INDEPENDENT ORBITER ASSESSMENT

ANALYSIS OF THE INSTRUMENTATION SUBSYSTEM

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McDONNELL DOUGLAS
INDEPENDENT ORBITER ASSESSMENT

ANALYSIS
OF THE
INSTRUMENTATION
SUBSYSTEM

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INDEPENDENT ORBITER ASSESSMENT
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1.0 EXECUTIVE SUMMARY

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

<table>
<thead>
<tr>
<th>Summary of IOA Failure Modes By Criticality (HW/F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criticality:</td>
</tr>
<tr>
<td>Number       :</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Summary of IOA Potential Critical Items (HW/F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criticality:</td>
</tr>
<tr>
<td>Number       :</td>
</tr>
</tbody>
</table>

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.
INSTRUMENTATION OVERVIEW ANALYSIS SUMMARY

<table>
<thead>
<tr>
<th>CRITICALITY</th>
<th>#FM</th>
<th>#PCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2/1R</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2/2</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>3/1R</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>3/2R</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>3/3</td>
<td>54</td>
<td>0</td>
</tr>
</tbody>
</table>

FIGURE 1
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

<table>
<thead>
<tr>
<th>OI NOMENCLATURE</th>
<th>INSTALLED LOCATION</th>
<th>OI NOMENCLATURE</th>
<th>INSTALLED LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>OF1</td>
<td>AV BAY 1</td>
<td>PDI</td>
<td>AV BAY 1</td>
</tr>
<tr>
<td>OF2</td>
<td>AV BAY 2</td>
<td>PCMMUs 1 2</td>
<td>AV BAY 1 AV BAY 2</td>
</tr>
<tr>
<td>OF3</td>
<td>AV BAY 3</td>
<td>MTU</td>
<td>AV BAY 3B</td>
</tr>
<tr>
<td>OF4</td>
<td>FWD RCS MODULE</td>
<td>RCDRs OPS 1 2 P/L</td>
<td>AV BAY 2 AV BAY 1</td>
</tr>
<tr>
<td>QA1</td>
<td>AV BAY 4</td>
<td>OTB</td>
<td>BEHIND PANEL L16</td>
</tr>
<tr>
<td>QA2</td>
<td>AV BAY 5</td>
<td>PTB</td>
<td>BEHIND PANEL L16</td>
</tr>
<tr>
<td>QA3</td>
<td>AV BAY 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OM1</td>
<td>MID FUSELAGE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OM2</td>
<td>MID FUSELAGE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OL1</td>
<td>LEFT OMS POD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OL2</td>
<td>LEFT OMS POD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OR1</td>
<td>RIGHT OMS POD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OR2</td>
<td>RIGHT OMS POD</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### MADS

<table>
<thead>
<tr>
<th>MADS NOMENCLATURE</th>
<th>INSTALLED LOCATION</th>
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</thead>
<tbody>
<tr>
<td>WBSC</td>
<td>MID BODY</td>
</tr>
<tr>
<td>SGSC</td>
<td>MID BODY</td>
</tr>
<tr>
<td>PCMU</td>
<td>MID BODY</td>
</tr>
<tr>
<td>FDM</td>
<td>MID BODY</td>
</tr>
<tr>
<td>PDA</td>
<td>MID BODY</td>
</tr>
<tr>
<td>MCM</td>
<td>CABIN MIDDECK</td>
</tr>
<tr>
<td>RCDR</td>
<td>CABIN MIDDECK</td>
</tr>
</tbody>
</table>
OPERATIONAL INSTRUMENTATION EQUIPMENT LOCATION

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

2. FWD AVIONICS BAY 2
   DSC OF2
   MDM OP2
   PGMWU 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
NOTE: SHARED AREAS NOT INCLUDED IN IOA
MODULAR AUXILIARY DATA SYSTEM INTERFACES

MADS

OI

T-O UMBILICAL

ACIP

ET PCM

GSE

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.
INSTRUMENTATION SUBSYSTEM OVERVIEW

INSTRUMENTATION

OPERATIONAL INSTRUMENTATION

MODULAR AUXILIARY DATA SYSTEM

FIGURE 7
IOA
PCMMU DETAIL SYSTEM REPRESENTATION

PULSE CODE MODULATION
MASTER UNIT

PCMMU NO. 1
PCMMU NO. 2

POWER SUPPLY
OI MIA
PAYLOAD I/O BUFFER
TLM FORMAT & CONTROL

GPC MIA
OI MDM I/O BUFFER
TOGGLE BUFFER
CENTRAL TIMING

GPC I/O BUFFER
PAYLOAD MIA
OI/PL DATA RAM
BYTE STATUS REGISTER

FETCH CMD READOUT CONTROL

FIGURE 11
Figure 12

SI0 - Serial Input/Output
AI - Analog Input Single-Ended
AD - Analog Input Differential
DIH - Digital Input High
DIL - Digital Input Low

MIA
2 0F2
IF Adapter

SCU
2 0F2
SCU Unit

TOP 1 OF2
Power

Ps Module
Input/Output

A/D 2 OF 2
A/D Converter

Analog/Digital

MDM 0A3
MDM 0A2
MDM 0A1
OI AFT

MDM 0F4
MDM 0F3
MDM 0F2
MDM 0F1
MDM 0F0
OI FWD

MDM 0I

OI MDM Detailed System Representation
OI DSC DETAIL SYSTEM REPRESENTATION

IOA

FORWARD
DSC OF1
DSC OF2
DSC OF3
DSC OF4

MID
DSC OM1
DSC OM2

AFT
DSC OA1
DSC OA2
DSC OA3

LEFT
DSC OL1
DSC OL2

RIGHT
DSC OR1
DSC OR2

CMIB
15/30 CARD
(TYPICAL)

POWER
SUPPLY
PS 1 OF 2
PS 2 OF 2

BITE
1 OF 1

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

FIGURE 13
IOA INSTRUMENTATION SUBSYSTEM MADS BLOCK DIAGRAM

REAL TIME STATUS MEASUREMENT FOR MADS

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>
<thead>
<tr>
<th>TABLE II Summary of IOA Failure Modes and Criticalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criticality:</td>
</tr>
<tr>
<td>MTU</td>
</tr>
<tr>
<td>PCMMU/SWITCHES</td>
</tr>
<tr>
<td>MDMs</td>
</tr>
<tr>
<td>DSCs</td>
</tr>
<tr>
<td>PDI</td>
</tr>
<tr>
<td>OPS RCDR</td>
</tr>
<tr>
<td>PL RCDR</td>
</tr>
<tr>
<td>OTB</td>
</tr>
<tr>
<td>PTB</td>
</tr>
<tr>
<td>MADS</td>
</tr>
<tr>
<td>SENSORS</td>
</tr>
<tr>
<td>TOTAL</td>
</tr>
</tbody>
</table>

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>
<thead>
<tr>
<th>TABLE III Summary of IOA Potential Critical Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criticality:</td>
</tr>
<tr>
<td>MTU</td>
</tr>
<tr>
<td>PCMMU FORMAT</td>
</tr>
<tr>
<td>SWITCH</td>
</tr>
<tr>
<td>PCMMU PWR</td>
</tr>
<tr>
<td>MDMA</td>
</tr>
<tr>
<td>TOTAL</td>
</tr>
</tbody>
</table>
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
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)
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

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACIP</td>
<td>Aerodynamics Coefficient Instrumentation Package</td>
</tr>
<tr>
<td>AOA</td>
<td>Abort Once Around</td>
</tr>
<tr>
<td>ARPCS</td>
<td>Atmospheric Revitalization Pressure Control System</td>
</tr>
<tr>
<td>AV</td>
<td>Avionics</td>
</tr>
<tr>
<td>BFS</td>
<td>Backup Flight System</td>
</tr>
<tr>
<td>Calibr</td>
<td>Calibration</td>
</tr>
<tr>
<td>CCTV</td>
<td>Closed Circuit Television</td>
</tr>
<tr>
<td>CIL</td>
<td>Critical Items List</td>
</tr>
<tr>
<td>CRIT</td>
<td>Criticality</td>
</tr>
<tr>
<td>DFI</td>
<td>Development Flight Instrumentation</td>
</tr>
<tr>
<td>DFL</td>
<td>Decommutator Format Load</td>
</tr>
<tr>
<td>Dk</td>
<td>Deck</td>
</tr>
<tr>
<td>DOD</td>
<td>Department of Defense</td>
</tr>
<tr>
<td>DSC</td>
<td>Dedicated Signal Conditioner</td>
</tr>
<tr>
<td>EIU</td>
<td>Engine Interface Unit</td>
</tr>
<tr>
<td>Ena</td>
<td>Enable</td>
</tr>
<tr>
<td>ET</td>
<td>External Tank</td>
</tr>
<tr>
<td>F</td>
<td>Functional</td>
</tr>
<tr>
<td>FASCOS</td>
<td>Flight Acceleration Safety Cutoff System</td>
</tr>
<tr>
<td>FDM</td>
<td>Frequency Division Multiplexer</td>
</tr>
<tr>
<td>Flt</td>
<td>Flight</td>
</tr>
<tr>
<td>FMEA</td>
<td>Failure Modes and Effects Analysis</td>
</tr>
<tr>
<td>Fwd</td>
<td>Forward</td>
</tr>
<tr>
<td>GMT</td>
<td>Greenwich Meridien Time</td>
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<td>OI</td>
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| 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 on-orbit phase prior to planned end of mission

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

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

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

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

**MISSION** - assigned performance of a specific Orbiter flight with payload/objective accomplishments including orbit phasing and altitude (excludes secondary payloads such as GAS cans, middeck P/L, etc.)
MULTIPLE ORDER FAILURE - describes the failure due to a single cause or event of all units which perform a necessary (critical) function

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

OPS - software operational sequence

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

PHASE DEFINITIONS:

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

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

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

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

LANDING/SAFING PHASE - begins at first main gear touchdown and ends with the completion of post-landing safing operations
APPENDIX B
DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

B.2 IOA Project Level Ground Rules and Assumptions

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

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

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

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

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

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

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

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

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

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

   RATIONALE: Failures caused by human operational error are out-of-scope of this task.
6. All hardware analyses will, as a minimum, be performed at the level of analysis existent within NASA/Prime Contractor Orbiter FMEA/CILs, and will be permitted to go to greater hardware detail levels but not lesser.

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

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

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

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

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

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

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

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

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

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

RATIONALE: Clarify definition of emergency systems to ensure consistency throughout IOA project.
APPENDIX B
DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

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
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 101

HIGHEST CRITICALITY
HDW/FUNC
FLIGHT: 3/3
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
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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

REPORT DATE 12/29/86  C-2
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 102

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

BREAKDOWN HIERARCHY:
1) INSTRUMENTATION
2) OI
3) DSC

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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

REPORT DATE 12/29/86 C-3
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 103

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
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LOCATION: OF1-AV BAY 1, OF2-AV BAY 2, OF3-AV BAY 3
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

REPORT DATE 12/29/86 C-4
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 104

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
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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

REPORT DATE 12/29/86 C-5
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 105

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
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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

REPORT DATE 12/29/86  C-6
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 106

ITEM: DSC 0F4, OM2, OLI/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

CRITICALITIES

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

LOCATION: OF4-FWD RCS MODULE, OM2-MID FUSELAGE, OLI/2-LEFT OMS POD, ORL/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:

REPORT DATE 12/29/86 C-7
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 112

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

CRITICALITIES

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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

REPORT DATE 12/29/86 C-8
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

CRITICALITIES

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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 PCMU. 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

REPORT DATE 12/29/86  C-9
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 114

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
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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 PCMU. 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:

REPORT DATE 12/29/86 C-10
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/18/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 115

HIGHEST CRITICALITY
HDW/FUNC
FLIGHT: 2/1R
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

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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

REPORT DATE 12/29/86 C-11
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 121

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

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

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

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

REPORT DATE 12/29/86 C-12
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
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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

REPORT DATE 12/29/86  C-13
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 123

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
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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/FOMM SYS BRIEF 22, OMRSD, PCMMU SPECIFICATION MC476-0130

REPORT DATE 12/29/86
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
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**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

**REPORT DATE 12/29/86**
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 125

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

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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

REPORT DATE 12/29/86    C-16
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 126

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
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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

REPORT DATE 12/29/86 C-17
INDEPENDENT ORBITER ASSESSMENT
ORBiter SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 131

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 2/2
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
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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

REPORT DATE 12/29/86 C-18
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
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CRITICALITIES

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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 ORBITER 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, OMRSR

REPORT DATE 12/29/86 C-19
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 133

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

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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

REPORT DATE 12/29/86 C-20
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 141

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

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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, OMRSRD

REPORT DATE 12/29/86 C-21
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
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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

REPORT DATE 12/29/86  C-22
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 143

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
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)

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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

REPORT DATE 12/29/86 C-23
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 151

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
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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

REPORT DATE 12/29/86 C-24
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 152

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

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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

REPORT DATE 12/29/86 C-25
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 153

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
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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, MIS HANDLING

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

REPORT DATE 12/29/86 C-26
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 161

HIGHEST CRITICALITY

FLIGHT: 3/2R
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
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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 DOWNLINK. 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

REPORT DATE 12/29/86 C-27
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 162

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

CAUSES: VIBRATION, PARTIAL INPUT, PIECE-PART STRUCTURAL FAILURE, MIS HANDLING, 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

REPORT DATE 12/29/86 C-28
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86

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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
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CRITICALITIES

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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

REPORT DATE 12/29/86 C-29
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 171

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

CRITICALITIES

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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 ISRecordED 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

REPORT DATE 12/29/86 C-30
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 172

HIGHEST CRITICALITY
FLIGHT: 3/3
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) 
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CRITICALITIES

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

LOCATION: AFT FLT STATION, PNL AIR
PART NUMBER: 36V73A1A355/6

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

REPORT DATE 12/29/86 C-31
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 173

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: /
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.
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CRITICALITIES

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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

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

LOCATION: AFT FLT STATION, PNL AIR
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.

REPORT DATE 12/29/86  C-33
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 181

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

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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

REPORT DATE 12/29/86 C-34
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 182

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 AIR
4) SWITCH, P/L RCDR MODE SELECT
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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

REPORT DATE 12/29/86 C-35
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 AIR
4) SWITCH, OPERATE/ERASE
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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

REPORT DATE 12/29/86  C-36
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 184

HIGHEST CRITICALITY
FLIGHT: 3/2R
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
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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

REPORT DATE 12/29/86 C-37
INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86  
SUBSYSTEM: INSTRUMENTATION  
MDAC ID: 201  

HIGHEST CRITICALITY HDW/FUNC  
FLIGHT: 3/3  
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

CRITICALITIES

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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

REPORT DATE 12/29/86 C-38
INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET  

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<td>ITEM:</td>
<td>WIDE BAND ACIP PCM SWITCH</td>
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<td>FAILURE MODE:</td>
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BREAKDOWN HIERARCHY:  
1) INSTRUMENTATION  
2) MODULAR AUXILIARY DATA SYSTEM  
3) WIDE BAND ACIP PCM  
4)  
5)  
6)  
7)  
8)  
9)  

CRITICALITIES  

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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

CRITICALITIES

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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

REPORT DATE 12/29/86  C-40
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 213

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

CRITICALITIES

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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
ORBITE SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 218

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)

CRITICALITIES

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

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

CAUSES: MISHANDLE, 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 RECODERS. 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

REPORT DATE 12/29/86 C-42
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)

CRITICALITIES

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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-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

REPORT DATE 12/29/86 C-43
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 222

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
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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 ESTABLISHPOINTS 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

REPORT DATE 12/29/86 C-44
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 231

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)
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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

REPORT DATE 12/29/86 C-45
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
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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

REPORT DATE 12/29/86 C-46
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 12/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 233

HIGHEST CRITICALITY
FLIGHT: 3/3
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
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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/COMM SYS BRIEF, SCHEMATIC VS72-978099

REPORT DATE 12/29/86 C-47
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 241

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)

CRITICALITIES

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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

REPORT DATE 12/29/86 C-48
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
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CRITICALITIES

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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

REPORT DATE 12/29/86  C-49
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 252

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

CRITICALITIES

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

LOCATION: CABIN MIDDECK
PART NUMBER: ME435-0053

CAUSES: CONTAMINATION, MISHANDLEING, 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

REPORT DATE 12/29/86 C-50
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 253

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
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CRITICALITIES

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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

REPORT DATE 12/29/86 C-51
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 254

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
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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

REPORT DATE 12/29/86 C-52
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 255

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

CRITICALITIES

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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

REPORT DATE 12/29/86 C-53
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 261

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

CRITICALITIES

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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

REPORT DATE 12/29/86   C-54
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

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

REPORT DATE 12/29/86 C-55
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 263

HIGHEST CRITICALITY

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
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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

REPORT DATE 12/29/86 C-56
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 264

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

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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

REPORT DATE 12/29/86 C-57
DATE: 11/22/86

SUBSYSTEM: INSTRUMENTATION

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

MDAC ID: 265

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
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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
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 266

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

CRITICALITIES

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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
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 267

HIGHEST CRITICALITY

HDW/FUNC

FLIGHT: 3/3
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

CRITICALITIES

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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

REPORT DATE 12/29/86 C-60
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 268

HIGHEST CRITICALITY
FLIGHT: 3/3
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) 
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CRITICALITIES

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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

REPORT DATE 12/29/86 C-61
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 269

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
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) ...

CRITICALITIES

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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 MEASUREMENTS WOULD NOT BE CRITICAL TO CREW/VEHICLE OR TO MISSION.

REFERENCES: SCHEMATIC VS72-978099

REPORT DATE 12/29/86 C-62
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: INSTRUMENTATION
MDAC ID: 270

HIGHEST CRITICALITY
FLIGHT: 3/3
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
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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 MISSION.

REFERENCES: SCHEMATIC VS72-978099

REPORT DATE 12/29/86 C-63
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: EPDC/INSTRUMENTATION
MDAC ID: 106

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
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)
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6)
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8)
9) 05-6R

CRITICALITIES

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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

REPORT DATE 12/23/86  C-2
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)
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9) 05-6R

CRITICALITIES

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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 OF 2 AND OF 3. 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

REPORT DATE 12/23/86  C-3
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

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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 PROCESSED 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

REPORT DATE 12/23/86  C-4
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
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8)
9) 05-6R

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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:

REPORT DATE 12/23/86  C-5
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
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9) 05-6R

CRITICALITIES

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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

REPORT DATE 12/23/86  C-6
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
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9) 05-6R

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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

REPORT DATE 12/23/86  C-7
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
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9) 05-6R

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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

REPORT DATE 12/23/86  C-8
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
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9) 05-6R

CRITICALITIES

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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

REPORT DATE 12/23/86  C-9
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: EPDC/INSTRUMENTATION
MDAC ID: 117

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
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)
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9) 05-6R

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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

REPORT DATE 12/23/86  C-10
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86

SUBSYSTEM: EPDC/INSTRUMENTATION
MDAC ID: 118

HIGHEST CRITICALITY

FLIGHT: 3/1R
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

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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

REPORT DATE 12/23/86 C-11
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

CRITICALITIES

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LOCATION: 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

REPORT DATE 12/23/86  C-12
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: EPDC/INSTRUMENTATION
MDAC ID: 128

HIGHEST CRITICALITY: HDW/FUNC
FLIGHT: 2/2
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
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9) 05-6R

CRITICALITIES

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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

REPORT DATE 12/23/86 C-13
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
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9) 05-6R

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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

REPORT DATE 12/23/86 C-14
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: EPDC/INSTRUMENTATION
MDAC ID: 164

HIGHEST CRITICALITY
HDW/FUNC
FLIGHT: 3/2R
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
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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

REPORT DATE 12/23/86        C-15
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: EPDC/INSTRUMENTATION
MDAC ID: 176

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
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
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9) 05-6R

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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

REPORT DATE 12/23/86 C-16
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: EPDC/INSTRUMENTATION
MDAC ID: 177

HIGHEST CRITICALITY

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

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LOCATION:
PART NUMBER: VS70-974102

CAUSES: VIBRATION, TEMPERATURE, CONTAMINATION, SHOCK, MIS HANDLING/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

SUBSYSTEM: EPDC/INSTRUMENTATION

MDAC ID: 185

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/2R
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, 36V3A1A3
3) POWER AND CONTROL CIRCUIT
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9) 05-6R

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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

REPORT DATE 12/23/86 C-18
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)
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9) 05-6R

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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

REPORT DATE 12/23/86  C-19
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

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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

REPORT DATE 12/23/86  C-20
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: EPDC/INSTRUMENTATION
MDAC ID: 214

HIGHEST CRITICALITY
HDW/FUNC
FLIGHT: 3/3
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

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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

REPORT DATE 12/23/86 C-21
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: EPDC/INSTRUMENTATION
MDAC ID: 242

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
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

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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

REPORT DATE 12/23/86 C-22
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: EPDC/INSTRUMENTATION
MDAC ID: 243

HIGHEST CRITICALITY
HDW/FUNC
FLIGHT: 3/3
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

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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

REPORT DATE 12/23/86 C-23
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: EPDC/INSTRUMENTATION
MDAC ID: 256

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

ITEM: POWER AND CONTROL CIRCUIT, MADS REC DR (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

CRITICALITIES

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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

REPORT DATE 12/23/86 C-24
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)
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8)
9) 05-6R

CRITICALITIES

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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

REPORT DATE 12/23/86  C-25
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86
SUBSYSTEM: EPDC/INSTRUMENTATION
MDAC ID: 272

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, IA
5)
6)
7)
8)
9) 05-6R

CRITICALITIES

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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

REPORT DATE 12/23/86 C-26
INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/22/86

SUBSYSTEM: EPDC/INSTRUMENTATION
MDAC ID: 273

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
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
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8)
9) 05-6R

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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

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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) 
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8) 
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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
SUBSYSTEM: EPDC/INSTRUMENTATION
MDAC ID: 275
HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 3/3
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

CRITICALITIES

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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

REPORT DATE 12/23/86 C-29
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