MODE: FAILS TO CLOSE, SHORTED, FAILS TO OPEN

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) PANEL 33V73A17
3) SWITCH 19
4)
5)
6)
7)
8)
9) 05-6R

CRITICALITIES

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

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

LOCATION: 33V73A17519
PART NUMBER: ME452-0102-7301

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

EFFECTS/RATIONALE:
PROVIDES MANUAL CONTROL OF RPC'S WHICH SUPPLY POWER TO MDM'S OA1, OA2 AND OA3. CRITICAL APU MEASUREMENTS ARE PROCESSED BY THE SUBJECT MDMs. LOSS OF FUNCTION COULD AFFECT CREW/VEHICLE IF SUBSYSTEM MEASUREMENT WERE LOST.

REFERENCES: VS70-974102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPDC/INSTRUMENTATION FLIGHT: 3/3
MDAC ID: 127 ABORT: 3/3

ITEM: PCM POWER AND CONTROL CIRCUIT, CRITICALITY 3
COMPONENTS (3)
FAILURE MODE: OPEN, SHORTED, INADVERTENT OPERATION, ERRONEOUS OUTPUT

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) PANEL, 35V73A3A7
3) POWER AND CONTROL CIRCUIT
4)
5)
6)
7)
8)
9) 05-62

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:
PART NUMBER: VS70-974102

CAUSES: MECHANICAL SHOCK, CONTAMINATION, MISHANDLING, VIBRATION, TEMPERATURE

EFFECTS/RATIONALE:
PROVIDES REDUNDANT POWER AND CONTROL FOR PCM 1 AND 2. ALL COMPONENTS IN THIS CIRCUIT ARE CRITICALITY 3 EXCEPT TOGGLE SWITCH, ME452-0102-7303, WHICH IS COVERED IN MDAC ID 128. WILL NOT AFFECT CREW, VEHICLE OR MISSION.

REFERENCES: VS70-974102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPDC/INSTRUMENTATION FLIGHT: 2/2
MDAC ID: 128 ABORT: 3/3

ITEM: SWITCH TOGGLE, 3P3T (1)
FAILURE MODE: FAILS TO CLOSE, OPEN, SHORTED

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) PANEL, A3A7
3) SWITCH, S7
4)
5)
6)
7)
8)
9) 05-6R

CRITICALITIES

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

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

LOCATION: PANEL C3
PART NUMBER: ME452-0102-7303

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

EFFECTS/RATIONALE:
PROVIDES MANUAL CONTROL AND POWER TO PCM'S 1 AND 2. SWITCH FAILURE COULD CAUSE LOSS OF MISSION DUE TO LOSS OF POWER TO PCM'S 1 & 2 AND SUBSEQUENT LOSS OF GPC DOWNLIST, OPERATIONAL INSTRUMENTATION AND PAYLOAD DATA.

REFERENCES: VS70-974102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPDC/INSTRUMENTATION FLIGHT: 3/2R
MDAC ID: 134 ABORT: 3/3

ITEM: POWER AND CONTROL CIRCUIT, MTU (2)
FAILURE MODE: OPEN, SHORTED, INADVERTENT OPERATION

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) PANEL, 33V73A13
3) CIRCUIT BREAKER, MTU POWER
4)
5)
6)
7)
8)
9) 05-6R

CRITICALITIES

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

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

LOCATION:
PART NUMBER: VS70-974102

CAUSES: VIBRATION, CONTAMINATION, MECHANICAL SHOCK, TEMPERATURE MISHANDLING/ABUSE

EFFECTS/RATIONALE:
PROVIDES REDUNDANT POWER AND CONTROL AND CIRCUIT PROTECTION FOR ESSENTIAL BUSES 1BC AND 2CA AND THE MASTER TIMING UNIT. MTU TIME IS USED BY ORBITER FOR AUTHENTICATION OF ENCRYPTED COMMANDS; ITS LOSS COULD CAUSE LOSS OF MISSION.

REFERENCES: VS70-974102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPDC/INSTRUMENTATION FLIGHT: 3/2R
MDAC ID: 164 ABORT: 3/3

ITEM: POWER AND CONTROL CIRCUIT, PDI (2)
FAILURE MODE: OPEN, SHORTED INADVERTENT OPERATION

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) PANEL 36V73A1A2
3) POWER CONTROL CIRCUIT
4)
5)
6)
7)
8)
9) 05-6R

CRITICALITIES

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

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

LOCATION:
PART NUMBER: VS70-974102

CAUSES: VIBRATION, MECHANICAL SHOCK, TEMPERATURE, CONTAMINATION, MISHANDLING/ABUSE

EFFECTS/RATIONALE:
PROVIDES REDUNDANT POWER AND CONTROL FOR THE PDI. LOSS OF POWER AND CONTROL FUNCTIONS AND SUBSEQUENT LOSS OF PDI PAYLOAD DATA COULD BE MISSION CRITICAL FOR PAYLOADS REQUIRING PREDEPLOY CHECKOUT TELEMETRY DATA.
(FOR SOME MISSIONS A SPARE PDI IS REQUIRED TO BE CARRIED AS A REPLACEMENT.)

REFERENCES: VS70-974102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPDC/INSTRUMENTATION FLIGHT: 3/3
MDAC ID: 176 ABORT: 3/3

ITEM: POWER AND CONTROL CIRCUIT, OPS RCDR 1, (2)
FAILURE MODE: OPEN, SHORTED, INADVERTENT OPERATION

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) PANEL, 36V73A1A3
3) POWER AND CONTROL CIRCUIT
4)
5)
6)
7)
8)
9) 05-6R

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:
PART NUMBER: VS70-974102

CAUSES: TEMPERATURE, MECHANICAL SHOCK, VIBRATION, CONTAMINATION, MISHANDLING/ABUSE.

EFFECTS/RATIONALE:
PROVIDES REDUNDANT POWER AND CONTROL FOR OPS RECORDER 1. LOSS OF DATA WILL NOT AFFECT CREW, VEHICLE OR MISSION.

REFERENCES: VS70-974102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPDC/INSTRUMENTATION FLIGHT: 3/3
MDAC ID: 177 ABORT: 3/3

ITEM: POWER AND CONTROL CIRCUIT, OPS RCDR 2, (2)
FAILURE MODE: OPEN, SHORTED, INADVERTENT OPERATION

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) PANEL, 36V73A1A3
3) POWER AND CONTROL CIRCUIT
4)
5)
6)
7)
8)
9) 05-6R

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:
PART NUMBER: VS70-974102

CAUSES: VIBRATION, TEMPERATURE, CONTAMINATION, SHOCK, MISHANDLING/ABUSE

EFFECTS/RATIONALE:
PROVIDES REDUNDANT POWER AND CONTROL FOR OPS RCDR 2. LOSS OF DATA WILL NOT AFFECT CREW, VEHICLE OR MISSION.

REFERENCES: VS70-974102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPDC/INSTRUMENTATION FLIGHT: 3/2R
MDAC ID: 185 ABORT: 3/3

ITEM: POWER AND CONTROL CIRCUIT PAYLOAD RECORDER (2)
FAILURE MODE: OPEN, SHORT, INADVERTENT OPERATION

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) PANEL, 36V73A1A3
3) POWER AND CONTROL CIRCUIT
4)
5)
6)
7)
8)
9) 05-6R

CRITICALITIES

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

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

LOCATION:
PART NUMBER: VS70-974102

CAUSES: VIBRATION, TEMPERATURE, MECHANICAL SHOCK, CONTAMINATION, MISHANDLING/ABUSE

EFFECTS/RATIONALE:
PROVIDES REDUNDANT POWER AND CONTROL FOR PAYLOAD RECORDER. LOSS OF PL RCDR PWR/CONTROL AND CONSEQUENT LOSS OF DATA WILL NOT AFFECT CREW/VEHICLE, BUT COULD CAUSE LOSS OF MISSION FOR SOME MISSIONS.

REFERENCES: VS70-974102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	EPDC/INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	202	ABORT:	3/3

ITEM: POWER AND CONTROL CIRCUIT WBSC EQUIPMENT (1)
FAILURE MODE: OPEN, SHORTED, INADVERTENT OPERATION

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) PANEL, 36V73A7A2
3) POWER AND CONTROL CIRCUIT (MADS)
4)
5)
6)
7)
8)
9) 05-6R

CRITICALITIES

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

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

LOCATION:
PART NUMBER: VS72-978102

CAUSES: VIBRATION, MECHANICAL SHOCK, CONTAMINATION, TEMPERATURE MISHANDLING/ABUSE

EFFECTS/RATIONALE:
PROVIDES POWER AND CONTROL FOR MADS WIDEBAND EQUIPMENT AND MADS RECORDER. LOSS OF MADS DATA WILL NOT AFFECT CREW, VEHICLE OR MISSION

REFERENCES: VS72-978102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	EPDC/INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	203	ABORT:	3/3

ITEM: POWER DISTRIBUTION ASSEMBLY
FAILURE MODE: OPEN, INADVERTENT OPERATION

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) PDA, 4OV78A190
3)
4)
5)
6)
7)
8)
9) 05-6R

CRITICALITIES

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

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

LOCATION:
PART NUMBER: VS72-978102

CAUSES: MISHANDLING/ABUSE, VIBRATION, MECHANICAL SHOCK, TEMPERATURE, CONTAMINATION

EFFECTS/RATIONALE:
MULTIPLE POWER DISTRIBUTION FROM 5 MADS BUSES VIA IN-LINE FUSES. LOSS OF POWER AND CONSEQUENT LOSS OF MADS DATA WILL NOT AFFECT CREW, VEHICLE OR MISSION.

REFERENCES: VS72-978102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	EPDC/INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	214	ABORT:	3/3

ITEM: POWER CONTROL CIRCUIT SG/PCM (1)
FAILURE MODE: OPEN, SHORTED, INADVERTENT OPERATION

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) PANEL, 36V73A7AZ
3) POWER AND CONTROL CIRCUIT (MADS)
4)
5)
6)
7)
8)
9) 05-6R

CRITICALITIES

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

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

LOCATION:
PART NUMBER: VS72-978102

CAUSES: VIBRATION, CONTAMINATION, MECHANICAL SHOCK, TEMPERATURE

EFFECTS/RATIONALE:
PROVIDES MADS BUS POWER FOR STRAIN GAGE OR PCM EQUIPMENT, SINGLE STRING. LOSS OF MADS DATA WILL NOT AFFECT CREW, VEHICLE OR MISSION.

REFERENCES: VS72-978102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	EPDC/INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	242	ABORT:	3/3

ITEM: POWER & CONTROL CIRCUIT, MCM (1)
FAILURE MODE: OPEN, SHORTED, INADVERTENT OPERATION

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) PANEL A7A2, C3A5
3) POWER AND CONTROL CIRCUIT
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: VS72-978102

CAUSES: VIBRATION, TEMPERATURE, MECHANICAL SHOCK, CONTAMINATION, MISHANDLING/ABUSE.

EFFECTS/RATIONALE:
PROVIDES POWER CONTROL AND CIRCUIT PROTECTION FOR THE MADS CONTROL MODULE. LOSS OF POWER TO AND CONTROL OF MCM AND THE CONSEQUENT LOSS OF MADS DATA WILL NOT AFFECT CREW/VEHICLE OR MISSION.

REFERENCES: VS72-978102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPDC/INSTRUMENTATION FLIGHT: 3/3
MDAC ID: 243 ABORT: 3/3

ITEM: CIRCUIT, ET POWER DISTRIBUTION
FAILURE MODE: OPEN, SHORTED, INADVERTENT OPERATION

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) AFT AVIONICS BAY
3) MASD POWER DISTRIBUTION ASSEMBLY (PDA)
4) CIRCUIT, ET POWER DISTRIBUTION
5)
6)
7)
8)
9) 05-6R

CRITICALITIES

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

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

LOCATION:
PART NUMBER: 02

CAUSES: TEMPERATURE, VIBRATION, MECHANICAL SHOCK, CONTAMINATION, MISHANDLING/ABUSE.

EFFECTS/RATIONALE:
PROVIDES POWER FOR ET DFI AND DEADFACE RELAYS. NO EFFECT ON CREW, VEHICLE OR MISSION.

REFERENCES: VS72-978102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPDC/INSTRUMENTATION FLIGHT: 3/3
MDAC ID: 256 ABORT: 3/3

ITEM: POWER AND CONTROL CIRCUIT, MADS RCDR (1)
FAILURE MODE: OPEN, SHORTED, INADVERTENT OPERATION

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) PANEL, 36V73A7A2
3) POWER CONTROL CIRCUIT
4)
5)
6)
7)
8)
9) 05-6R

CRITICALITIES

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

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

LOCATION:
PART NUMBER: VS70-978102

CAUSES: VIBRATION, CONTAMINATION, TEMPERATURE, MECHANICAL SHOCK

EFFECTS/RATIONALE:
PROVIDES POWER AND CONTROL TO THE MADS RECORDER. LOSS OF MADS DATA WILL NOT AFFECT CREW, VEHICLE OR MISSION.

REFERENCES: VS72-978102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	EPDC/INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	271	ABORT:	3/3

ITEM: CIRCUIT BREAKER, 5A, (1)
FAILURE MODE: OPEN, SHORTED, INADVERTENT OPERATION

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) PANEL 014
3) MAIN BUS A
4) CKT BKR, 5A
5)
6)
7)
8)
9) 05-6R

CRITICALITIES

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

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

LOCATION:
PART NUMBER: MC454-0026-2050

CAUSES: CONTAMINATION, MECHANICAL SHOCK, MISHANDLING/ABUSE, TEMPERATURE, VIBRATION

EFFECTS/RATIONALE:
PROVIDES MAIN BUS A DISTRIBUTION CIRCUIT PROTECTION AND POWER FOR WATER LOOP-1 INTERCHANGER FLOW SENSOR AND IMU AIRFLOW SENSOR. LOSS OF DATA WILL NOT AFFECT CREW, VEHICLE OR MISSION.

REFERENCES: VS72-978102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPDC/INSTRUMENTATION FLIGHT: 3/3
MDAC ID: 272 ABORT: 3/3

ITEM: FUSE, FPCA MN BUS A 1A (1)
FAILURE MODE: OPEN

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) FWD PCA-1
3) MAIN BUS A
4) FUSE, 1A
5)
6)
7)
8)
9) 05-6R

CRITICALITIES

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

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

LOCATION:
PART NUMBER: ME451-0018-0100

CAUSES: MISHANDLING/ABUSE, VIBRATION, MECHANICAL SHOCK, TEMPERATURE, CONTAMINATION

EFFECTS/RATIONALE:
PROVIDES CIRCUIT PROTECTION FOR MAIN BUS A AND THE WATER LOOP 1 INTERCHANGER FLOW SENSOR. LOSS OF DATA WILL NOT AFFECT CREW, VEHICLE OR MISSION.

REFERENCES: VS72-978102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPDC/INSTRUMENTATION FLIGHT: 3/3
MDAC ID: 273 ABORT: 3/3

ITEM: FUSE, FPCA, MN BUS A 1A (1)
FAILURE MODE: OPEN

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) FWD PCA-1
3) MAIN BUS A
4) FUSE, 1A
5)
6)
7)
8)
9) 05-6R

CRITICALITIES

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

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

LOCATION:
PART NUMBER: ME451-0018-0100

CAUSES: MISHANDLING/ABUSE, VIBRATION, MECHANICAL SHOCK, TEMPERATURE, CONTAMINATION

EFFECTS/RATIONALE:
PROVIDES CIRCUIT PROTECTION FOR MAIN BUS A AND THE IMU AIRFLOW RATE SENSOR. LOSS OF DATA WILL NOT AFFECT CREW, VEHICLE OR MISSION.

REFERENCES: VS72-978102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE:	11/22/86	HIGHEST CRITICALITY	HDW/FUNC
SUBSYSTEM:	EPDC/INSTRUMENTATION	FLIGHT:	3/3
MDAC ID:	274	ABORT:	3/3

ITEM: CIRCUIT BREAKER, 5A (1)
FAILURE MODE: OPEN, SHORTED, INADVERTENT OPERATION

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) PANEL 015
3) MAIN BUS B
4) CIRCUIT BREAKER, 5A
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION:
PART NUMBER: MC454-0026-2050

CAUSES: CONTAMINATION, MECHANICAL SHOCK, MISHANDLING/ABUSE, TEMPERATURE, VIBRATION

EFFECTS/RATIONALE:
PROVIDES CIRCUIT PROTECTION FOR MAIN BUS B AND POWER FOR WATER LOOP-2 INTERCHANGER FLOW SENSOR. LOSS OF DATA WILL NOT AFFECT CREW, VEHICLE OR MISSION.

REFERENCES: VS72-978102

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: EPDC/INSTRUMENTATION FLIGHT: 3/3
MDAC ID: 275 ABORT: 3/3

ITEM: FUSE, FPCA-2, MN B, 1A (1)
FAILURE MODE: OPEN

LEAD ANALYST: T. EMMONS SUBSYS LEAD: K. SCHMECKPEPER

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) FWD PCA-2
3) MAIN BUS B
4) FUSE, 1A
5)
6)
7)
8)
9) 05-6R

CRITICALITIES

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

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

LOCATION:
PART NUMBER: ME451-0018-0100

CAUSES: MISHANDLING/ABUSE VIBRATION, MECHANICAL SHOCK, TEMPERATURE, CONTAMINATION

EFFECTS/RATIONALE:
PROVIDES CIRCUIT PROTECTION FOR MDM BUS B AND THE WATER LOOP-2 INTERCHANGER FLOW SENSOR. LOSS OF DATA WILL NOT AFFECT CREW, VEHICLE OR MISSION.

REFERENCES: VS72-978102

APPENDIX D
POTENTIAL CRITICAL ITEMS

MDAC ID	ITEM	FAILURE MODE
115	MDMs 0A1, OA2, OA3	Loss of Output, Open, Shorted
124	PCMMU Format Control Switch	Physical Binding/ Jamming
125	PCMMU Format Control Switch	Shorted
126	PCMMU Format Control Switch	Open
128	OI PCMMU PWR Switch	Fails to Close, Shorted, Open
131	MTU	Loss of Output
132	MTU	Erroneous Output
133	MTU	Erratic Output