

# **INDEPENDENT ORBITER ASSESSMENT**

## **ANALYSIS OF THE DISPLAYS AND CONTROLS SUBSYSTEM**

**01 DECEMBER 1987**



MCDONNELL DOUGLAS ASTRONAUTICS COMPANY  
HOUSTON DIVISION

SPACE TRANSPORTATION SYSTEM ENGINEERING AND OPERATIONS SUPPORT

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INDEPENDENT ORBITER ASSESSMENT  
ANALYSIS OF THE DISPLAYS AND CONTROLS SUBSYSTEM

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# Independent Orbiter Assessment Analysis of the Display and Control Subsystem

## 1.0 EXECUTIVE SUMMARY

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

The function of the D&C hardware is to provide the crew with the monitor, command, and control capabilities required for management of all normal and contingency mission and flight operations. The D&C hardware for which failure modes analysis was performed consists of the following :

- o Acceleration Indicator (G-METER)
- o Head Up Display (HUD)
- o Display Driver Unit (DDU)
- o Alpha/Mach Indicator (AMI)
- o Horizontal Situation Indicator (HSI)
- o Attitude Director Indicator (ADI)
- o Propellant Quantity Indicator (PQI)
- o Surface Position Indicator (SPI)
- o Altitude/Vertical Velocity Indicator (AVVI)
- o Caution and Warning Assembly (CWA)
- o Annunciator Control Assembly (ACA)
- o Event Timer (ET)
- o Mission Timer (MT)
- o Interior Lighting
- o Exterior Lighting

The IOA analysis process utilized available D&C hardware drawings, workbooks, specifications, schematics, and systems briefs for defining hardware assemblies, components, and circuits. Each hardware item was evaluated and analyzed for possible failure modes and effects. Criticality was assigned based upon the severity of the effect for each failure mode.

Figure 1 presents a summary of the failure criticalities for each of the fifteen major subdivisions of the D&C subsystem. A summary of the number of failure modes, by criticality, is also presented below with Hardware (HW) criticality first and Functional (F) criticality second.

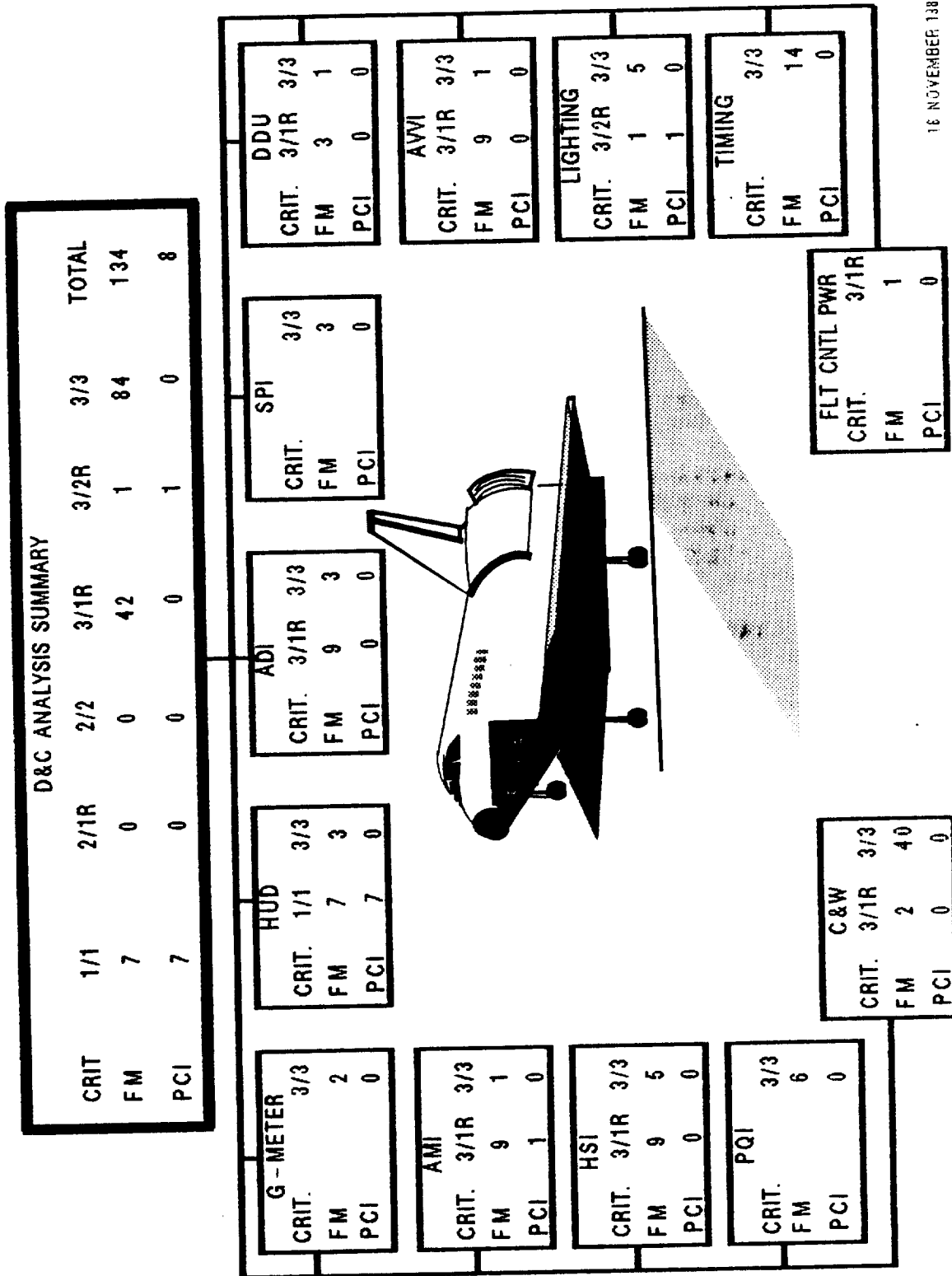
Summary of IOA Failure Modes By Criticality (HW/F)							
Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
Number :	7	0	0	42	1	84	134

For each failure mode identified, the criticality and redundancy screens were examined to identify critical items. A summary of Potential Critical Items (PCIs) is presented as follows:

Summary of IOA Potential Critical Items (HW/F)						
Criticality:	1/1	2/1R	2/2	3/1R	3/2R	TOTAL
Number :	7	0	0	0	1	8



# D&C OVERVIEW ANALYSIS SUMMARY



16 NOVEMBER 1987

Figure 1 - D&C OVERVIEW ANALYSIS SUMMARY

## **2.0 INTRODUCTION**

### **2.1 Purpose**

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

### **2.2 Scope**

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

### **2.3 Analysis Approach**

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

#### **Step 1.0 Subsystem Familiarization**

- 1.1 Define subsystem functions
- 1.2 Define subsystem components
- 1.3 Define subsystem specific ground rules and assumptions

#### **Step 2.0 Define subsystem analysis diagram**

- 2.1 Define subsystem
- 2.2 Define major assemblies
- 2.3 Develop detailed subsystem representations

#### **Step 3.0 Failure events definition**

- 3.1 Construct matrix of failure modes
- 3.2 Document IOA analysis results

Step 4.0 Compare IOA analysis data to NASA FMEA/CIL

4.1 Resolve differences

4.2 Review in-house

4.3 Document assessment issues

4.4 Forward findings to Project Manager

## **2.4 D&C Ground Rules and Assumptions**

The D&C ground rules and assumptions used in the IOA are defined in Appendix B.

### 3.0 SUBSYSTEM DESCRIPTION

#### 3.1 Design and Function

The function of the D&C hardware is to provide the crew with the monitor, command, and control capabilities required for management of all normal and contingency mission and flight operations.

Figure 2 is an overview of the D&C hardware for which failure modes analysis was performed. For the analysis, the hardware was divided into the following five categories:

- I. FLIGHT DISPLAYS AND ANNUNCIATORS - These categories includes the displays that allows manual control of the vehicle, provide monitoring of automatic control performance, and provide display of critical flight parameters. The components of this category are:

- |             |                  |
|-------------|------------------|
| (1) G-METER | (6) PQI          |
| (2) AMI     | (7) SPI          |
| (3) AVVI    | (8) HSI          |
| (4) ADI     | (9) FLT CNTL PWR |
| (5) HUD     |                  |

Figures 3 - 10 provide a hardware breakdown of each of the above components.

- II. CAUTION AND WARNING - This category consists of those components that inform the crew of out-of-limit conditions of the vehicle. This category consist of the following:

- |                         |                           |
|-------------------------|---------------------------|
| (1) ANNUNCIATOR (CWA)   | (3) ELECTRONIC UNIT (CWE) |
| (2) LIMIT MODULE (CWLM) |                           |

Figure 11 provides a hardware breakdown of each of the above components.

- III. DISPLAY DRIVER UNIT - This category consists of the electronic unit that provides the interface between the GPC and the primary flight displays. The function of this unit is to 1) decode data signals from the GPC and convert these signals to display driver commands, 2) provide ac and dc operating power to the ADI, and 3) set flag on the dedicated displays. The hardware in this category is the DDU.

Figure 12 is a hardware breakdown of this component.

- IV. TIMING DISPLAYS - This category provide the crew with time referenced to GMT or GET and consist of the following components:
- (1) MISSION TIMER
  - (2) EVENT TIMER

Figures 13 - 14 provides a hardware breakdown of these components.

- V. LIGHTING - This category consist of the components that allows illumination of displays and controls, payload bay operations, EVA's, RMS operations, and docking operations. The components of this category are:
- (1) INTERIOR LIGHTING
  - (2) EXTERIOR LIGHTING

Figures 15 - 16 provides a hardware breakdown of these components.

A brief description of the flight displays and annunciators, caution and warning, display driver unit, timing displays, and lighting is provided below.

1. One self contained G-METER located on panel F7. It senses linear acceleration along the Z-body axis of the vehicle.
2. Two AMI's one at the CDRs station and one at the PLTs station. These provide angle of attack, mach/velocity, equivalent airspeed, and acceleration information to the crew.
3. Two AVVIs, located on panels F6 and F8. They provide altitude acceleration, altitude rate, barometric altitude, and radar altitude information to the crew.
4. Three ADI located on panel F6, F8, and A6. These provide simultaneous display of attitude, attitude angular rate, and attitude error information to the crew.
5. Two HUDs located at the CDR and PLT stations. These provide the crew with information required for landing.
6. Two Propellant Quantity Indicators located on panel F6 and F8 to provide the crew with the amount of propellant remaining.
7. Two SPIs located at CDR and PLT stations. The Surface Position Indicators allows the crew to view the status of the aerosurfaces of the vehicle.
8. Caution and Warning - The function of this system is to inform the crew of out-of-limit conditions of predetermined parameters of the vehicle.
9. Annunciator Control Assembly - This system provides visual indication of Orbiter status (emergency/warning - RED, caution - YELLOW, and advisory - WHITE).
10. Display Driver Unit - The function of this unit is to provide the interface between the GPC and the primary flight displays.

11. Timing displays provide the crew with time referenced to Greenwich Mean Time, liftoff, or to a particular event.
12. Lighting - The function of this system is to provide illumination of the controllers, numeric displays, interior, and exterior of the vehicle.

### **3.2 Interfaces and Locations**

The D&C hardware is located through the Orbiter. The precise location for each component/switch/circuit is provided on the analysis worksheets in Appendix C.

The D&C hardware is interfaced with the software via the flight critical MDMs. Switch and power status is monitored via the flight critical MDMs and operational instrumentation.

### **3.3 Hierarchy**

Figure 2 illustrates the breakdown of the D&C into its hardware components, and Figures 3 - 16 are the detailed systems representations.

# D&C SUBSYSTEM OVERVIEW

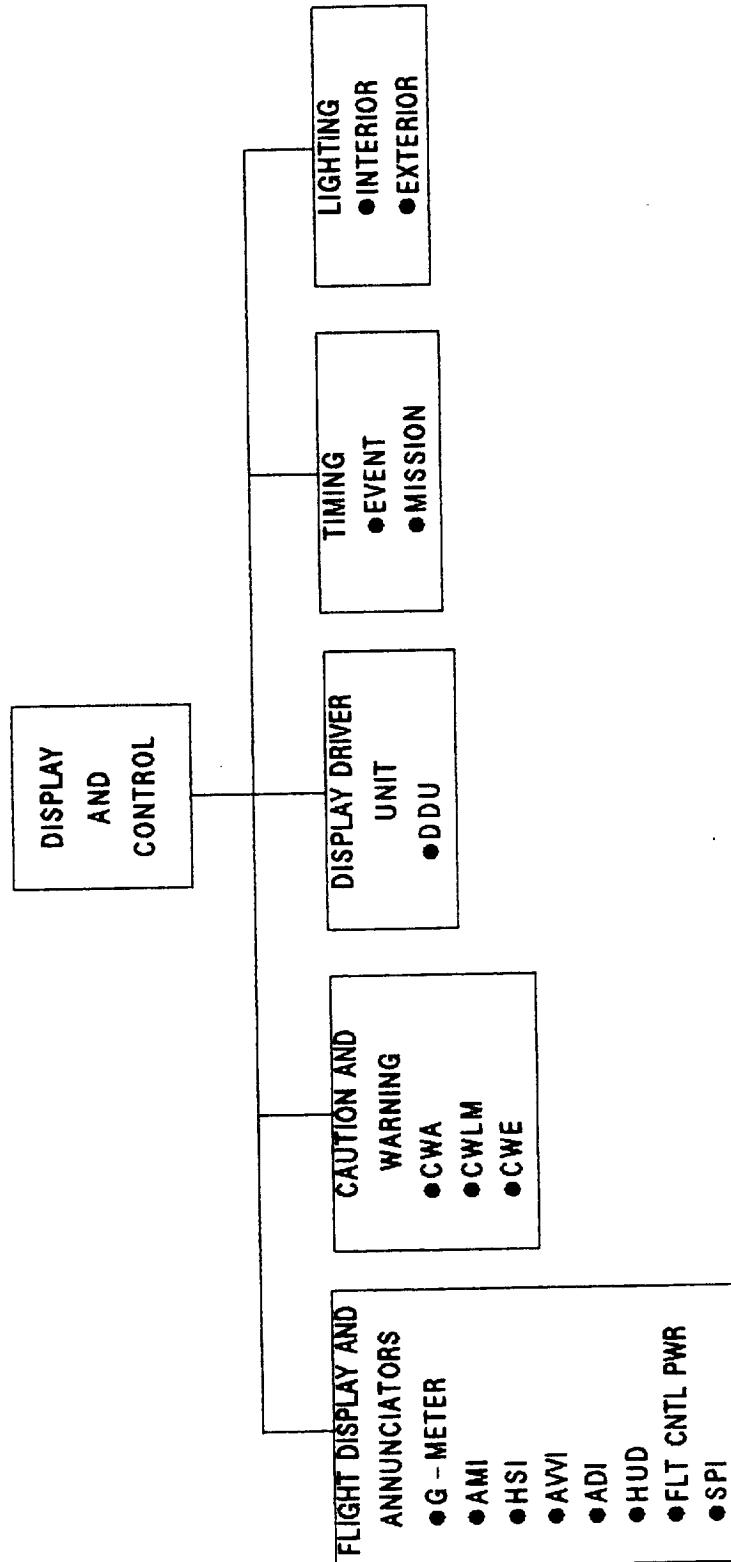


Figure 2 - D&C SUBSYSTEM OVERVIEW

ACCELERATION INDICATOR

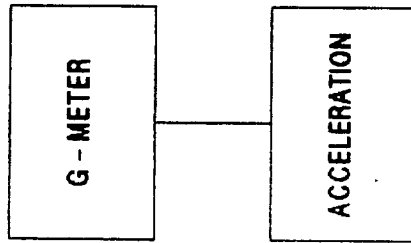


Figure 3 - D&C ACCELERATION INDICATOR (G-METER)



# HEAD UP DISPLAY

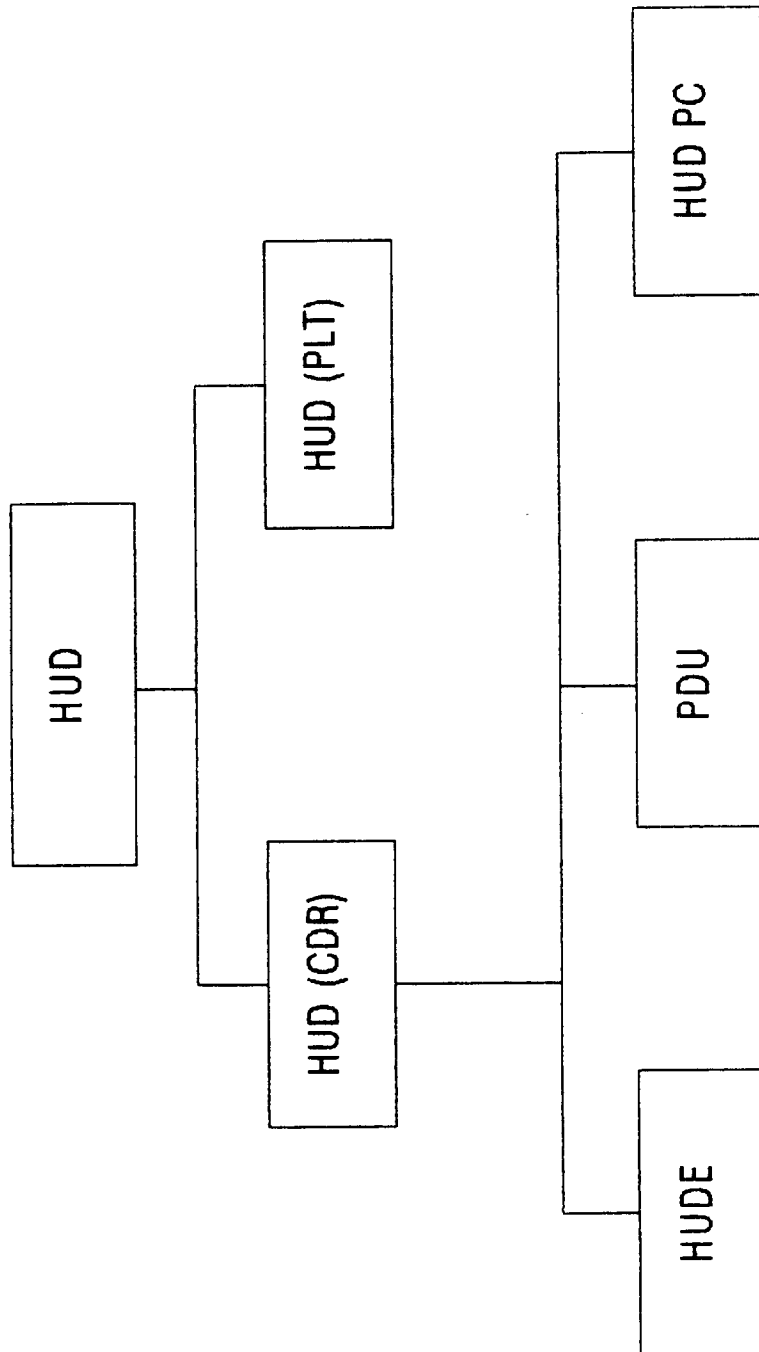


Figure 4 - D&C HEADS UP DISPLAY (HUD)

# ALPHA/MACH INDICATOR

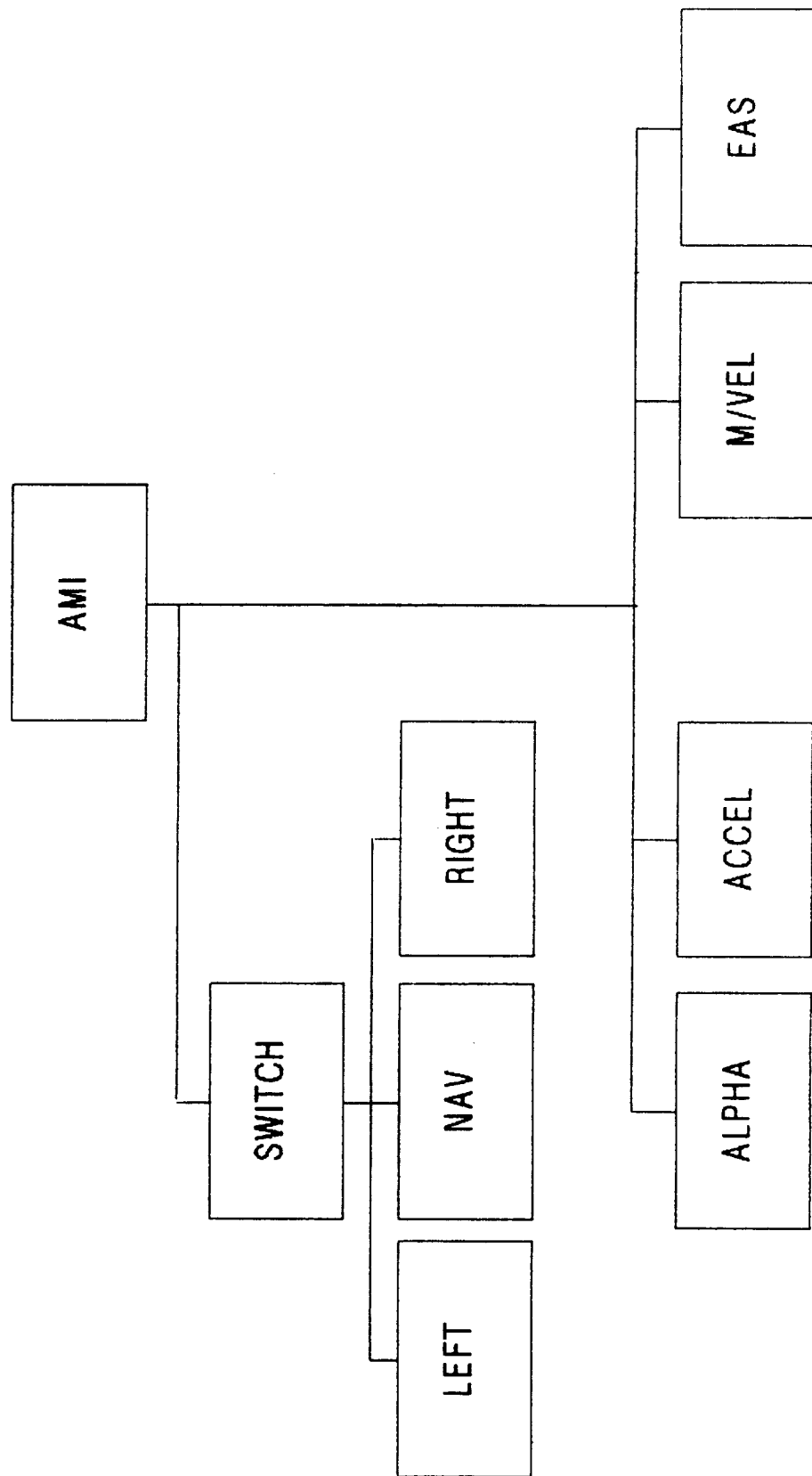


Figure 5 - D&C ALPHA/MACH INDICATOR (AMI)

# HORIZONTAL SITUATION INDICATOR

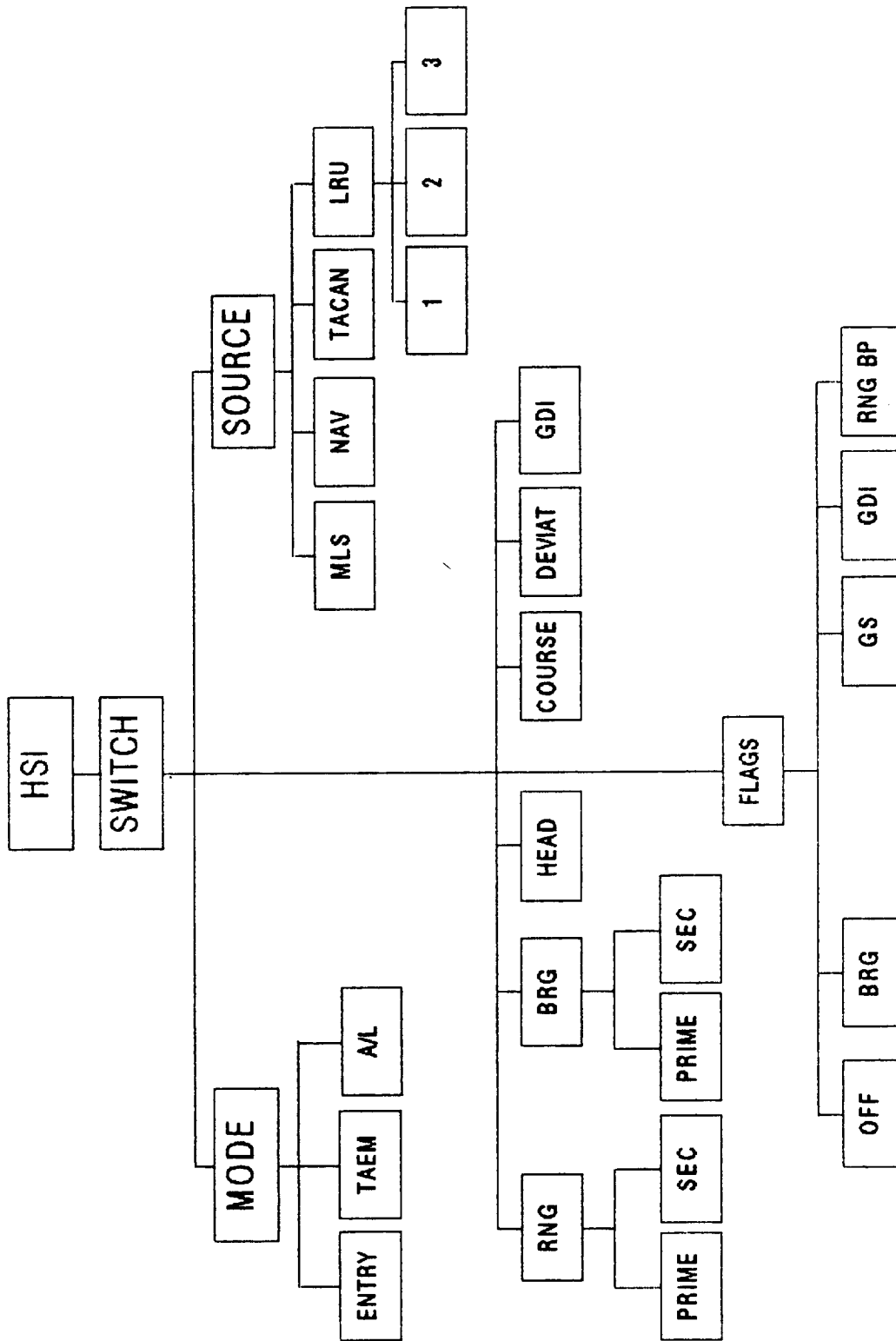


Figure 6 - D&C HORIZONTAL SITUATION INDICATOR (HSI)

# ATTITUDE DIRECTOR INDICATOR

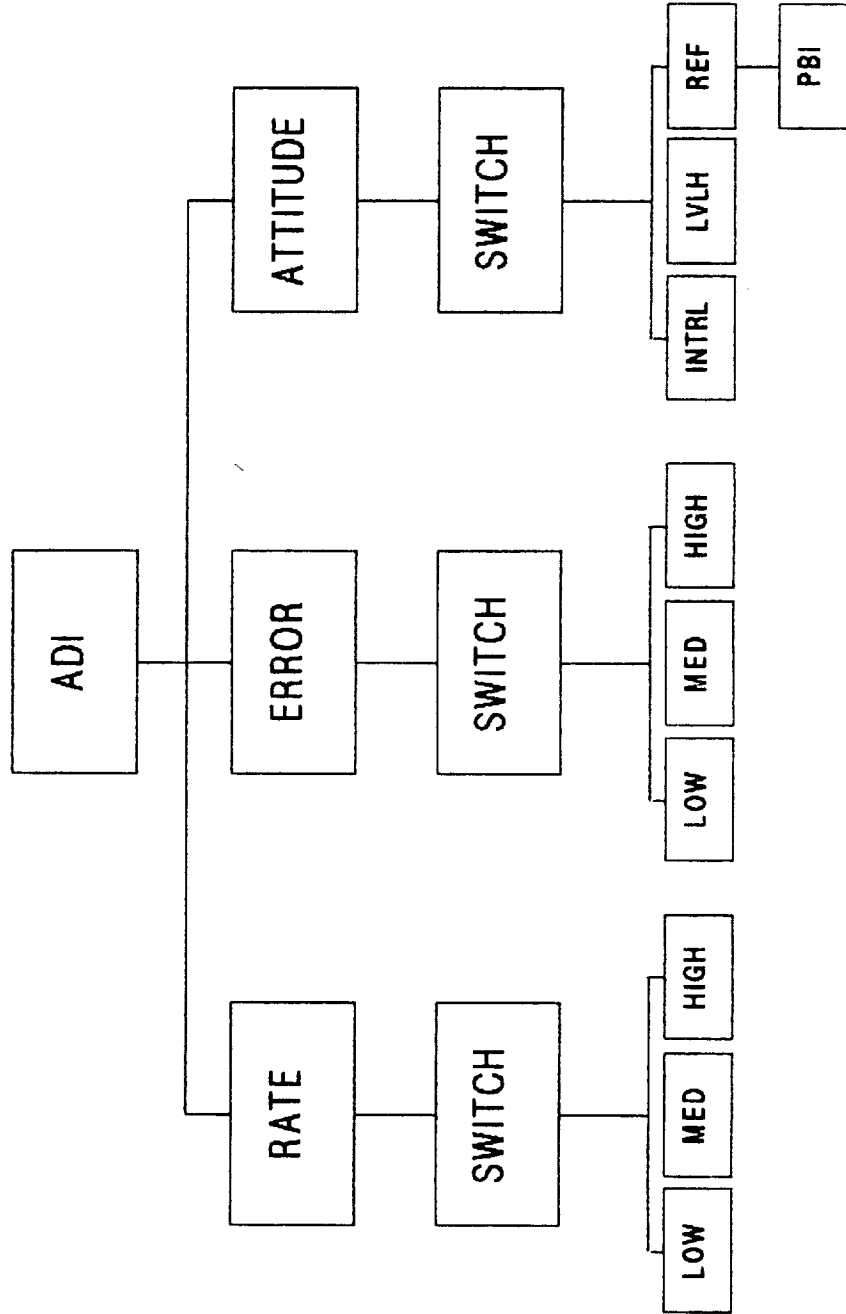
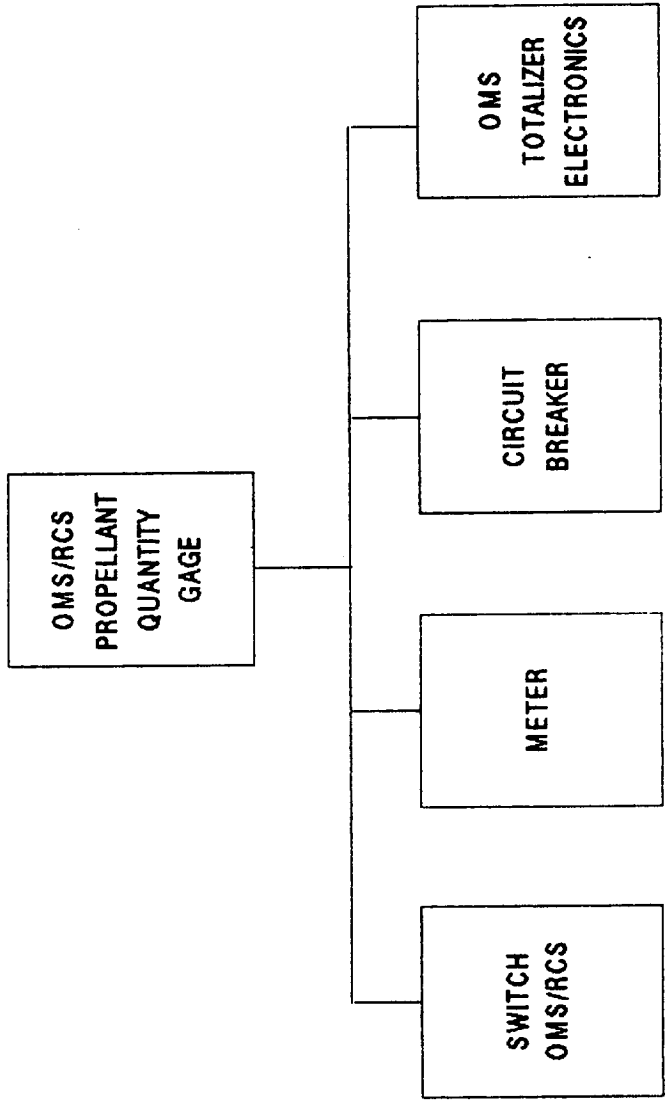


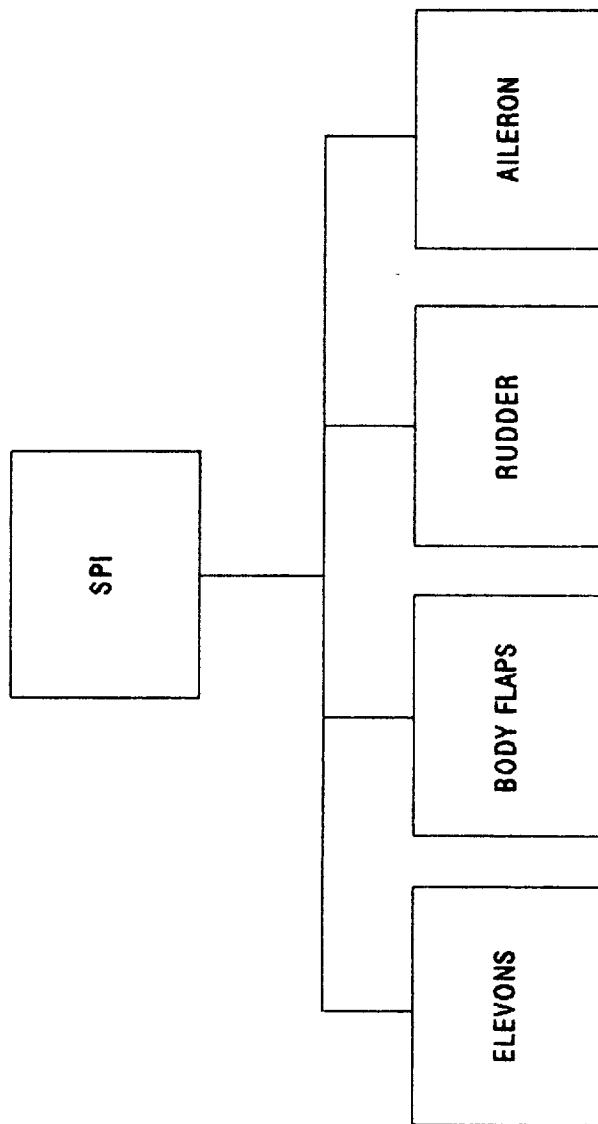
Figure 7 - D&C ATTITUDE DIRECTOR INDICATOR (ADI)

**OMS/RCS PROPELLANT QUANTITY INDICATOR**



**Figure 8 - D&C PROPELLANT QUANTITY INDICATOR (PQI)**

**SURFACE POSITION INDICATOR**



**Figure 9 - D&C SURFACE POSITION INDICATOR (SPI)**

ALTITUDE/VERTICAL VELOCITY INDICATOR

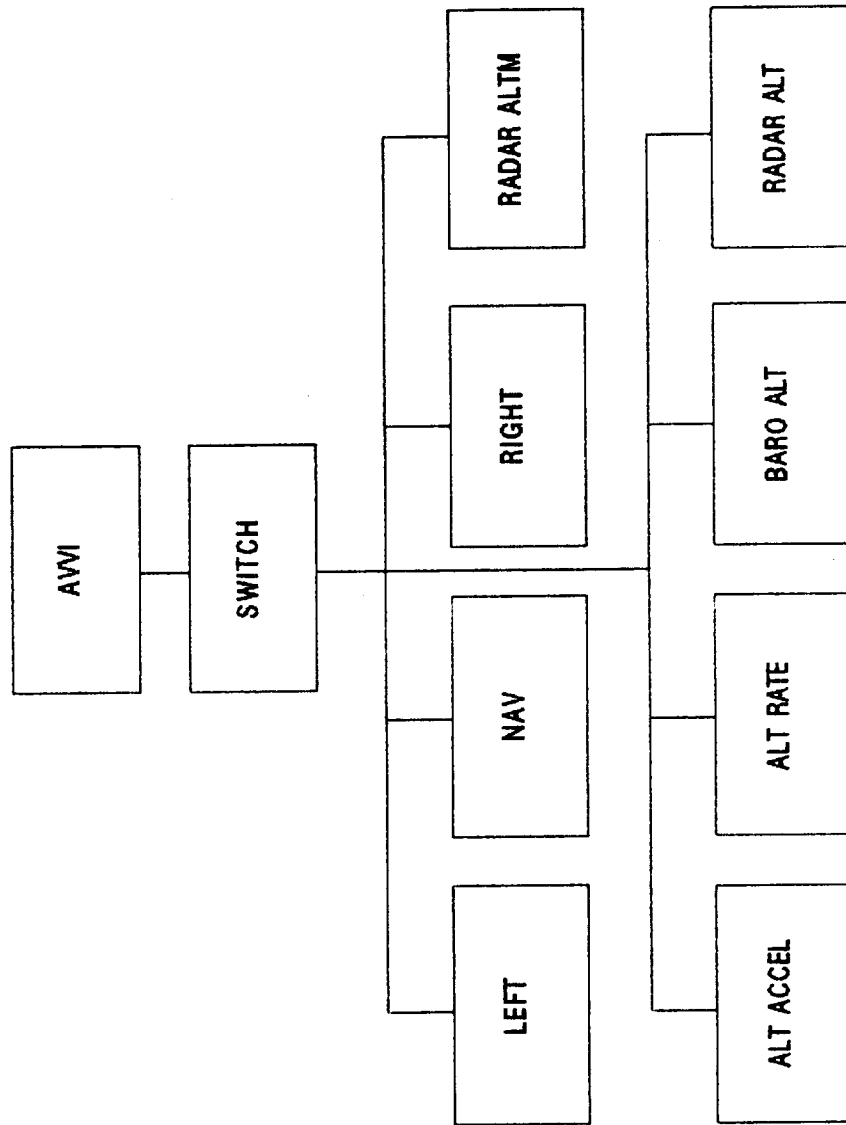


Figure 10 - D&C ALT/VERTICAL VELOCITY INDICATOR (AVVI)

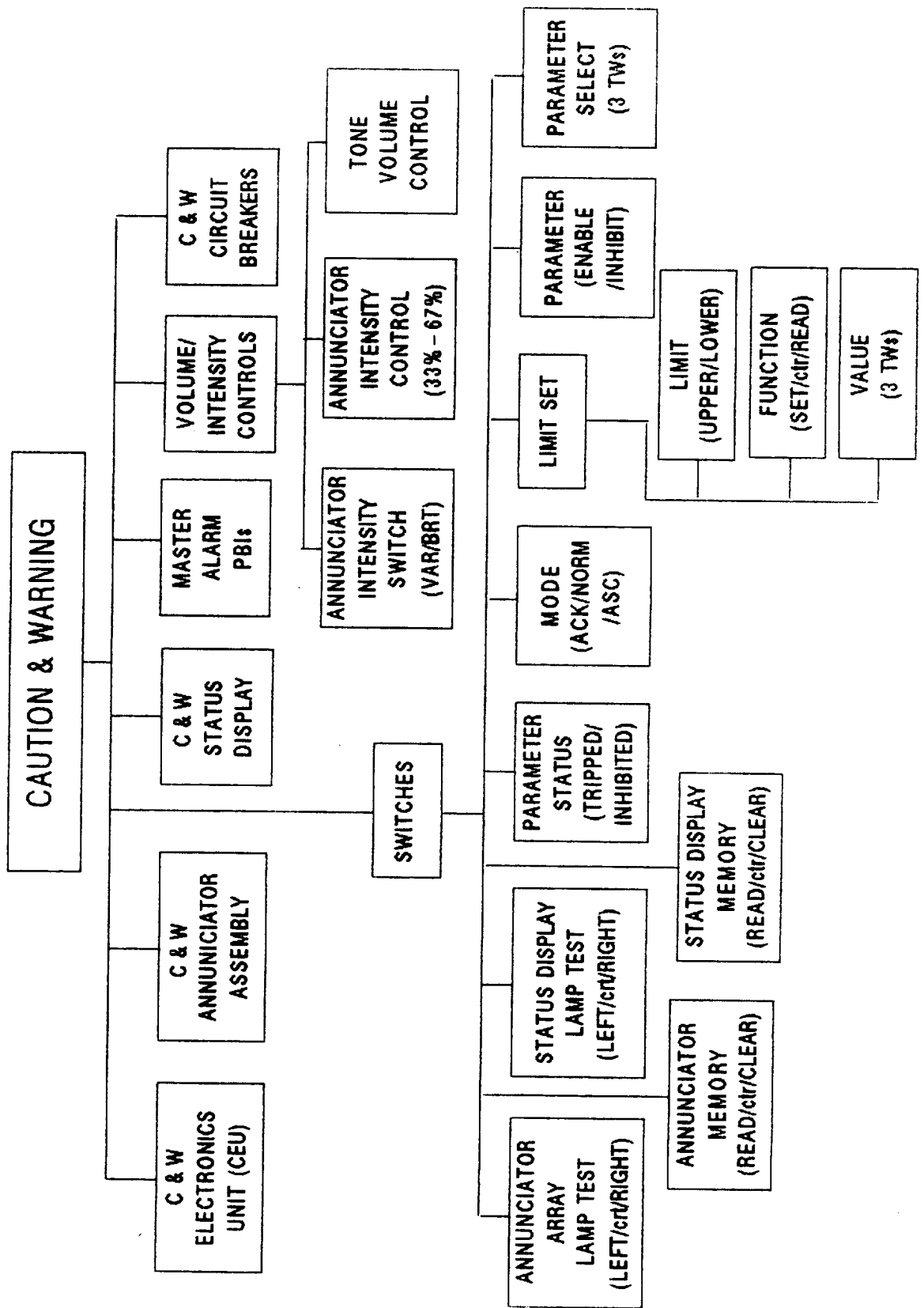


Figure 11 - D&C CAUTION AND WARNING ASSEMBLY (CWA)



DISPLAY DRIVER UNIT (DDU)

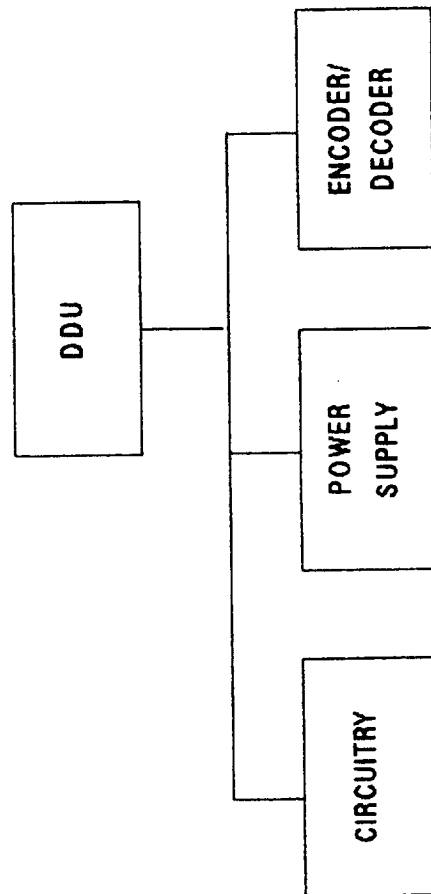


Figure 12 - DISPLAY DRIVER UNIT (DDU)

# EVENT TIMER

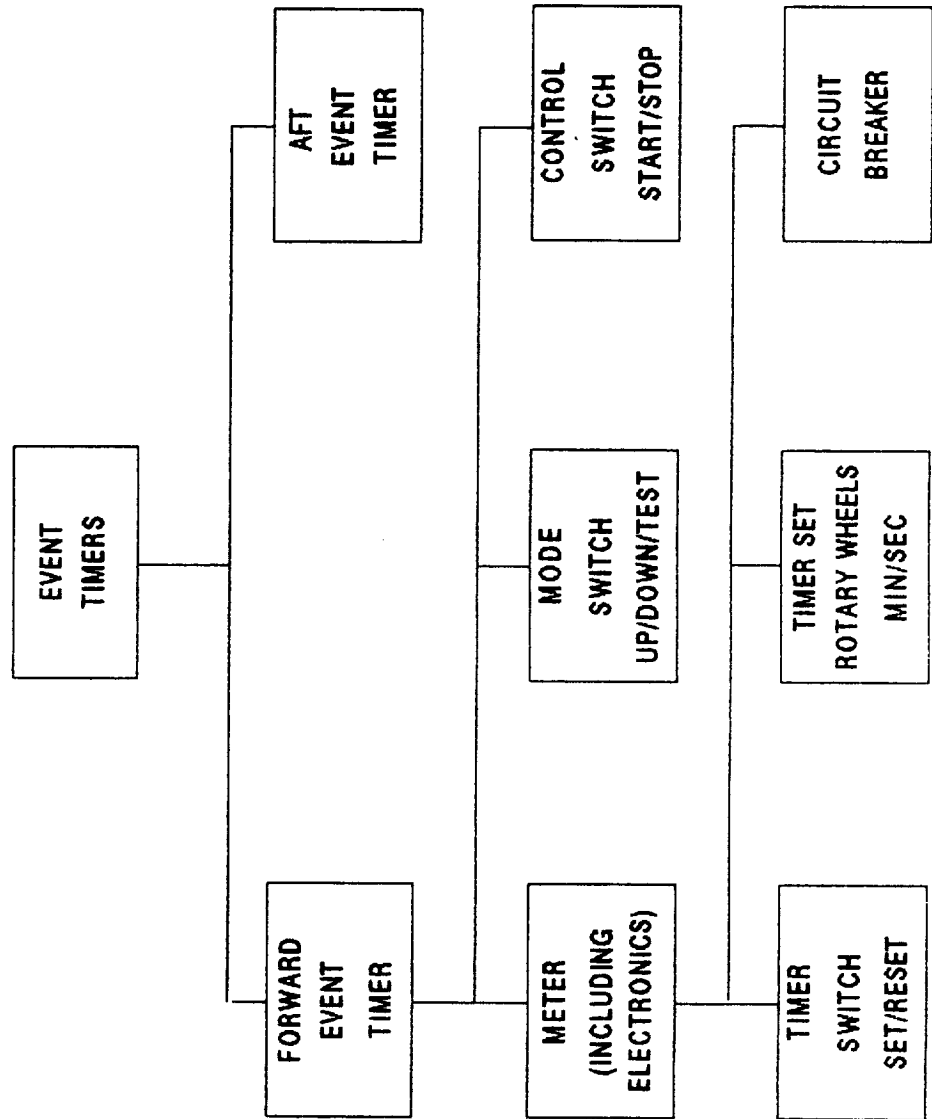


Figure 13 - D&C EVENT TIMER (ET)

# MISSION TIMER

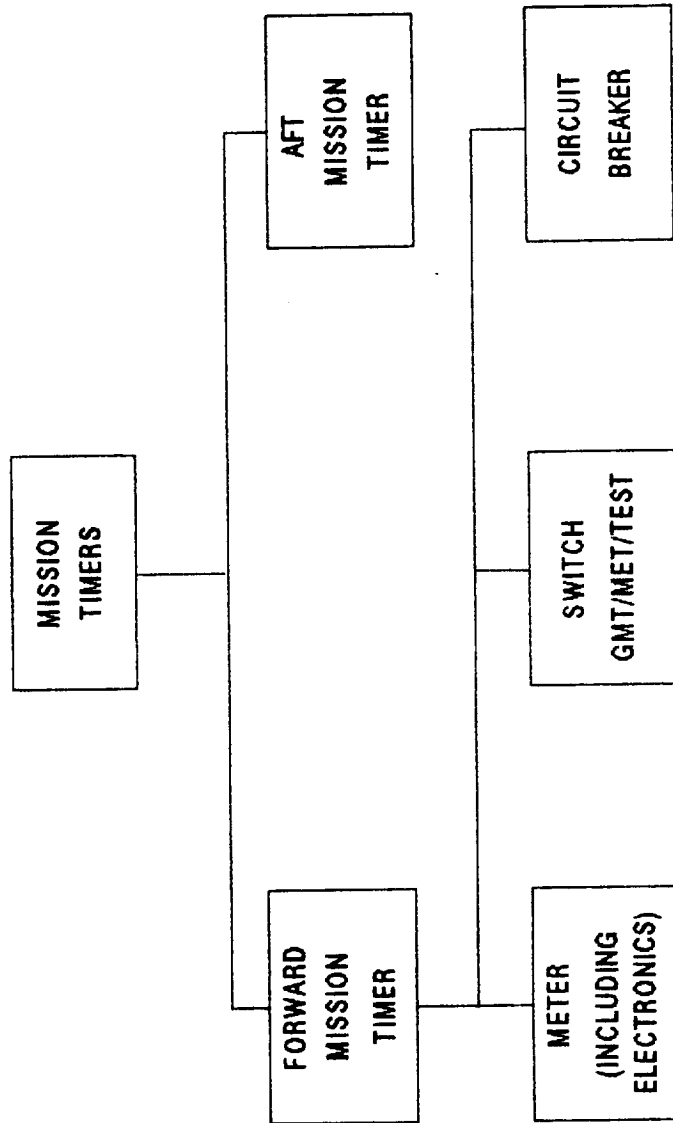


Figure 14 - D&C MISSION TIMER (MT)

INTERIOR LIGHTING

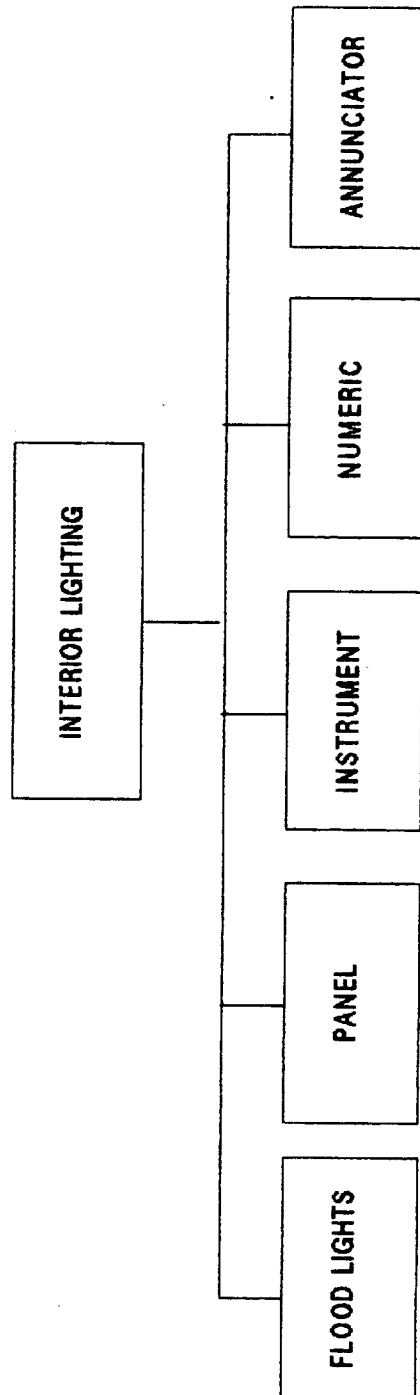


Figure 15 - D&C INTERIOR LIGHTING

EXTERIOR LIGHTING

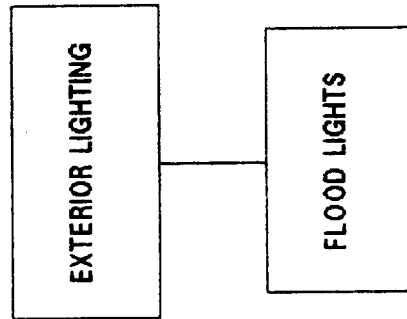


Figure 16 - D&C EXTERIOR LIGHTING

#### 4.0 ANALYSIS RESULTS

The D&C analysis was divided into the following five categories:

- I. FLIGHT DISPLAYS AND ANNUNCIATORS
- II. CAUTION AND WARNING
- III. DISPLAY DRIVER UNIT
- IV. TIMING DISPLAYS
- V. LIGHTING

Table I summarizes the total number of identified failure modes and their criticalities. Table II summarizes the total number of PCIs.

Table I Summary of IOA Failure Modes and Criticalities							
Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
Number :	7	-	-	42	1	84	134

Table II Summary of IOA Potential Critical Items							
Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
Number	7	-	-	-	1	-	8

The five categories are summarized below, with the detailed analysis results for each of the identified failure modes presented in Appendix C.

#### 4.1 ANALYSIS RESULTS - D&C FLIGHT DISPLAYS AND ANNUNCIATORS

Eight components were included in this category. Table III lists the components and summarizes the failure mode criticalities for each component. Table IV summarizes the number of PCIs for this category.

Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
1. G-METER	-	-	-	-	-	2	2
2. AMI	-	-	-	9	-	1	10
3. HSI	-	-	-	9	-	5	14
4. AVVI	-	-	-	9	-	1	10
5. ADI	-	-	-	9	-	3	12
6. HUD	7	-	-	-	-	3	10
8. PQI	-	-	-	-	-	6	6
9. FLT CNL PWR	-	-	-	1	-	1	2
9. SPI	-	-	-	-	-	3	3
TOTAL	7	-	-	37	-	25	69

Criticality:	1/1	2/1R	2/2	3/1R	3/2R	TOTAL
Number :	7	-	-	-	-	7

**4.2 ANALYSIS RESULTS - D&C CAUTION AND WARNING**

Three groups make up this category. Table V lists the individual groups and summarizes the failure mode criticalities for each. Table VI summarizes the number of PCIs for this category.

TABLE V D&C CAUTION AND WARNING Summary of IOA Failure Modes and Criticalities							
Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
1. CWA	-	-	-	2	-	36	38
2. CWLM	-	-	-	-	-	2	2
3. CWE	-	-	-	-	-	2	2
TOTAL	-	-	-	2	-	40	42

TABLE VI D&C CAUTION AND WARNING Summary of IOA Potential Critical Items						
Criticality:	1/1	2/1R	2/2	3/1R	3/2R	TOTAL
Number :	-	-	-	-	-	-



#### 4.3 ANALYSIS RESULTS - D&C DISPLAY DRIVER UNIT

One group make up this category. Table VII lists the individual group and summarizes the failure mode criticalities. Table VIII summarizes the number of PCIs for this category.

TABLE VII D&C DISPLAY DRIVER UNIT Summary of IOA Failure Modes and Criticalities							
Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
1. DDU	-	-	-	3	-	1	4
TOTAL	-	-	-	3	-	1	4

TABLE VIII D&C DISPLAY DRIVER UNIT Summary of IOA Potential Critical Items						
Criticality:	1/1	2/1R	2/2	3/1R	3/2R	TOTAL
Number :	-	-	-	-	-	-

**4.4 ANALYSIS RESULTS - D&C TIMING**

Two groups make up this category. Table IX lists the individual groups and summarizes the failure mode criticality for each group. Table X summarizes the number of PCIs for this category.

TABLE IX D&C TIMING Summary of IOA Failure Modes and Criticality							
Criticality	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
1. EVENT	-	-	-	-	-	8	8
2. MISSION	-	-	-	-	-	6	6
TOTAL	-	-	-	-	-	14	14

TABLE X D&C TIMING Summary of IOA Potential Critical Items						
Criticality:	1/1	2/1R	2/2	3/1R	3/2R	TOTAL
Number :	-	-	-	-	-	-

#### 4.5 ANALYSIS RESULTS - LIGHTING

Two groups make up this category. Table XI lists the individual groups and summarizes the failure modes criticalities for each group. Table XII summarizes the number of PCIs for this category.

TABLE XI D&C LIGHTING Summary of IOA Failure Modes and Criticalities							
Criticality:	1/1	2/1R	2/2	3/1R	3/2R	3/3	TOTAL
1. INTERIOR	-	-	-	-	-	4	4
2. EXTERIOR	-	-	-	-	1	1	2
TOTAL	-	-	-	-	1	5	6

TABLE XII D&C LIGHTING Summary of IOA Potential Critical Items						
Criticality:	1/1	2/1R	2/2	3/1R	3/2R	TOTAL
Number :	-	-	-	-	1	1

#### 4.6 LIST OF MDAC ANALYSIS WORKSHEET IDENTIFICATION NUMBERS

	<u>ITEM</u>	<u>MDAC ID'S</u>
1.	HUD	101 - 115
2.	DDU	201 - 205
3.	G-METER	301 - 305
4.	AMI	401 - 415
5.	HSI	501 - 515
6.	AVVI	601 - 612
7.	SPI	701 - 705
8.	EVENT TIMER	1101 - 1110
9.	ADI	1201 - 1215
10.	MISSION TIMER	1301 - 1308
11.	CAUTION AND WARNING	1401 - 1440
12.	ACA	1601 - 1605
13.	PROP QUANT INDICATOR (PQI)	1701 - 1706
14.	INT & EXT LIGHTING	1801 - 1812
15.	INST PWR CKT	1901 - 1902, 2401, 2
16.	MEAS ISO RESISTOR	2001 - 2002
17.	PWR CHT - FUSES	2201 - 2203
18.	CROSS POINTER INDICATOR	2301 - 2301

## 5.0 REFERENCES

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

1. JSC-18863, Guidance and Control Systems Briefs, 9-30-85
2. CONT 2102, Dedicated Display workbook, 2-1-82
3. SSSH System Drawing 1 G&C DISP 1 DWG 9.1
4. JSC-12820, STS operational Flight Rules, PCN-1, 2-14-86
5. CONT 2102, Caution and Warning Workbook 8-5-83
6. JSC- 11174 SSSH System Drawing 20 HUD, DWG 9.20A
7. VS70-973009 Integrated Schematic HEAD UP DISPLAY 10-22-80
8. DISPLAY and CONTROL FSSR STS83-0020C
9. MC409-0023 DDU Specification 6-6-77
10. JSC - 11174 SSSH System Drawing 10 TIM DWG 8.10
11. VS70-730129, Schematic Diagram, Caution & Warning  
11-12-80
12. Shuttle Flight Operation Manual 8-31-84
13. JSC - 11174, SSSH System Drawing C&W DWG 5.2
14. JSC - 18691, FDF Malfunction Procedures 10-10-85
15. VS70-973099, Schematic Diagram, Event & Mission Timers
16. JSC - 11174 SSSH System Drawing OMS GAUGE DWG 11.2
17. JSC - 11174 SSSH System Drawing 3 ANNUN DWG 4.2 5-21-85



**APPENDIX A  
ACRONYMS**

AA - Accelerometer Assembly  
ACA - Annunciator Control Assembly  
ACCEL - Acceleration  
A/D - Analog to Digital  
ADI - Attitude Direction Indicator  
ADTA - Air Data Transducer Assembly  
AID - Analog Input Differential  
A/L - Autoland  
ALC - Aft Load Controller  
ALPHA - Angle of Attack  
ALT - Altitude  
ALTM - Altimeter  
AMI - Alpha Mach Indicator  
AOA - Abort Once Around  
APC - Aft Power Controller  
ASA - Aerosurface Servo Amplifier  
ASC - Ascent  
ATO - Abort To Orbit  
ATVC - Ascent Thrust Vector Control  
AVVI - Altitude Vertical Velocity Indicator  
BARO - Barometric  
BF - Body Flap  
BFS - Backup Flight System  
BITE - Built-In Test Equipment  
BP - Barber Pole  
BRG - Bearing  
BRT - Bright  
CB - Circuit Breaker  
CDR - Commander  
CEU - Caution and Warning Electronic Unit  
CIL - Critical Items List  
CKT - Circuit  
CNL - Control  
CNTLR - Controller  
COAS - Crew Optical Alignment Sight  
CRIT - Criticality  
CRT - Cathode Ray Tube  
CSS - Control Stick Steering  
CTR - Center  
CWA - Caution and Warning Annunciator  
CWE - Caution and Warning Electronic  
CWLM - Caution and Warning Limit Module  
C&W - Caution and Warning System  
DAP - Digital Auto Pilot  
DDU - Display Driver Unit  
DEU - Display Electronics Unit  
DEVIAT- Deviation  
DISC - Discrete  
DPS - Data Processing System  
DU - Display Unit

## APPENDIX A

EAS	-	Equivalent Air Speed
EIU	-	Engine Interface Unit
EVA	-	Extra Vehicular Activity
FA	-	Flight Aft
FCOS	-	Flight Control Operating System
FCS	-	Flight Control System
FDIR	-	Fault Detection, Identification, Reconfiguration
FF	-	Flight Forward
FLT	-	Flight
FM	-	Failure Mode
FMEA	-	Failure Mode and Effects Analysis
FSM	-	Fault Summary Message
FSSR	-	Functional Subsystem Software Requirements
FSW	-	Flight Software
FUNC	-	Function
GDI	-	Glideslope Deviation Indicator
GMT	-	Greenwich Mean Time
GPC	-	General Purpose Computer
GS	-	Glideslope
GSE	-	Ground Support Equipment
HEAD	-	Heading
HSI	-	Horizontal Situation Indicator
HUD	-	Head Up Display
HUDE	-	Head Up Display Electronics
H/W	-	Hardware
IMU	-	Inertial Measurement Unit
INTRL	-	Inertial
IOA	-	Independent Orbiter Assessment
LF	-	Launch Forward
LL	-	Launch Left
LPS	-	Launch Processing System
LR	-	Launch Right
LRU	-	Line Replaceable Unit
LVLH	-	Local Vertical Local Horizontal
MAN	-	Manual
MC	-	Memory Configuration
MCC	-	Mission Control Center
MCDS	-	Multifunction CRT Display System
MDAC	-	McDonnell Douglas Astronautics Company
MDM	-	Multiplexer/Demultiplexer
MEC	-	Main Engine Controller
MED	-	Medium
MET	-	Mission Elapsed Time
MIN	-	Minimum
MLS	-	Microwave Landing System
MM	-	Major Mode
MSK	-	Manual Select Keyboard
M/VEL	-	Mach/Velocity
MVS	-	Mid Value Select



## APPENDIX A

NA	-	Not Applicable
NASA	-	National Aeronautics and Space Administration
NAV	-	Navigation
NORM	-	Normal
NSTS	-	National Space Transportation System
OA	-	Operational Aft
OF	-	Operational Forward
OMRSD	-	Operational Maintenance Requirements and Specifications Document
OMS	-	Orbital Maneuvering System
OPS	-	Operational Sequence
P	-	Pitch
PBI	-	Pushbutton Indicator
PCI	-	Potential Critical Item
PCM	-	Pulse Code Modulation
PDU	-	Pilot Display Unit
PLT	-	Pilot
POS	-	Position
PWR	-	Power
R	-	Roll
REF	-	Reference
RCS	-	Reaction Control System
RGA	-	Rate Gyro Assembly
RHC	-	Rotational Hand Controller
RI	-	Rockwell International
RJD	-	Reaction Jet Driver
RM	-	Redundancy Management
RNG	-	Range
ROT	-	Rotation
RPC	-	Remote Power Controller
RPTA	-	Rudder Pedal Transducer Assembly
RS	-	Redundant Set
RTLS	-	Return To Landing Site
SBTC	-	Speed Brake Thrust Controller
SEC	-	Secondary
SF	-	Selection Filter
SM	-	Systems Management
SOP	-	Subsystem Operating Program
SPI	-	Surface Position Indicator
SRB	-	Solid Rocket Booster
SSME	-	Space Shuttle Main Engine
ST	-	Star Tracker
STS	-	Space Transportation System
SW	-	Switch
S/W	-	Software
TACAN	-	Tactical Air Navigation
TAL	-	Transatlantic Abort Landing
TAME	-	Terminal Area Energy Management
TD	-	Touch Down

## APPENDIX A

THC	-	Translational Hand Controller
TRANS	-	Translation
TVC	-	Thrust Vector Control
TW	-	Thumbwheel
VAR	-	Variable
VDC	-	Volts Direct Current
VERN	-	Vernier
Y	-	Yaw

## **APPENDIX B**

### **DEFINITIONS, GROUND RULES, AND ASSUMPTIONS**

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

**APPENDIX B**  
**DEFINITIONS, GROUND RULES, AND ASSUMPTIONS**

**B.1 Definitions**

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

INTACT ABORT DEFINITIONS:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

OPS - software operational sequence

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

PHASE DEFINITIONS:

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

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

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

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

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

**APPENDIX B**  
**DEFINITIONS, GROUND RULES, AND ASSUMPTIONS**

**B.2 IOA Project Level Ground Rules and Assumptions**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**APPENDIX B  
DEFINITIONS, GROUND RULES, AND ASSUMPTIONS**

**B.3 D&C - Specific Ground Rules and Assumptions**

1. The failure analyses will be conducted to the black box level for components whose output serves only one function unless a lower level is required.

**RATIONALE:** The definition credible failure modes are oriented toward the black box functional output.

2. For black boxes whose output serves more than one function, the analysis will go to a level that effects each of the different functions.

**RATIONALE:** The defined credible failure modes are oriented toward the black box functional output.

3. Credible failure modes for most black boxes are defined to be

- (1) No output
- (2) Erroneous output (Output that redundancy management will detect as a failure.)
- (3) Premature output (Output occurs without command. This may not be credible for all black boxes.)

**RATIONALE:** Covers worst case effects on function.

4. Credible failures for switches are defined to be

- (1) Fails on (Power cannot be shut off by switch.)
- (2) Fails off (Power cannot be turned on.)
- (3) Short to ground
- (4) Internal short (Short across switch contacts.)

**RATIONALE:** Covers worst case effects on function.

5. Power circuits analysis does not include the resistors that reside between the power circuit and a MDM.

**RATIONALE:** These resistors provide signal conditioning for the MDM and are not a part of the power circuit.



**APPENDIX C  
DETAILED ANALYSIS**

This section contains the IOA analysis worksheets employed during the analysis of the D&C subsystem. The information on these worksheets is intentionally similar to the FMEA's written by Rockwell and the NASA. Each of these sheets identifies the item being analyzed, and parent assembly, as well as the function. For each failure mode, the possible causes are outlined, and the assessed hardware and functional criticality for each mission phase is listed, as described in the JSC/NSTS 22206, Instructions For Preparation of Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL). Finally, effects are entered at the bottom of each sheet, and the worst case criticality is entered at the top.

**LEGEND FOR IOA ANALYSIS WORKSHEETS**  
-----

**Hardware Criticalities :**

- 1 = Loss of life or vehicle
- 2 = Loss of mission
- 3 = Non loss of life or vehicle or mission

**Functional Criticalities :**

- 1R = Redundant identical hardware components or redundant functional paths all of which, if failed, could cause loss of life or vehicle.
- 2R = Redundant identical hardware components or redundant functional paths all of which, if failed, could cause loss of mission.

**Redundancy Screen A :**

- 1 = Is Checked Out PreFlight
- 2 = Is Capable of Check Out PreFlight
- 3 = Not Capable of Check Out PreFlight
- 4 = Do Not Know

**Redundancy Screens B and C :**

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

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 1/1  
MDAC ID: 101 ABORT: 1/1

ITEM: HUDE  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HUD
- 3) HUDE
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: AVIONICS BAY 3B  
PART NUMBER: MC409-0096-0012

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

EFFECTS/RATIONALE:

IN THE EVENT OF A NIGHT LANDING. IF THE COMMANDER'S HUD IS LOST WHILE ORBITER IS APPROACHING FINAL FLARE THE COMMANDER WILL NOT HAVE ALTITUDE DATA READILY AVAILABLE AND HENCE A SAFE LANDING WILL DEPEND ON THE SKILL OF THE COMMANDER.

REFERENCES: (1) SYSTEM BRIEF - GNC/JSC 18863, (2) SSSH - JSC 11174 - 20 HUD - DWG NO. 9.20A, (3) INTEGRATED SYSTEM SCHEMATIC - VS70-973099 - 73AZ, (4) D&C FSSR STS83-0020C

REPORT DATE 12/17/87

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INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 1/1  
MDAC ID: 102 ABORT: 1/1

ITEM: HUDE  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HUD
- 3) HUDE
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: AVIONICS BAY 3B  
PART NUMBER: MC409-0096-0012

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

EFFECTS/RATIONALE:

IN THE EVENT OF A NIGHT LANDING. IF THE COMMANDER'S HUD IS LOST WHILE ORBITER IS APPROACHING FINAL FLARE THE COMMANDER WILL NOT HAVE ALTITUDE DATA READILY AVAILABLE AND HENCE A SAFE LANDING WILL DEPEND ON THE SKILL OF THE COMMANDER.

REFERENCES: (1) SYSTEM BRIEF - GNC/JSC 18863, (2) SSSH - JSC 11174 - 20 HUD - DWG NO. 9.20A, (3) INTEGRATED SYSTEM SCHEMATIC - VS70-973099 - 73AZ, (4) D&C FSSR STS83-0020C

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 1/1  
MDAC ID: 103 ABORT: 1/1

ITEM: PDU  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HUD
- 3) PDU
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F6, PNL A8  
PART NUMBER: MC409-0096-0031

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

EFFECTS/RATIONALE:

IN THE EVENT OF A NIGHT LANDING. IF THE COMMANDER'S HUD IS LOST WHILE ORBITER IS APPROACHING FINAL FLARE THE COMMANDER WILL NOT HAVE ALTITUDE DATA READILY AVAILABLE AND HENCE A SAFE LANDING WILL DEPEND ON THE SKILL OF THE COMMANDER.

REFERENCES: (1) SYSTEM BRIEF - GNC/JSC 18863, (2) SSSH - JSC 11174 - 20 HUD - DWG NO. 9.20A, (3) INTEGRATED SYSTEM SCHEMATIC - VS70-973099 - 73AZ, (4) D&C FSSR STS83-0020C

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 1/1  
MDAC ID: 104 ABORT: 1/1

ITEM: PDU  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HUD
- 3) PDU
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F6, PNL A8  
PART NUMBER: MC409-0096-0031

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

EFFECTS/RATIONALE:

IN THE EVENT OF A NIGHT LANDING. IF THE COMMANDER'S HUD IS LOST WHILE ORBITER IS APPROACHING FINAL FLARE THE COMMANDER WILL NOT HAVE ALTITUDE DATA READILY AVAILABLE AND HENCE A SAFE LANDING WILL DEPEND ON THE SKILL OF THE COMMANDER.

REFERENCES: (1) SYSTEM BRIEF - GNC/JSC 18863, (2) SSSH - JSC 11174 - 20 HUD - DWG NO. 9.20A, (3) INTEGRATED SYSTEM SCHEMATIC - VS70-973099 - 73AZ, (4) D&C FSSR STS83-0020C

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 105 ABORT: 3/3

ITEM: SWITCH, DATA BUS SELECT 1,2,3,4  
FAILURE MODE: FAILS TO TRANSFER IN ANY POSITION

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HUD
- 3) SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

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

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

LOCATION: PNL F6, PNL F8  
PART NUMBER: ME452-0093-5025

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

EFFECTS/RATIONALE:

NO EFFECT, DATA WILL BE TRANSMITTED TO THE HUD VIA THE DEFAULT  
DATA BUS.

REFERENCES: (1) SYSTEM BRIEF - GNC/JSC 18863, (2) SSSH - JSC  
11174 - 20 HUD - DWG NO. 9.20A, (3) INTEGRATED SYSTEM SCHEMATIC -  
VS70-973099 - 73AZ, (4) D&C FSSR STS83-0020C

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 1/1  
MDAC ID: 106 ABORT: 1/1

ITEM: RESISTOR, CURRENT LIMITING  
FAILURE MODE: FAILS OPEN, SHORTS TO GROUND

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HUD
- 3) RESISTOR
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F6, PNL F8  
PART NUMBER: RLR42C122GM

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

EFFECTS/RATIONALE:

IN THE EVENT OF A NIGHT LANDING. IF THE COMMANDER'S HUD IS LOST WHILE ORBITER IS APPROACHING FINAL FLARE THE COMMANDER WILL NOT HAVE ALTITUDE DATA READILY AVAILABLE AND HENCE A SAFE LANDING WILL DEPEND ON THE SKILL OF THE COMMANDER.

REFERENCES: (1) SYSTEM BRIEF - GNC/JSC 18863, (2) SSSH - JSC 11174 - 20 HUD - DWG NO. 9.20A, (3) INTEGRATED SYSTEM SCHEMATIC - VS70-973099 - 73AZ, (4) D&C FSSR STS83-0020C

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 1/1  
MDAC ID: 107 ABORT: 1/1

ITEM: SWITCH - ON/OFF  
FAILURE MODE: FAILS OPEN

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HUD
- 3) SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F3  
PART NUMBER: ME452-0102-7101

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

EFFECTS/RATIONALE:

IN THE EVENT OF A NIGHT LANDING. IF THE COMMANDER'S HUD IS LOST WHILE ORBITER IS APPROACHING FINAL FLARE THE COMMANDER WILL NOT HAVE ALTITUDE DATA READILY AVAILABLE AND HENCE A SAFE LANDING WILL DEPEND ON THE SKILL OF THE COMMANDER.

REFERENCES: (1) SYSTEM BRIEF - GNC/JSC 18863, (2) SSSH - JSC 11174 - 20 HUD - DWG NO. 9.20A, (3) INTEGRATED SYSTEM SCHEMATIC - VS70-973099 - 73AZ, (4) D&C FSSR STS83-0020C

REPORT DATE 12/17/87

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INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 3/3  
MDAC ID: 108 ABORT: 3/3

ITEM: SWITCH - ON/OFF  
FAILURE MODE: FAILED CLOSED

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HUD
- 3) SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F3  
PART NUMBER: ME452-0102-7101

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

EFFECTS/RATIONALE:  
NO EFFECT - SWITCH IS NORMALLY CLOSED WHEN USE OF HUD IS  
CRITICAL.

REFERENCES: (1) SYSTEM BRIEF - GNC/JSC 18863, (2) SSSH - JSC  
11174 - 20 HUD - DWG NO. 9.20A, (3) INTEGRATED SYSTEM SCHEMATIC -  
VS70-973099 - 73AZ, (4) D&C FSSR STS83-0020C

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 3/3  
MDAC ID: 109 ABORT: 3/3

ITEM: RPC  
FAILURE MODE: FAILS CLOSED

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HUD
- 3) RPC
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F-PCA-1, F-PCA-2  
PART NUMBER: MC450-0017-1100

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

EFFECTS/RATIONALE:

NO EFFECT - RPC IS NORMALLY CLOSED WHEN USE OF HUD IS CRITICAL.

REFERENCES: (1) SYSTEM BRIEF - GNC/JSC 18863, (2) SSSH - JSC  
11174 - 20 HUD - DWG NO. 9.20A, (3) INTEGRATED SYSTEM SCHEMATIC -  
VS70-973099 - 73AZ, (4) D&C FSSR STS83-0020C

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 1/1  
MDAC ID: 110 ABORT: 1/1

ITEM: RPC  
FAILURE MODE: FAILS TO TRANSFER

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HUD
- 3) RPC
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F-PCA-1, F-PCA-2  
PART NUMBER: MC450-0017-1100

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

EFFECTS/RATIONALE:

IN THE EVENT OF A NIGHT LANDING. IF THE COMMANDER'S HUD IS LOST  
PRIOR TO FINAL FLARE, ALTITUDE DATA IS NOT READILY AVAILABLE.  
HENCE A SAFE LANDING DEPENDS ENTIRELY ON THE SKILL OF THE  
COMMANDER.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/09/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 201 ABORT: 3/1R

ITEM: DDU  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) DDU
- 3)
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: AVIONIC BAY  
PART NUMBER: MC409-0023-0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

ALL FLIGHT INSTRUMENTATION AND CONTROLLER TRANSDUCERS WILL FAIL IN THE STATION ASSIGNED TO THE AFFECTED DDU. THE OTHER FLIGHT STATION AND THE AUTO MODE IS AVAILABLE. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF VEHICLE'S STATUS DURING CRITICAL FLIGHT PHASES REQUIRING CREW RESPONSE IN THE MANUAL MODE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/09/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 202 ABORT: 3/1R

ITEM: DDU  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) DDU
- 3)
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: AVIONIC BAY  
PART NUMBER: MC409-0023-0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

ALL FLIGHT INSTRUMENTATION AND CONTROLLER TRANSDUCERS WILL HAVE ERRONEOUS INFORMATION IN THE STATION ASSIGNED TO THE AFFECTED DDU. THE OTHER FLIGHT STATION AND THE AUTO MODE IS AVAILABLE. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF VEHICLE'S STATUS DURING CRITICAL FLIGHT PHASES REQUIRING CREW RESPONSE IN THE MANUAL MODE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/09/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 3/1R  
MDAC ID: 203 ABORT: 3/1R

ITEM: DDU - DATA BUS SWITCH, & CB  
FAILURE MODE: FAIL OPEN, SHORT TO GROUND

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) DDU
- 3) DATA BUS SWITCH, & CB
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: AVIONIC BAY  
PART NUMBER: MC409-0023-0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF FLIGHT INSTRUMENTATION AND CONTROLLER TRANSDUCERS INFORMATION IN THE STATION ASSIGNED TO THE AFFECTED DDU. THE OTHER FLIGHT STATION IS AVAILABLE. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF VEHICLE'S STATUS DURING CRITICAL FLIGHT PHASES REQUIRING CREW RESPONSE IN THE MANUAL MODE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/09/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 3/3  
MDAC ID: 204 ABORT: 3/3

ITEM: DDU - DATA BUS SWITCH, & CB  
FAILURE MODE: FAIL CLOSE, SHORT CONTACT TO CONTACT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) DDU
- 3) DATA BUS SWITCH, & CB
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: AVIONIC BAY  
PART NUMBER: MC409-0023-0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:  
NONE. CAPABILITY TO SWITCH DATA BUS IS LOST.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/15/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 301 ABORT: 3/3

ITEM: G-METER  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) G-METER
- 3)
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F7  
PART NUMBER: MC432-0219-0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

NONE. OUTPUT OF THE DISPLAY NOT CRITICAL TO MISSION  
ACCOMPLISHMENT OR CREW/VEHICLE SAFETY.

REFERENCES:



INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/15/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 302 ABORT: 3/3

ITEM: G-METER  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) G-METER
- 3)
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F7  
PART NUMBER: MC432-0219-0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:  
NONE. OUTPUT OF THE DISPLAY NOT CRITICAL TO MISSION  
ACCOMPLISHMENT OR CREW/VEHICLE SAFETY.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/10/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 401 ABORT: 3/1R

ITEM: AMI-ALPHA  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) AMI
- 3) ALPHA
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC432-0023-0224-0011/0022

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF ALPHA ON AFFECTED AMI. INFORMATION AVAILABLE ON OTHER AMI AND CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF VEHICLE'S ALPHA REQUIRING CREW RESPONSE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/10/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 402 ABORT: 3/1R

ITEM: AMI-ALPHA  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) AMI
- 3) ALPHA
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC432-0023-0224-0011/0022

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

ERRONEOUS ALPHA IN AFFECTED AMI. INFORMATION AVAILABLE ON OTHER AMI AND CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF VEHICLE'S TRUE ALPHA REQUIRING CREW RESPONSE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/10/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 403 ABORT: 3/1R

ITEM: AMI-M/VEL  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) AMI
- 3) M/VEL
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC432-0023-0224-0011/0022

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF M/VEL ON AFFECTED AMI. INFORMATION AVAILABLE ON OTHER AMI AND CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF VEHICLE'S M/VEL REQUIRING CREW RESPONSE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/10/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 404 ABORT: 3/1R

ITEM: AMI-M/VEL  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) AMI
- 3) M/VEL
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC432-0023-0224-0011/0022

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

ERRONEOUS M/VEL ON AFFECTED AMI. INFORMATION AVAILABLE ON OTHER AMI AND CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF VEHICLE'S TRUE M/VEL REQUIRING CREW RESPONSE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/10/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 405 ABORT: 3/1R

ITEM: AMI-ACCEL  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) AMI
- 3) ACCEL
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC432-0023-0224-0011/0022

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF ACCEL ON AFFECTED AMI. INFORMATION AVAILABLE ON OTHER AMI AND CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF VEHICLE'S ACCEL REQUIRING CREW RESPONSE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/10/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 406 ABORT: 3/1R

ITEM: AMI-ACCEL  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) AMI
- 3) ACCEL
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC432-0023-0224-0011/0022

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

ERRONEOUS ACCEL ON AFFECTED AMI. INFORMATION AVAILABLE ON OTHER AMI AND CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF VEHICLE'S TRUE ACCEL REQUIRING CREW RESPONSE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/10/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 407 ABORT: 3/1R

ITEM: AMI-EAS  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) AMI
- 3) EAS
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC432-0023-0224-0011/0022

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF EAS ON AFFECTED AMI. INFORMATION AVAILABLE ON OTHER AMI AND CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF VEHICLE'S EAS REQUIRING CREW RESPONSE.

REFERENCES:



INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/10/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 408 ABORT: 3/1R

ITEM: AMI-EAS  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) AMI
- 3) EAS
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC432-0023-0224-0011/0022

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

ERRONEOUS EAS ON AFFECTED AMI. INFORMATION AVAILABLE ON OTHER AMI AND CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF VEHICLE'S TRUE EAS REQUIRING CREW RESPONSE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/10/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 3/1R  
MDAC ID: 409 ABORT: 3/1R

ITEM: AMI-ADTA SW, RESISTOR, & FUSES  
FAILURE MODE: FAIL OPEN, SHORT TO GROUND

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) AMI
- 3) ADTA SW, RESISTOR, AND FUSES
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC452-0102-7106

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF SOURCE OF INPUT ON AFFECTED AMI. INFORMATION AVAILABLE ON OTHER AMI AND CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF VEHICLE'S STATE REQUIRING CREW RESPONSE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/10/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 3/3  
MDAC ID: 410 ABORT: 3/3

ITEM: AMI-ADTA SW, RESISTOR, & FUSES  
FAILURE MODE: FAIL CLOSED, SHORT CONTACT TO CONTACT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) AMI
- 3) ADTA SW, RESISTOR, AND FUSES
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC452-0102-7106

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

NONE. SOURCE OF INFORMATION ON AFFECTED AMI WILL NOT CHANGE.  
OTHER AMI OR CRT AVAILABLE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/03/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 501 ABORT: 3/1R

ITEM: HSI-BEARING  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HSI
- 3) BEARING
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC432-0218-0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

BEARING OF VEHICLE IS LOST ON AFFECTED HSI. INFORMATION IS AVAILABLE ON OTHER HSI OR CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF THE VEHICLE'S POSITION REQUIRING RESPONSE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/03/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 502 ABORT: 3/1R

ITEM: HSI-BEARING  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HSI
- 3) BEARING
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC432-0218-0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

ACTUAL BEARING OF VEHICLE IS LOST ON AFFECTED HSI. INFORMATION IS AVAILABLE ON OTHER HSI OR CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF THE VEHICLE'S POSITION REQUIRING RESPONSE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/03/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 503 ABORT: 3/1R

ITEM: HSI-HEADING  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HSI
- 3) HEADING
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC432-0218-0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

HEADING OF VEHICLE IS LOST ON AFFECTED HSI. INFORMATION IS AVAILABLE ON OTHER HSI OR CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF THE VEHICLE'S POSITION REQUIRING RESPONSE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/03/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 504 ABORT: 3/1R

ITEM: HSI-HEADING  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HSI
- 3) HEADING
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC432-0218-0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

ACTUAL HEADING OF VEHICLE IS LOST ON AFFECTED HSI. INFORMATION IS AVAILABLE ON OTHER HSI OR CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF THE VEHICLE'S POSITION REQUIRING RESPONSE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/03/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 505 ABORT: 3/1R

ITEM: HSI-COURSE  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HSI
- 3) COURSE
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC432-0218-0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

COURSE OF VEHICLE IS LOST ON AFFECTED HSI. INFORMATION IS AVAILABLE ON OTHER HSI OR CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF THE VEHICLE'S POSITION REQUIRING RESPONSE.

REFERENCES:



INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/03/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 506 ABORT: 3/1R

ITEM: HSI-COURSE  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HSI
- 3) COURSE
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC432-0218-0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

ACTUAL COURSE OF VEHICLE IS LOST ON AFFECTED HSI. INFORMATION IS AVAILABLE ON OTHER HSI OR CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF THE VEHICLE'S POSITION REQUIRING RESPONSE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/03/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 507 ABORT: 3/3

ITEM: HSI-RNG  
FAILURE MODE:

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HSI
- 3) RNG
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC432-0218-0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:  
NONE. RNG NOT A CRITICAL DISPLAY REQUIRING CREW RESPONSE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/03/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 508 ABORT: 3/3

ITEM: HSI-RNG  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HSI
- 3) RNG
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC432-0218-0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:  
NONE. RNG NOT A CRITICAL DISPLAY REQUIRING CREW RESPONSE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/03/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 509 ABORT: 3/1R

ITEM: HSI-MODE SW & RESISTOR  
FAILURE MODE: FAIL OPEN, SHORT TO GND

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HSI
- 3) MODE SW & RESISTOR
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC432,0218-0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

INPUT TO AFFECTED HSI WILL BE LOST. INFORMATION AVAILABLE ON OTHER HSI OR CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF VEHICLE'S POSITION REQUIRING CREW RESPONSE IN MANUAL MODE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/03/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 510 ABORT: 3/3

ITEM: HSI-MODE SW & RESISTOR  
FAILURE MODE: FAILED CLOSED, SHORT CONTACT TO CONTACT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HSI
- 3) MODE SW & RESISTOR
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC432-0218-0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:  
NONE. MODE CAN NOT BE SHANGED. OTHER HSI OR CRT AVAILABLE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/03/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 511 ABORT: 3/1R

ITEM: HSI-SOURCE SW & RESISTOR  
FAILURE MODE: FAIL OPEN, SHORT TO GROUND

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HSI
- 3) SOURCE SW & RESISTOR
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC432-0218-0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

INPUT TO AFFECTED HSI WILL BE LOST. INFORMATION AVAILABLE ON OTHER HSI OR CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF VEHICLE'S POSITION REQUIRING CREW RESPONSE IN MANUAL MODE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/03/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 512 ABORT: 3/3

ITEM: HSI-SOURCE SW & RESISTOR  
FAILURE MODE: FAIL CLOSED, SHORT CONTACT TO CONTACT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HSI
- 3) SOURCE SW & RESISTOR
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC432-0218-0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:  
NONE. SOURCE CAN NOT BE CHANGED. OTHER HSI OR CRT AVAILABLE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/03/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 3/1R  
MDAC ID: 513 ABORT: 3/1R

ITEM: HSI-SOURCE SEL SW, RESISTOR, & FUSE  
FAILURE MODE: FAIL OPEN, SHORT TO GROUND

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HSI
- 3) SOURCE SEL SW, RESISTOR, & FUSE
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC432-0218-0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

INPUT TO AFFECTED HSI WILL BE LOST. INFORMATION AVAILABLE ON OTHER HSI OR CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF VEHICLE'S POSITION REQUIRING CREW RESPONSE IN MANUAL MODE.

REFERENCES:



INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/03/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 3/3  
MDAC ID: 514 ABORT: 3/3

ITEM: HSI-SOURCE SEL SW, RESISTOR, & FUSE  
FAILURE MODE: FAIL CLOSED, SHORT CONTACT TO CONTACT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HSI
- 3) SOURCE SEL SW, RESISTOR, & FUSE
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: F6, F8  
PART NUMBER: MC432-0218-0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

NONE. ANTENNA CAN NOT BE CHANGED. OTHER HSI OR CRT AVAILABLE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 601 ABORT: 3/1R

ITEM: AVVI - ALT ACCEL  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) AVVI
- 3) ALT ACCEL
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F6, F8  
PART NUMBER: MC432-0225-0011/0022

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF ALT ACCEL ON AFFECTED AVVI. INFORMATION AVAILABLE ON OTHER AVVI OR CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF VEHICLE'S ALT ACCEL REQUIRING CREW RESPONSE IN MANUAL MODE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 602 ABORT: 3/1R

ITEM: AVVI - ALT ACCEL  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) AVVI
- 3) ALT ACCEL
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F6, F8  
PART NUMBER: MC432-0025-0011/0022

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF ACTUAL ALT ACCEL ON AFFECTED AVVI. INFORMATION AVAILABLE ON OTHER AVVI OR CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF VEHICLE'S ACTUAL ALT ACCEL REQUIRING CREW RESPONSE IN MANUAL MODE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 603 ABORT: 3/1R

ITEM: AVVI - ALT RATE  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) AVVI
- 3) ALT RATE
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F6, F8  
PART NUMBER: MC432-0225-0011/0022

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF ALT RATE ON AFFECTED AVVI. INFORMATION AVAILABLE ON OTHER AVVI OR CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF VEHICLE'S ALT RATE REQUIRING CREW RESPONSE IN MANUAL MODE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 604 ABORT: 3/1R

ITEM: AVVI - ALT RATE  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) AVVI
- 3) ALT RATE
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F6, F8  
PART NUMBER: MC432-0025-0011/0022

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF ACTUAL ALT RATE ON AFFECTED AVVI. INFORMATION AVAILABLE ON OTHER AVVI OR CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF VEHICLE'S ACTUAL ALT RATE REQUIRING CREW RESPONSE IN MANUAL MODE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 605 ABORT: 3/1R

ITEM: AVVI - ALT  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) AVVI
- 3) ALT
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

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

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

LOCATION: PNL F6, F8  
PART NUMBER: MC432-0225-0011/0022

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF ALT ON AFFECTED AVVI. INFORMATION AVAILABLE ON OTHER AVVI OR CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF VEHICLE'S ALT REQUIRING CREW RESPONSE IN MANUAL MODE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 606 ABORT: 3/1R

ITEM: AVVI - ALT  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) AVVI
- 3) ALT
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F6, F8  
PART NUMBER: MC432-0225-0011/0022

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:  
LOSS OF ACTUAL ALT ON AFFECTED AVVI. INFORMATION AVAILABLE ON OTHER AVVI OR CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF VEHICLE'S ACTUAL ALT REQUIRING CREW RESPONSE IN MANUAL MODE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 607 ABORT: 3/1R

ITEM: AVVI - RDR ALT  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) AVVI
- 3) RDR ALT
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F6, F8  
PART NUMBER: MC432-0225-0011/0022

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF RDR ALT ON AFFECTED AVVI. INFORMATION AVAILABLE ON OTHER AVVI OR CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY OF VEHICLE'S RDR ALT REQUIRING CREW RESPONSE IN MANUAL MODE.

REFERENCES:



INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 608 ABORT: 3/1R

ITEM: AVVI - RDR ALT  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) AVVI
- 3) RDR ALT
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F6, F8  
PART NUMBER: MC432-0025-0011/0022

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF ACTUAL RDR ALT ON AFFECTED AVVI. INFORMATION AVAILABLE ON OTHER AVVI OR CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW /VEHICLE DUE TO LOSS OF VISIBILITY OF VEHICLE'S ACTUAL RDR ALT REQUIRING CREW RESPONSE IN MANUAL MODE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 3/3  
MDAC ID: 609 ABORT: 3/3

ITEM: AVVI - RDR ALT SW, RESISTOR, & FUSE  
FAILURE MODE: FAIL OPEN, SHORT TO GROUND

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) AVVI
- 3) RDR ALT SW, RESISTOR, & FUSE
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F6, F8  
PART NUMBER: MC432-0225-0011/0022

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

NONE. LOSS OF RDR ALT ON AFFECTED AVVI. INFORMATION AVAILABLE  
ON OTHER AVVI OR CRT.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/12/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 3/3  
MDAC ID: 610 ABORT: 3/3

ITEM: AVVI - RDR ALT SW, RESISTOR, & FUSE  
FAILURE MODE: FAIL CLOSED, SHORT CONTACT TO CONTACT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) AVVI
- 3) RDR ALT SW, RESISTOR, & FUSE
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F6, F8  
PART NUMBER: MC432-0225-0011/0022

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

NONE. LOSS OF CAPABILITY TO SWITCH RDR ALT ON AFFECTED AVVI.  
INFORMATION AVAILABLE ON OTHER AVVI OR CRT.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 701 ABORT: 3/3

ITEM: SPI  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) SPI
- 3)
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F7  
PART NUMBER: MC432-0224-0011

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

NONE. INFORMATION AVAILABLE ON CRT. ITEM NOT CRITICAL TO  
CREW/VEHICLE SAFETY OR MISSION COMPLETENESS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 702 ABORT: 3/3

ITEM: SPI  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) SPI
- 3)
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F7  
PART NUMBER: MC432-0224-0011

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

NONE. INFORMATION AVAILABLE ON CRT. ITEM NOT CRITICAL TO  
CREW/VEHICLE SAFETY OR MISSION COMPLETENESS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 3/3  
MDAC ID: 703 ABORT: 3/3

ITEM: SPI-PWR CKT  
FAILURE MODE: FAILED OPEN

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) SPI
- 3) CIRCUIT
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F6  
PART NUMBER: MC451-0018-0300

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

NONE. INFORMATION AVAILABLE ON CRT. ITEM NOT CRITICAL TO CREW/VEHICLE SAFETY OR MISSION COMPLETENESS. CIRCUIT CONSIST OF POWER THROUGH THE INST PWR SWITCH AND FUSES.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1101 ABORT: 3/3

ITEM: METER, EVENT TIMER  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) EVENT TIMER
- 3) METER
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F7, PNL A4  
PART NUMBER: MC456-0053-002

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

EFFECTS/RATIONALE:

NONE: EVENT TIME CAN BE DETERMINED FROM MISSION TIMER.

REFERENCES: (1) SYSTEM BRIEF - GNC/JSC 18863, (2) SSSH - JSC  
11174 - 10 TIM - DWG NO. 8.10, (3) INTEGRATED SYSTEM SCHEMATIC -  
VS70-973099 - 73KA, 73KB

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1102 ABORT: 3/3

ITEM: METER, EVENT TIMER  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) EVENT TIMER
- 3) METER
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

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

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

LOCATION: PNL F7, PNL A4  
PART NUMBER: MC456-0053-002

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

EFFECTS/RATIONALE:

NONE: EVENT TIME CAN BE DETERMINED FROM MISSION TIMER.

REFERENCES: (1) SYSTEM BRIEF - GNC/JSC 18863, (2) SSSH - JSC  
11174 - 10 TIM - DWG NO. 8.10, (3) INTEGRATED SYSTEM SCHEMATIC -  
VS70-973099 - 73KA, 73KB



INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1103 ABORT: 3/3

ITEM: SWITCH - UP/DOWN/TEST  
FAILURE MODE: FAILS CLOSED IN A POSITION OTHER THAN THE ONE  
SELECTED

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) EVENT TIMER
- 3) SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL C2, PNL A6  
PART NUMBER: ME452-0102-7107

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:

LOSS OF DESIRED TIMER OUTPUT - TIMING INFORMATION IS AVAILABLE ON  
OTHER TIMER OR CAN BE DETERMINED FROM MISSION TIMER.

REFERENCES: (1) SYSTEM BRIEF - GNC/JSC 18863, (2) SSSH - JSC  
11174 - 10 TIM - DWG NO. 8.10, (3) INTEGRATED SYSTEM SCHEMATIC -  
VS70-973099 - 73KA, 73KB

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1104 ABORT: 3/3

ITEM: CIRCUIT BREAKER  
FAILURE MODE: FAILS CLOSED

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) EVENT TIMER
- 3) CIRCUIT BREAKER
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL 014B, PNL 015A  
PART NUMBER: MC454-0026-2030

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

EFFECTS/RATIONALE:  
NO EFFECT, CIRCUIT IS NORMALLY CLOSED.

REFERENCES: (1) SYSTEM BRIEF - GNC/JSC 18863, (2) SSSH - JSC  
11174 - 10 TIM - DWG NO. 8.10, (3) INTEGRATED SYSTEM SCHEMATIC -  
VS70-973099 - 73KA, 73KB

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 3/3  
MDAC ID: 1105 ABORT: 3/3

ITEM: CIRCUIT BREAKER-EVENT TIMER  
FAILURE MODE: FAILS TO TRANSFER

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) EVENT TIMER
- 3) CIRCUIT BREAKER
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL 014B, PNL 015A  
PART NUMBER: MC454-0026-2030

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

EFFECTS/RATIONALE:

LOSS OF TIMER OUTPUT. EVENT TIME IS AVAILABLE ON OTHER TIMER OR  
CAN BE DETERMINED FROM MISSION TIMER.

REFERENCES: (1) SYSTEM BRIEF - GNC/JSC 18863, (2) SSSH - JSC  
11174 - 10 TIM - DWG NO. 8.10, (3) INTEGRATED SYSTEM SCHEMATIC -  
VS70-973099 - 73KA, 73KB

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1106 ABORT: 3/3

ITEM: SWITCH - START/STOP  
FAILURE MODE: FAILS OPEN OR CLOSED IN ANY POSITION

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) EVENT TIMER
- 3) SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL C2, PNL A6  
PART NUMBER: ME452-0102-7105

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

EFFECTS/RATIONALE:

ERRONEOUS TIMER OUTPUT, EVENT TIME IS AVAILABLE ON OTHER TIMER OR  
CAN BE DETERMINED FROM MISSION TIMER.

REFERENCES: (1) SYSTEM BRIEF - GNC/JSC 18863, (2) SSSH - JSC  
11174 - 10 TIM - DWG NO. 8.10, (3) INTEGRATED SYSTEM SCHEMATIC -  
VS70-973099 - 73KA, 73KB

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1107 ABORT: 3/3

ITEM: SWITCH - SET/RESET  
FAILURE MODE: FAILS OPEN OR CLOSED IN ANY POSITION

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) EVENT TIMER
- 3) SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL C2, PNL A6  
PART NUMBER: ME452-0102-7105

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

EFFECTS/RATIONALE:

ERRONEOUS TIMER OUTPUT, EVENT TIME IS AVAILABLE ON OTHER TIMER OR  
CAN BE DETERMINED FROM MISSION TIMER.

REFERENCES: (1) SYSTEM BRIEF - GNC/JSC 18863, (2) SSSH - JSC  
11174 - 10 TIM - DWG NO. 8.10, (3) INTEGRATED SYSTEM SCHEMATIC -  
VS70-973099 - 73KA, 73KB

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1108 ABORT: 3/3

ITEM: SWITCH - THUMBWHEEL - MIN/SEC  
FAILURE MODE: ANY CONTACT FAILED OPEN OR CLOSED

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) EVENT TIMER
- 3) SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL C2, PNL A6  
PART NUMBER: ME452-0134-1005

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

EFFECTS/RATIONALE:

ERRONEOUS TIMER OUTPUT, EVENT TIME IS AVAILABLE ON OTHER TIMER OR CAN BE DETERMINED FROM MISSION TIMER.

REFERENCES: (1) SYSTEM BRIEF - GNC/JSC 18863, (2) SSSH - JSC 11174 - 10 TIM - DWG NO. 8.10, (3) INTEGRATED SYSTEM SCHEMATIC - VS70-973099 - 73KA, 73KB

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/02/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 1201 ABORT: 3/1R

ITEM: ADI-ATTITUDE  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ADI
- 3) ATTITUDE
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PANEL F6, F8, A134  
PART NUMBER: MC432-0233-0001, 0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

ATTITUDE INFORMATION LOST ON AFFECTED AID. INFORMATION AVAILABLE ON THE CRT DISPLAY OR OTHER ADI'S. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY TO THE CREW OF VEHICLE ATTITUDE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/02/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 1202 ABORT: 3/1R

ITEM: ADI-ATTITUDE  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ADI
- 3) ATTITUDE
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PANEL F6, F8, A134  
PART NUMBER: MC432-0233-0001, 0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

ERRONEOUS ATTITUDE INFORMATION ON THE AFFECTED ADI. INFORMATION AVAILABLE ON OTHER ADI'S AND CRT. LOSS OF ALL REDUNDANCY MAY CAUSE CREW TO REACT WITH IMPROPER DECISIONS AFFECTING THE SAFETY OF THE CREW/VEHICLE.

REFERENCES:



INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/02/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 1203 ABORT: 3/1R

ITEM: ADI-RATES  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ADI
- 3) RATES
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PANEL F6, F8, A134  
PART NUMBER: MC432-0233-0001, 0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

RATE INFORMATION LOST ON THE AFFECTED ADI. INFORMATION AVAILABLE ON OTHER ADI'S AND CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO LOSS OF VISIBILITY TO THE CREW OF VEHICLE RATE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/02/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 1204 ABORT: 3/1R

ITEM: ADI-RATES  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ADI
- 3) RATE
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PANEL F6, F8, A134  
PART NUMBER: MC432-0233-0001

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

RATE INFORMATION ERRONEOUS ON THE AFFECTED ADI. INFORMATION AVAILABLE ON OTHER AID'S AND THE CRT. IF ALL REDUNDANCY IS LOST, THE SAFETY OF THE CREW/VEHICLE MAY BE AFFECTED BY THE CREW'S RESPONSES.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/02/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 1205 ABORT: 3/1R

ITEM: ADI-ERRORS  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ADI
- 3) ERRORS
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PANEL F6, F8, A134  
PART NUMBER: MC432-0233-0001

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

ATTITUDE ERROR INFORMATION LOST ON AFFECTED ADI. INFORMATION AVAILABLE ON OTHER ADI'S AND CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE BECAUSE OF LOSS OF VISIBILITY TO THE CREW OF VEHICLE ATTITUDE ERRORS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/02/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 1206 ABORT: 3/1R

ITEM: ADI-ERRORS  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ADI
- 3) ERRORS
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PANEL F6, F8, A134  
PART NUMBER: MC432-0233-0001

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

ATTITUDE ERROR INFORMATION ON AFFECTED ADI. INFORMATION AVAILABLE ON OTHER ADI'S AND CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE BECAUSE OF THE LOSS OF VISIBILITY TO THE CREW OF CORRECT VEHICLE ATTITUDE ERRORS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/02/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 1207 ABORT: 3/1R

ITEM: ADI-ERR SEL SW & RESISTOR  
FAILURE MODE: FAILS OPEN, SHORT TO GROUND

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ADI
- 3) ERRORS
- 4) SCALE SEL
- 5) SW & RESISTOR
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F6, F8, A134  
PART NUMBER: MC432-0233-0001, 0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF ATTITUDE ERROR INFORMATION ON THE AFFECTED ADI.  
INFORMATION AVAILABLE ON OTHER ADI'S OR CRT. LOSS OF ALL  
REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO THE LOSS OF  
VISIBILITY OF THE VEHICLE'S ATTITUDE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/02/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1208 ABORT: 3/3

ITEM: ADI-ERR SEL SW & RESISTOR  
FAILURE MODE: FAIL CLOSED, SHORT CONTACT TO CONTACT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ADI
- 3) ERROR
- 4) SCALE SEL
- 5) SW & RESISTOR
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F6, F8, A134  
PART NUMBER: MC432,0233,0001, 0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:  
NONE. SCALE OF ATTITUDE INFORMATION CAN NOT BE CHANGED.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/02/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1209 ABORT: 3/3

ITEM: ADI-RATE SEL SW & RESISTOR  
FAILURE MODE: FAIL CLOSED, SHORT CONTACT TO CONTACT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ADI
- 3) RATE
- 4) SCALE SEL
- 5) SW & RESISTOR
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F6, F8, A134  
PART NUMBER: MC432-0233-0001, 0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:  
NONE. SCALE OF RATE INFORMATION CAN NOT BE CHANGED.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/02/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 1210 ABORT: 3/1R

ITEM: ADI-RATE SEL SW & RESISTOR  
FAILURE MODE: FAIL OPEN, SHORT TO GROUND

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ADI
- 3) RATE
- 4) SCALE SEL
- 5) SW & RESISTOR
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F6, F8, A134  
PART NUMBER: MC432-0233-0001, 0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF RATE INFORMATION ON AFFECTED ADI. INFORMATION AVAILABLE ON OTHER ADI OR CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO THE LOSS OF VISIBILITY OF VEHICLE'S RATES REQUIRING CREW RESPONSE DURING MANUAL MODE.

REFERENCES:



INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/02/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 1211 ABORT: 3/1R

ITEM: ADI-MODE SEL SW  
FAILURE MODE: FAIL OPEN; SHORT TO GND

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ADI
- 3) MODE SEL SW
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F6, F8, A134  
PART NUMBER: MC432-0233-0001, 0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF REFERENCE INFORMATION LOST ON AFFECTED ADI. INFORMATION AVAILABLE ON OTHER ADI OR CRT. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO THE LOSS OF VISIBILITY OF VEHICLE'S REFERENCE REQUIRING CREW RESPONSE DURING MANUAL MODE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/02/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1212 ABORT: 3/3

ITEM: ADI-MODE SEL SW  
FAILURE MODE: FAILED CLOSED

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ADI
- 3) MODE SEL SW
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL F6, F8, A134  
PART NUMBER: MC432-0233-0001, 0002

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

NONE. REFERENCE FRAME CANNOT BE CHANGED. OTHER ADI OR CRT AVAILABLE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1301 ABORT: 3/3

ITEM: METER, MISSION TIMER  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) MISSION TIMER
- 3) METER
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL 03, PNL A4  
PART NUMBER: MC456-0054-002

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

EFFECTS/RATIONALE:  
NONE. MISSION TIME IS AVAILABLE ON OTHER MISSION TIMER OR CRT.

REFERENCES: (1) SYSTEM BRIEF - GNC/JSC 18863, (2) SSSH - JSC  
11174 - 10 TIM - DWG NO. 8.10, (3) INTEGRATED SYSTEM SCHEMATIC -  
VS70-973099 - 73KA, 73KB

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1302 ABORT: 3/3

ITEM: METER, MISSION TIMER  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) MISSION TIMER
- 3) METER
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL 03, PNL A4  
PART NUMBER: MC456-0054-002

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

EFFECTS/RATIONALE:

NONE. MISSION TIME IS AVAILABLE ON OTHER MISSION TIMER OR CRT.

REFERENCES: (1) SYSTEM BRIEF - GNC/JSC 18863, (2) SSSH - JSC  
11174 - 10 TIM - DWG NO. 8.10, (3) INTEGRATED SYSTEM SCHEMATIC -  
VS70-973099 - 73KA, 73KB

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1303 ABORT: 3/3

ITEM: SWITCH - GMT/MET/TEST  
FAILURE MODE: FAILS CLOSED IN A POSITION OTHER THAN THE ONE  
SELECTED

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) MISSION TIMER
- 3) SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL 03, PNL A4  
PART NUMBER: ME452-0102-7101

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:

LOSS OF DESIRED TIMER OUTPUT - TIMING INFORMATION IS AVAILABLE ON  
OTHER TIMER OR CRT.

REFERENCES: (1) SYSTEM BRIEF - GNC/JSC 18863, (2) SSSH - JSC  
11174 - 10 TIM - DWG NO. 8.10, (3) INTEGRATED SYSTEM SCHEMATIC -  
VS70-973099 - 73KA, 73KB

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1304 ABORT: 3/3

ITEM: CIRCUIT BREAKER  
FAILURE MODE: FAILS CLOSED

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) MISSION TIMER
- 3) CIRCUIT BREAKER
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL 014B, PNL 015A  
PART NUMBER: MC454-0026-2030

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

EFFECTS/RATIONALE:

NO EFFECT, CIRCUIT IS NORMALLY CLOSED.

REFERENCES: (1) SYSTEM BRIEF - GNC/JSC 18863, (2) SSSH - JSC  
11174 - 10 TIM - DWG NO. 8.10, (3) INTEGRATED SYSTEM SCHEMATIC -  
VS70-973099 - 73KA, 73KB

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 3/3  
MDAC ID: 1305 ABORT: 3/3

ITEM: CIRCUIT BREAKER-MISSION TIMER  
FAILURE MODE: FAILS TO TRANSFER

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) MISSION TIMER
- 3) CIRCUIT BREAKER
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL 014B, PNL 015A  
PART NUMBER: MC545-0026-2030

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

EFFECTS/RATIONALE:

LOSS OF DESIRED TIMER OUTPUT - TIMING INFORMATION IS AVAILABLE ON  
OTHER TIMER OR CRT.

REFERENCES: (1) SYSTEM BRIEF - GNC/JSC 18863, (2) SSSH - JSC  
11174 - 10 TIM - DWG NO. 8.10, (3) INTEGRATED SYSTEM SCHEMATIC -  
VS70-973099 - 73KA, 73KB

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1306 ABORT: 3/3

ITEM: SWITCH - GMT/MET/TEST  
FAILURE MODE: FAILS OPEN

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) MISSION TIMER
- 3) SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL 03, PNL A4  
PART NUMBER: ME452-0102-7101

CAUSES: CONTAMINATION, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:

LOSS OF DESIRED TIMER OUTPUT - TIMING INFORMATION IS AVAILABLE ON OTHER TIMER OR CRT.

REFERENCES: (1) SYSTEM BRIEF - GNC/JSC 18863, (2) SSSH - JSC 11174 - 10 TIM - DWG NO. 8.10, (3) INTEGRATED SYSTEM SCHEMATIC - VS70-973099 - 73KA, 73KB



INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1401 ABORT: 3/3

ITEM: CAUTION & WARNING ELECTRONICS UNIT (CEU)  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) CEU
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

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

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

LOCATION: 83V73A4 (BAY 3A)  
PART NUMBER: MC409-0012-0031

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF C/W ANNUNCIATION FROM THE ANNUNCIATOR ARRAY, C/W STATUS MATRIX, AND MASTER ALARM LIGHTS AND TONE. OUT-OF-LIMITS CONDITIONS ARE STILL ANNUNCIATED BY SOFTWARE FAULT MESSAGES. THE ABILITY TO SET OR READ A PARAMETER'S LIMITS AND TO ENABLE OR INHIBIT ANNUNCIATION FOR A PARAMETER USING C/W SWITCHES IS ALSO LOST. THESE FUNCTIONS MAY BE PERFORMED USING SM SPEC 60 OR GPC READ/WRITE PROCEDURES.

LOSS OF C/W ANNUNCIATION HAS NO SAFETY IMPACT IF INTERFACING SUBSYSTEMS ARE OPERATING WITHIN LIMITS; ALL C/W MONITORED QUANTITIES ARE DISPLAYED VIA GAGES AND/OR CRT DISPLAYS.

REFERENCES: ROCKWELL DWG. VS70-730129, SCHEMATIC DRAWING - CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL, VOL. 1, CAUTION & WARNING, 8/31/84; C&W 2102, CAUTION & WARNING WORKBOOK, 8/5/83; JSC-18691, FDF MALFUNCTION PROCEDURES.

REPORT DATE 12/17/87

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INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1402 ABORT: 3/3

ITEM: CAUTION & WARNING ELECTRONICS UNIT (CEU)  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) CEU
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

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

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

LOCATION: 83V73A4 (BAY 3A)  
PART NUMBER: MC409-0012-0031

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

THE ABILITY TO CORRECTLY SET OR READ PARAMETER LIMIT VALUES, OR  
TO ENABLE OR INHIBIT ANNUNCIATION FOR A PARAMETER USING C/W  
SWITCHES MAY BE LOST.

FAILURE TO ANNUNCIATE AN OUT-OF LIMITS CONDITION OR FALSE  
ANNUNCIATION OF AN OUT-OF-LIMITS CONDITION MAY ALSO OCCUR.  
SOFTWARE PROVIDES REDUNDANCY FOR THESE FUNCTIONS.

LOSS OF C/W ANNUNCIATION HAS NO SAFETY IMPACT IF INTERFACING  
SUBSYSTEMS ARE OPERATING WITHIN LIMITS; ALL C/W MONITORED  
QUANTITIES ARE DISPLAYED VIA GAGES AND/OR CRT DISPLAYS, AND  
PARAMETER LIMITS ARE AVAILABLE IN THE FDF REFERENCE DATA BOOK.

REFERENCES: ROCKWELL DWG. VS70-730129, SCHEMATIC DRAWING -  
CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL,  
VOL. 1, CAUTION & WARNING, 8/31/84; C&W 2102, CAUTION & WARNING  
WORKBOOK, 8/5/83; JSC-18691, FDF MALFUNCTION PROCEDURES.

REPORT DATE 12/17/87

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INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/11/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1403 ABORT: 3/3

ITEM: C/W ANNUNCIATOR ASSEMBLY  
FAILURE MODE: LOSS OF OUTPUT / PARTIAL OUTPUT

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W ANNUNCIATOR ASSEMBLY
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

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

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

LOCATION: 34V73A7A2 (PANEL F7)  
PART NUMBER: MC434-0069-0012

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

ONE MEANS OF ANNUNCIATING AN OUT-OF-LIMITS CONDITION IS LOST.  
THE MASTER ALARM LIGHTS & TONE AND SOFTWARE MESSAGES PROVIDE  
ADDITIONAL FAULT ANNUNCIATION.

IF ALL FAILURE ANNUNCIATION IS LOST, AN UNANNUNCIATED OUT-OF-  
LIMITS CONDITION MAY EXIST.

LOSS OF C/W ANNUNCIATION HAS NO SAFETY IMPACT IF INTERFACING  
SUBSYSTEMS ARE OPERATING WITHIN LIMITS; ALL C/W MONITORED  
QUANTITIES ARE ALSO DISPLAYED VIA GAGES AND/OR CRT DISPLAYS, AND  
PARAMETER LIMITS ARE AVAILABLE IN THE FDF REFERENCE DATA BOOK.

REFERENCES: ROCKWELL DWG. VS70-730129, SCHEMATIC DRAWING -  
CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL,  
VOL. 1, CAUTION & WARNING, 8/31/84; C&W 2102, CAUTION & WARNING  
WORKBOOK, 8/5/83; JSC-18691, FDF MALFUNCTION PROCEDURES.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/10/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1404 ABORT: 3/3

ITEM: C/W STATUS DISPLAY  
FAILURE MODE: LOSS OF OUTPUT / PARTIAL OUTPUT

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W STATUS DISPLAY
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

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

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

LOCATION: 32V73A13A1XDS1 (PANEL R13A1)  
PART NUMBER: MC409-0012-0002

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

ONE MEANS OF SETTING/READING LIMIT VALUES AND ENABLING/INHIBITING ANNUNCIATION OF A PARAMETER IS LOST. THESE FUNCTIONS MAY BE PERFORMED USING SPEC 60 OR GPC READ/WRITE PROCEDURES. LOSS OF THESE FUNCTIONS HAS NO SAFETY IMPACT ON THE CREW, VEHICLE, OR MISSION. PARAMETER LIMIT VALUES ARE LISTED IN THE FDF REFERENCE DATA BOOK, AND THE CREW MAY MONITOR GAGES/CRT DISPLAYS TO SEE THAT PARAMETERS ARE WITHIN LIMITS.

REFERENCES: ROCKWELL DWG. VS70-730129, SCHEMATIC DRAWING - CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL, VOL. 1, CAUTION & WARNING, 8/31/84; C&W 2102, CAUTION & WARNING WORKBOOK, 8/5/83; JSC-18691, FDF MALFUNCTION PROCEDURES.

REPORT DATE 12/17/87

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INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/18/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1405 ABORT: 3/3

ITEM: C/W STATUS DISPLAY  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W STATUS DISPLAY
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 32V73A13A1XDS1 (PANEL R13A1)  
PART NUMBER: MC409-0012-0002

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

OUTPUT OF INCORRECT PARAMETER LIMIT VALUES OR INCORRECT DISPLAY OF OUT-OF-LIMITS OR INHIBITED PARAMETERS MAY BE CONFUSING TO THE CREW. REDUNDANCY IS PROVIDED BY THE C/W ANNUNCIATOR ARRAY AND THE SM TABLE MAINTENANCE DISPLAY.

IF ALL DATA ON PARAMETER LIMIT VALUES AND/OR STATUS IS INCORRECT, THERE IS NO SAFETY IMPACT TO THE CREW, VEHICLE, OR MISSION. THE CREW MAY MONITOR PARAMETERS VIA GAGES AND/OR CRT DISPLAYS TO ASSURE THAT THEY ARE WITHIN LIMITS.

REFERENCES: ROCKWELL DWG. VS70-730129, SCHEMATIC DRAWING - CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL, VOL. 1, CAUTION & WARNING, 8/31/84; C&W 2102, CAUTION & WARNING WORKBOOK, 8/5/83; JSC-18691, FDF MALFUNCTION PROCEDURES.

REPORT DATE 12/17/87

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INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/09/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1406 ABORT: 3/3

ITEM: C/W ANNUNCIATOR MEMORY (READ/ctr/CLEAR)  
FAILURE MODE: OPEN CIRCUIT

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W ANNUNCIATOR MEMORY SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 35V73A3A5 (PANEL C3A5) - S6  
PART NUMBER: ME452-0102-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

IF THERE IS AN OPEN CIRCUIT IN THE ANNUNCIATOR MEMORY SWITCH, ONE MEANS TO READ WHICH PARAMETERS HAVE BEEN OUT-OF-LIMITS, OR TO CLEAR THE RECALL MEMORY IS LOST. REDUNDANCY IS PROVIDED BY THE STATUS DISPLAY MEMORY SWITCH. LOSS OF THIS FUNCTION HAS NO SAFETY IMPACT ON THE CREW, VEHICLE, OR MISSION.

REFERENCES: ROCKWELL DRAWING VS70-730129 SCHEMATIC DRAWING - CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL, VOL. 1, CAUTION & WARNING, AUGUST 31, 1984; C&W 2102, CAUTION & WARNING WORKBOOK, AUGUST 5, 1983.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/19/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1407 ABORT: 3/3

ITEM: C/W ANNUNCIATOR MEMORY (READ/ctr/CLEAR)  
FAILURE MODE: INADVERTENT OPERATION - STUCK IN "READ"

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W ANNUNCIATOR MEMORY SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

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

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

LOCATION: 35V73A3A5 (PANEL C3A5) - S6  
PART NUMBER: ME452-0102-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

ANNUNCIATOR LIGHTS FOR PARAMETERS WHICH HAVE BEEN OUT-OF-LIMITS SINCE THE LAST MEMORY CLEAR WILL REMAIN ILLUMINATED. MEMORY MAY BE CLEARED USING THE STATUS MATRIX MEMORY SWITCH.

LOSS OF ABILITY TO DISABLE THE READ MODE IS LOSS OF ONE MEANS OF LOCATING A FAILURE. HOWEVER, ALL C/W MONITORED PARAMETERS ARE DISPLAYED ON GAGES AND/OR CRT DISPLAYS, AND MAY BE MONITORED BY THE CREW.

THIS FAILURE HAS NO SAFETY IMPACT IF INTERFACING SUBSYSTEMS ARE OPERATING WITHIN LIMITS.

REFERENCES: ROCKWELL DRAWING VS70-730129 SCHEMATIC DRAWING - CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL, VOL. 1, CAUTION & WARNING, AUGUST 31, 1984; C&W 2102, CAUTION & WARNING WORKBOOK, AUGUST 5, 1983.

REPORT DATE 12/17/87

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INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/19/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1408 ABORT: 3/3

ITEM: C/W ANNUNCIATOR MEMORY (READ/ctr/CLEAR)  
FAILURE MODE: INADVERTENT OPERATION - STUCK IN "CLEAR"

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W ANNUNCIATOR MEMORY SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 35V73A3A5 (PANEL C3A5) - S6  
PART NUMBER: ME452-0102-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

IF THE ANNUNCIATOR MEMORY SWITCH IS STUCK IN THE "CLEAR"  
POSITION, OUT-OF-LIMITS OCCURENCES WILL NOT BE STORED IN RECALL  
MEMORY. ANNUNCIATION OF AN OUT-OF-LIMITS CONDITION WILL OCCUR AS  
USUAL.

THIS IS A NON-ESSENTIAL FUNCTION, AND ITS LOSS HAS NO SAFETY  
IMPACT ON THE CREW, VEHICLE, OR MISSION.

REFERENCES: ROCKWELL DRAWING VS70-730129 SCHEMATIC DRAWING -  
CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL,  
VOL. 1, CAUTION & WARNING, AUGUST 31, 1984; C&W 2102, CAUTION &  
WARNING WORKBOOK, AUGUST 5, 1983.



INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/18/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1409 ABORT: 3/3

ITEM: C/W ANNUNCIATOR LAMP TEST (LEFT/ctr/RIGHT)  
FAILURE MODE: OPEN CIRCUIT

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W ANNUNCIATOR LAMP TEST SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 33V73A6 (PANEL 06) - S14, 33V73A8 (PANEL 08) - S18  
PART NUMBER: ME452-0102-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF ABILITY TO TEST ANNUNCIATOR LAMPS HAS NO SAFETY IMPACT ON  
THE CREW, VEHICLE, OR MISSION.

REFERENCES: ROCKWELL DRAWING VS70-730129 SCHEMATIC DRAWING -  
CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL,  
VOL. 1, CAUTION & WARNING, AUGUST 31, 1984; C&W 2102, CAUTION &  
WARNING WORKBOOK, AUGUST 5, 1983.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/18/87 HIGHEST CRITICALITY HDW/FUNC  
 SUBSYSTEM: D&C FLIGHT: 3/3  
 MDAC ID: 1410 ABORT: 3/3

ITEM: C/W ANNUNCIATOR LAMP TEST (LEFT/ctr/RIGHT)  
 FAILURE MODE: INADVERTENT OPERATION - STUCK IN "LEFT" OR "RIGHT"

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W ANNUNCIATOR LAMP TEST SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 33V73A6 (PANEL 06) - S14, 33V73A8 (PANEL 08) - S18  
 PART NUMBER: ME452-0102-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
 THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

HALF OF THE ANNUNCIATOR LAMPS WILL REMAIN ON; ONE MEANS OF  
 FLAGGING AN OUT-OF-LIMITS CONDITION IS LOST.  
 ANNUNCIATION IS STILL PROVIDED BY THE MASTER ALARM TONE & LIGHTS  
 AND BY SOFTWARE MESSAGES. THE C/W STATUS MATRIX CAN BE CHECKED  
 TO FIND PARAMETERS OUT OF LIMITS. LOSS OF C/W ANNUNCIATION MAY  
 RESULT IN UNANNUNCIATED FAILURE CONDITIONS.  
 LOSS OF C/W ANNUNCIATION HAS NO SAFETY IMPACT IF INTERFACING  
 SUBSYSTEMS ARE OPERATING WITHIN LIMITS; ALL C/W MONITORED  
 QUANTITIES ARE DISPLAYED VIA GAGES AND/OR CRT DISPLAYS, AND MAY  
 BE MONITORED BY THE CREW.

REFERENCES: ROCKWELL DWG. VS70-730129, SCHEMATIC DRAWING -  
 CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL,  
 VOL. 1, CAUTION & WARNING, 8/31/84; C&W 2102, CAUTION & WARNING  
 WORKBOOK, 8/5/83; JSC-18691, FDF MALFUNCTION PROCEDURES.

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INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/18/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1411 ABORT: 3/3

ITEM: ANNUNCIATOR INTENSITY (VAR/BRT)  
FAILURE MODE: OPEN CIRCUIT

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) ANNUNCIATOR INTENSITY SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 33V73A6 (PANEL 06) - S51  
PART NUMBER: ME452-0102-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

AN OPEN CIRCUIT IN THE ANNUNCIATOR INTENSITY SWITCH HAS NO SAFETY  
IMPACT ON THE CREW, VEHICLE, OR MISSION.

REFERENCES: ROCKWELL DRAWING VS70-730129 SCHEMATIC DRAWING -  
CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL,  
VOL. 1, CAUTION & WARNING, AUGUST 31, 1984; C&W 2102, CAUTION &  
WARNING WORKBOOK, AUGUST 5, 1983.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/19/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1412 ABORT: 3/3

ITEM: ANNUNCIATOR INTENSITY (VAR/BRT)  
FAILURE MODE: FAILS TO SWITCH

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) ANNUNCIATOR INTENSITY SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 33V73A6 (PANEL 06) - S51  
PART NUMBER: ME452-0102-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

IF THE ANNUNCIATOR INTENSITY SWITCH IS STUCK IN THE "VARIABLE" OR  
"BRIGHT" POSITION, THERE IS NO IMPACT TO THE CREW, VEHICLE, OR  
MISSION.

REFERENCES: ROCKWELL DRAWING VS70-730129 SCHEMATIC DRAWING -  
CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL,  
VOL. 1, CAUTION & WARNING, AUGUST 31, 1984; C&W 2102, CAUTION &  
WARNING WORKBOOK, AUGUST 5, 1983.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/19/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1413 ABORT: 3/3

ITEM: ANNUNCIATOR INTENSITY KNOB  
FAILURE MODE: OPEN CIRCUIT

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) ANNUNCIATOR INTENSITY KNOB
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 33V73A6 (PANEL 06)  
PART NUMBER: ME452-0093-? OR ME444-0059-? OR ME444-0060-1101

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

AN OPEN CIRCUIT FAILURE IN THE ANNUNCIATOR INTENSITY KNOB HAS NO  
SAFETY IMPACT ON THE CREW, VEHICLE, OR MISSION.

REFERENCES: ROCKWELL DRAWING VS70-730129 SCHEMATIC DRAWING -  
CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL,  
VOL. 1, CAUTION & WARNING, AUGUST 31, 1984; C&W 2102, CAUTION &  
WARNING WORKBOOK, AUGUST 5, 1983.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/19/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1414 ABORT: 3/3

ITEM: ANNUNCIATOR INTENSITY KNOB  
FAILURE MODE: FAILS MID-TRAVEL - UNABLE TO ADJUST

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) ANNUNCIATOR INTENSITY KNOB
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

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

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

LOCATION: 33V73A6 (PANEL 06) - R2  
PART NUMBER: ME452-0102-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

IF THE ANNUNCIATOR INTENSITY KNOB IS FAILED IN ONE POSITION, THE CREW WILL BE UNABLE TO VARY THE INTENSITY OF THE ANNUNCIATOR LIGHTS. THIS HAS NO SAFETY IMPACT ON THE CREW, VEHICLE, OR MISSION.

REFERENCES: ROCKWELL DRAWING VS70-730129 SCHEMATIC DRAWING - CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL, VOL. 1, CAUTION & WARNING, AUGUST 31, 1984; C&W 2102, CAUTION & WARNING WORKBOOK, AUGUST 5, 1983.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/19/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1415 ABORT: 3/3

ITEM: C/W STATUS DISPLAY MEMORY (READ/ctr/CLEAR)  
FAILURE MODE: OPEN CIRCUIT

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W STATUS DISPLAY MEMORY SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 32V73A13A1 (PANEL R13A1) - S2  
PART NUMBER: ME452-0102-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

AN OPEN CIRCUIT IN THE STATUS DISPLAY MEMORY SWITCH CAUSES LOSS OF ONE MEANS TO READ WHICH PARAMETERS HAVE BEEN OUT-OF-LIMITS, OR TO CLEAR RECALL MEMORY. THE ANNUNCIATOR MEMORY SWITCH ALSO PROVIDES THIS FUNCTION.

LOSS OF THIS FUNCTION HAS NO IMPACT TO THE CREW, VEHICLE, OR MISSION.

REFERENCES: ROCKWELL DRAWING VS70-730129 SCHEMATIC DRAWING - CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL, VOL. 1, CAUTION & WARNING, AUGUST 31, 1984; C&W 2102, CAUTION & WARNING WORKBOOK, AUGUST 5, 1983.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/19/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1416 ABORT: 3/3

ITEM: C/W STATUS DISPLAY MEMORY (READ/ctr/CLEAR)  
FAILURE MODE: INADVERTENT OPERATION - STUCK IN "READ"

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W STATUS DISPLAY MEMORY SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 32V73A13A1 (PANEL R13A1) - S2  
PART NUMBER: ME452-0102-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

IF THE STATUS DISPLAY MEMORY SWITCH IS STUCK IN THE "READ" POSITION, STATUS MATRIX LIGHTS FOR PARAMETERS WHICH HAVE BEEN OUT OF LIMITS SINCE THE LAST MEMORY "CLEAR" WILL REMAIN ILLUMINATED. A MASTER ALARM WILL BE ANNUNCIATED AS USUAL IN CASE OF AN OUT-OF-LIMITS CONDITION. THE ANNUNCIATOR MEMORY SWITCH MAY ALSO BE USED TO CLEAR THE MEMORY.

LOSS OF THIS FUNCTION HAS NO SAFETY IMPACT.

REFERENCES: ROCKWELL DRAWING VS70-730129 SCHEMATIC DRAWING - CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL, VOL. 1, CAUTION & WARNING, AUGUST 31, 1984; C&W 2102, CAUTION & WARNING WORKBOOK, AUGUST 5, 1983.



INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/19/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1417 ABORT: 3/3

ITEM: C/W STATUS DISPLAY MEMORY (READ/ctr/CLEAR)  
FAILURE MODE: INADVERTENT OPERATION - STUCK IN "CLEAR"

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W STATUS DISPLAY MEMORY SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 32V73A13A1 (PANEL R13A1) - S2  
PART NUMBER: ME452-0102-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

IF THE STATUS DISPLAY MEMORY SWITCH IS STUCK IN "CLEAR", OUT-OF-LIMITS OCCURENCES WILL NOT BE STORED IN MEMORY. A MASTER ALARM WILL BE ANNUNCIATED AS USUAL. THIS FUNCTION IS NON-ESSENTIAL, AND ITS LOSS HAS NO SAFETY IMPACT.

REFERENCES: ROCKWELL DRAWING VS70-730129 SCHEMATIC DRAWING - CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL, VOL. 1, CAUTION & WARNING, AUGUST 31, 1984; C&W 2102, CAUTION & WARNING WORKBOOK, AUGUST 5, 1983.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/10/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1418 ABORT: 3/3

ITEM: C/W STATUS DISPLAY LAMP TEST (LEFT/ctr/RIGHT)  
FAILURE MODE: OPEN CIRCUIT

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W STATUS DISPLAY LAMP TEST SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 32V73A13A1 (PANEL R13A1) - S3  
PART NUMBER: ME452-0102-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF ABILITY TO TEST THE STATUS MATRIX LIGHTS HAS NO SAFETY  
IMPACT.

REFERENCES: ROCKWELL DRAWING VS70-730129 SCHEMATIC DRAWING -  
CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL,  
VOL. 1, CAUTION & WARNING, AUGUST 31, 1984; C&W 2102, CAUTION &  
WARNING WORKBOOK, AUGUST 5, 1983.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/19/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1419 ABORT: 3/3

ITEM: C/W STATUS DISPLAY LAMP TEST (LEFT/ctr/RIGHT)  
FAILURE MODE: INADVERTENT OPERATION

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W STATUS DISPLAY LAMP TEST SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 32V73A13A1 (PANEL R13A1) - S3  
PART NUMBER: ME452-0102-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

IF THE LAMP TEST SWITCH IS STUCK IN "LEFT" OR "RIGHT", HALF OF THE STATUS MATRIX LIGHTS WILL REMAIN LIT, CAUSING LOSS OF ONE MEANS OF CHECKING WHICH PARAMETERS HAVE BEEN OUT-OF-LIMITS OR ARE CURRENTLY INHIBITED.

IF STUCK IN "LEFT", THE ABILITY TO DISPLAY PARAMETER LIMIT VALUES ON THE C/W STATUS MATRIX IS ALSO LOST. THESE FUNCTIONS MAY BE PERFORMED USING SM SPEC 60 OR GPC READ/WRITE PROCEDURES. THIS FAILURE HAS NO SAFETY IMPACT ON THE CREW, VEHICLE, OR MISSION.

REFERENCES: ROCKWELL DWG. VS70-730129, SCHEMATIC DRAWING - CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL, VOL. 1, CAUTION & WARNING, 8/31/84; C&W 2102, CAUTION & WARNING WORKBOOK, 8/5/83; JSC-18691, FDF MALFUNCTION PROCEDURES.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/09/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1420 ABORT: 3/3

ITEM: C/W MODE (ACK/NORM/ASC)  
FAILURE MODE: OPEN CIRCUIT

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W MODE SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

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

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

LOCATION: 35V73A3A5 (PANEL C3A5) - S7  
PART NUMBER: ME452-0102-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

AN OPEN CIRCUIT IN THE C/W MODE SWITCH WILL CUT OFF POWER TO THE C/W ANNUNCIATOR ARRAY AND THE F2 MA LIGHT. THE FUNCTIONS OF THESE TWO ITEMS MAY BE ACCOMPLISHED USING CRT DISPLAYS AND THE C/W STATUS DISPLAY MATRIX.

LOSS OF C/W ANNUNCIATION HAS NO SAFETY IMPACT IF INTERFACING SUBSYSTEMS ARE OPERATING WITHIN PROPER LIMITS; ALL C/W MONITORED QUANTITIES ARE DISPLAYED VIA GAGES AND/OR CRT DISPLAYS.

REFERENCES: ROCKWELL DWG. VS70-730129, SCHEMATIC DRAWING - CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL, VOL. 1, CAUTION & WARNING, 8/31/84; C&W 2102, CAUTION & WARNING WORKBOOK, 8/5/83; JSC-18691, FDF MALFUNCTION PROCEDURES.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/19/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1421 ABORT: 3/3

ITEM: C/W MODE (ACK/NORM/ASC)  
FAILURE MODE: FAILS TO SWITCH - STUCK IN "ACK"

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W MODE SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 35V73A3A5 (PANEL C3A5) - S7  
PART NUMBER: ME452-0102-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

IF THE C/W MODE SWITCH IS STUCK IN "ACKNOWLEDGE", POWER TO THE  
C/W ANNUNCIATOR DISPLAY IS DISABLED, CAUSING LOSS OF ONE MEANS OF  
FLAGGING AN OUT-OF-LIMITS CONDITION.

THE MASTER ALARM LIGHTS AND TONE AND CRT FAULT MESSAGES PROVIDE  
REDUNDANT ANNUNCIATION, AND THE C/W STATUS DISPLAY ALLOWS THE  
CREW TO CHECK WHICH PARAMETERS ARE OUT-OF-LIMITS.

LOSS OF C/W ANNUNCIATION HAS NO SAFETY IMPACT IF INTERFACING  
SUBSYSTEMS ARE OPERATING PROPERLY; ALL C/W MONITORED QUANTITIES  
ARE DISPLAYED VIA GAGES AND/OR CRT DISPLAYS.

REFERENCES: ROCKWELL DWG. VS70-730129, SCHEMATIC DRAWING -  
CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL,  
VOL. 1, CAUTION & WARNING, 8/31/84; C&W 2102, CAUTION & WARNING  
WORKBOOK, 8/5/83; JSC-18691, FDF MALFUNCTION PROCEDURES.

REPORT DATE 12/17/87

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INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/10/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1422 ABORT: 3/3

ITEM: C/W PARAMETER SELECT  
FAILURE MODE: FAILS TO SWITCH / FAILS MID-TRAVEL

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W PARAMETER SELECT THUMBWHEELS / PUSHWHEELS
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 32V73A13A1 (PANEL R13A1) - S4  
PART NUMBER: MC452-0134-? / ME452-0156-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

FAILURE OF ONE OR MORE PARAMETER SELECT THUMBWHEELS / PUSHWHEELS  
CAUSES INABILITY TO SELECT PARAMETERS USING HARDWARE. THIS  
FUNCTION MAY BE ACCOMPLISHED USING THE SM TABLE MAINTENANCE  
DISPLAY (SPEC 60) OR GPC READ/WRITE PROCEDURES.  
SINCE INITIAL LIMIT VALUES AND STATUS ARE PROGRAMMED INTO READ-  
ONLY MEMORY, AND SINCE THESE PARAMETERS MAY BE MONITORED BY THE  
CREW, LOSS OF ABILITY TO SELECT A PARAMETER HAS NO SAFETY IMPACT.

REFERENCES: ROCKWELL DRAWING VS70-730129 SCHEMATIC DRAWING -  
CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL,  
VOL. 1; CAUTION & WARNING, AUGUST 31, 1984; C&W 2102, CAUTION &  
WARNING WORKBOOK, AUGUST 5, 1983.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/19/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1423 ABORT: 3/3

ITEM: C/W LIMIT SET FUNCTION (SET/ctr/READ)  
FAILURE MODE: OPEN CIRCUIT, FAILS TO SWITCH

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W LIMIT SET FUNCTION SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

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

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

LOCATION: 32V73A13A1 (PANEL R13A1) - S8  
PART NUMBER: ME452-0102-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

IF THE CREW IS UNABLE TO SELECT "SET" OR "READ", THEY WILL BE UNABLE TO SET OR READ PARAMETER LIMIT VALUES USING C/W SWITCHES. THIS FUNCTION MAY BE ACCOMPLISHED USING SM SPEC 60 OR GPC READ/WRITE PROCEDURES.

IF LIMITS ARE INCORRECT FOR A FLIGHT PHASE, OUT-OF-LIMITS CONDITIONS MAY GO UNANNUNCIATED.

HOWEVER, ALL C/W MONITORED PARAMETERS ARE DISPLAYED ON GAGES AND/OR CRT DISPLAYS; LOSS OF C/W ANNUNCIATION HAS NO SAFETY IMPACT IF ALL INTERFACING SUBSYSTEMS ARE OPERATING PROPERLY.

REFERENCES: ROCKWELL DWG. VS70-730129, SCHEMATIC DRAWING - CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL, VOL. 1, CAUTION & WARNING, 8/31/84; C&W 2102, CAUTION & WARNING WORKBOOK, 8/5/83; JSC-18691, FDF MALFUNCTION PROCEDURES.

REPORT DATE 12/17/87

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INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/11/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1424 ABORT: 3/3

ITEM: C/W LIMIT SET LIMIT (UPPER/LOWER)  
FAILURE MODE: OPEN CIRCUIT, FAILS TO SWITCH

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W LIMIT SET LIMIT SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 32V73A13A1 (PANEL R13A1) - S7  
PART NUMBER: ME452-0102-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF CAPABILITY TO READ OR CHANGE PARAMETER LIMIT VALUES USING  
C/W HARDWARE. REDUNDANCY FOR THIS FUNCTION IS PROVIDED BY THE SM  
TABLE MAINTENANCE DISPLAY (SPEC 60).

IF LIMITS ARE INCORRECT FOR A FLIGHT PHASE, OUT-OF-LIMITS  
CONDITIONS MAY GO UNANNUNCIATED.

HOWEVER, ALL C/W MONITORED PARAMETERS ARE DISPLAYED ON GAGES  
AND/OR CRT DISPLAYS; LOSS OF C/W ANNUNCIATION HAS NO SAFETY  
IMPACT IF ALL INTERFACING SUBSYSTEMS ARE OPERATING PROPERLY.

REFERENCES: ROCKWELL DWG. VS70-730129, SCHEMATIC DRAWING -  
CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL,  
VOL. 1, CAUTION & WARNING, 8/31/84; C&W 2102, CAUTION & WARNING  
WORKBOOK, 8/5/83; JSC-18691, FDF MALFUNCTION PROCEDURES.

REPORT DATE 12/17/87

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INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/11/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1425 ABORT: 3/3

ITEM: C/W LIMIT SET VALUE  
FAILURE MODE: OPEN CIRCUIT, FAILS TO SWITCH

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W LIMIT SET VALUE THUMBWHEELS/PUSHWHEELS
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 32V73A13A1 (PANEL R13A1) - S6  
PART NUMBER: MC452-0134-? / ME452-0156-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

FAILURE OF ONE OR MORE VALUE TWS PREVENTS THE CREW FROM SETTING PARAMETER LIMITS USING C/W HARDWARE. PARAMETER LIMITS MAY ALSO BE SET USING SM SPEC 60. IF THE LIMITS ARE INCORRECT FOR A FLIGHT PHASE, AN OUT-OF-LIMITS CONDITION MAY GO UNANNUNCIATED. ALL C/W MONITORED PARAMETERS ARE DISPLAYED ON GAGES AND/OR CRT DISPLAYS; LOSS OF C/W ANNUNCIATION HAS NO SAFETY IMPACT IF INTERFACING SUBSYSTEMS ARE OPERATING WITHIN LIMITS.

REFERENCES: ROCKWELL DWG. VS70-730129, SCHEMATIC DRAWING - CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL, VOL. 1, CAUTION & WARNING, 8/31/84; C&W 2102, CAUTION & WARNING WORKBOOK, 8/5/83; JSC-18691, FDF MALFUNCTION PROCEDURES.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/10/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1426 ABORT: 3/3

ITEM: C/W PARAMETER STATUS (TRIPPED/ctr/INHIBITED)  
FAILURE MODE: OPEN CIRCUIT, FAILS TO SWITCH

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W PARAMETER STATUS SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 32V73A13A1 (PANEL R13A1) - S1  
PART NUMBER: ME452-0102-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF PARAMETER STATUS SWITCH OUTPUT CAUSES LOSS OF THE ABILITY TO CHECK RECALL MEMORY FOR OUT-OF-LIMITS OR INHIBITED PARAMETERS USING THE C/W STATUS MATRIX. THE C/W ANNUNCIATOR ARRAY AND CRT DISPLAYS PROVIDE REDUNDANCY FOR THIS FUNCTION. LOSS OF THIS FUNCTION HAS NO SAFETY IMPACT.

REFERENCES: ROCKWELL DRAWING VS70-730129 SCHEMATIC DRAWING - CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL, VOL. 1, CAUTION & WARNING, AUGUST 31, 1984; C&W 2102, CAUTION & WARNING WORKBOOK, AUGUST 5, 1983.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/19/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1427 ABORT: 3/3

ITEM: C/W PARAMETER STATUS (TRIPPED/ctr/INHIBITED)  
FAILURE MODE: INADVERTENT OPERATION / FAILS CLOSED

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W PARAMETER STATUS SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 32V73A13A1 (PANEL R13A1) - S1  
PART NUMBER: ME452-0102-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

IF THE PARAMETER STATUS SWITCH IS STUCK IN THE "TRIPPED" OR  
"INHIBITED" POSITION, LIGHTS CORRESPONDING TO THOSE PARAMETERS  
WILL BE ILLUMINATED, CAUSING LOSS OF ONE MEANS OF CHECKING THE  
STATUS AND LIMIT VALUES OF PARAMETERS.

THESE FUNCTIONS MAY BE PERFORMED USING THE SM TABLE MAINTENANCE  
DISPLAY.

FAILURE OF THE C/W PARAMETER STATUS SWITCH HAS NO SAFETY IMPACT.

REFERENCES: ROCKWELL DRAWING VS70-730129 SCHEMATIC DRAWING -  
CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL,  
VOL. 1, CAUTION & WARNING, AUGUST 31, 1984; C&W 2102, CAUTION &  
WARNING WORKBOOK, AUGUST 5, 1983.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/10/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1428 ABORT: 3/3

ITEM: C/W PARAMETER (ENABLE/ctr/INHIBIT)  
FAILURE MODE: OPEN CIRCUIT

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W PARAMETER SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 32V73A13A1 (PANEL R13A1) - S9  
PART NUMBER: ME452-0102-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF ABILITY TO ENABLE AN INHIBITED PARAMETER MAY RESULT IN  
OUT-OF-LIMITS CONDITIONS GOING UNANNUNCIATED. REDUNDANCY FOR  
THIS FUNCTION IS PROVIDED BY THE SM TABLE MAINTENANCE DISPLAY.  
LOSS OF C/W ANNUNCIATION HAS NO SAFETY IMPACT IF INTERFACING  
SUBSYSTEMS ARE OPERATING CORRECTLY; ALL C/W MONITORED PARAMETERS  
ARE DISPLAYED VIA GAGES AND/OR CRT DISPLAYS, AND MAY BE MONITORED  
BY THE CREW.

REFERENCES: ROCKWELL DWG. VS70-730129, SCHEMATIC DRAWING -  
CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL,  
VOL. 1, CAUTION & WARNING, 8/31/84; C&W 2102, CAUTION & WARNING  
WORKBOOK, 8/5/83; JSC-18691, FDF MALFUNCTION PROCEDURES.

REPORT DATE 12/17/87

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INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/19/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1429 ABORT: 3/3

ITEM: C/W PARAMETER (ENABLE/ctr/INHIBIT)  
FAILURE MODE: INADVERTENT OPERATION / FAILS TO SWITCH

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W PARAMETER SWITCH
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

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

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

LOCATION: 32V73A13A1 (PANEL R13A1) - S9  
PART NUMBER: ME452-0102-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

IF STUCK IN "ENABLE", OR "INHIBIT", EACH PARAMETER SELECTED BY  
THE PARAMETER SELECT THUMBWHEELS WILL BE ENABLED OR INHIBITED.  
THIS CAN BE CORRECTED USING THE SM TABLE MAINTENANCE DISPLAY.  
IF THE FAILURE IS NOT DISCOVERED, OUT-OF-LIMITS CONDITIONS COULD  
GO UNANNUNCIATED.

LOSS OF C/W ANNUNCIATION HAS NO SAFETY IMPACT IF INTERFACING  
SUBSYSTEMS ARE OPERATING CORRECTLY; ALL C/W MONITORED PARAMETERS  
ARE DISPLAYED VIA GAGES AND/OR CRT DISPLAYS, AND MAY BE MONITORED  
BY THE CREW.

REFERENCES: ROCKWELL DWG. VS70-730129, SCHEMATIC DRAWING -  
CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL,  
VOL. 1, CAUTION & WARNING, 8/31/84; C&W 2102, CAUTION & WARNING  
WORKBOOK, 8/5/83; JSC-18691, FDF MALFUNCTION PROCEDURES.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/10/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1430 ABORT: 3/3

ITEM: C/W TONE VOLUME A (B)  
FAILURE MODE: OPEN CIRCUIT

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W TONE VOLUME A (B)
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 32V73A13A1 (PANEL R13A1) - R1 (R2)  
PART NUMBER: ME452-0093-? OR ME444-0059-? OR ME444-0060-1101

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

AN OPEN CIRCUIT IN ONE TONE VOLUME CONTROL IS A LOSS OF ONE OF TWO AUDIO ANNUNCIATION MEANS.  
LOSS OF C/W ANNUNCIATION HAS NO SAFETY IMPACT IF ALL INTERFACING SUBSYSTEMS ARE OPERATING WITHIN THEIR SPECIFIED LIMITS; ALL C/W MONITORED PARAMETERS ARE DISPLAYED VIA GAGES AND/OR CRT DISPLAYS, AND MAY BE MONITORED BY THE CREW.

REFERENCES: ROCKWELL DWG. VS70-730129, SCHEMATIC DRAWING - CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL, VOL. 1, CAUTION & WARNING, 8/31/84; C&W 2102, CAUTION & WARNING WORKBOOK, 8/5/83; JSC-18691, FDF MALFUNCTION PROCEDURES.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/19/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1431 ABORT: 3/3

ITEM: C/W TONE VOLUME A (B)  
FAILURE MODE: FAILS MID-TRAVEL - STUCK IN ONE POSITION

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W TONE VOLUME A (B)
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 32V73A13A1 (PANEL R13A1) - R1 (R2)  
PART NUMBER: ME452-0093-? OR ME444-0059-? OR ME444-0060-1101

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

IF A TONE VOLUME CONTROL KNOB IS STUCK IN ONE POSITION, THE CREW IS UNABLE TO VARY THE VOLUME OF THE KLAXON, SIREN, C/W AND SM ALERT TONES.

THIS HAS NO SAFETY IMPACT.

REFERENCES: ROCKWELL DRAWING VS70-730129 SCHEMATIC DRAWING - CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL, VOL. 1, CAUTION & WARNING, AUGUST 31, 1984; C&W 2102, CAUTION & WARNING WORKBOOK, AUGUST 5, 1983.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1432 ABORT: 3/3

ITEM: MASTER ALARM  
FAILURE MODE: FAILS TO INDICATE

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) MASTER ALARM PBI
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 34V73A2 - S1, 34V73A4 - S1, 36V73A7A1 - S51,  
80V73A124 - S3  
PART NUMBER: ME452-0060-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

FAILURE OF ONE OF THE FOUR MASTER ALARM INDICATORS IS A LOSS OF ONE MEANS OF ANNUNCIATING AN OUT-OF-LIMITS CONDITION. REDUNDANT ANNUNCIATION IS PROVIDED BY THE 3 REMAINING MA INDICATORS, C/W ANNUNCIATOR ARRAY LIGHTS AND ALARM TONES. LOSS OF C/W ANNUNCIATION HAS NO SAFETY IMPACT IF ALL INTERFACING SUBSYSTEMS ARE OPERATING WITHIN THEIR SPECIFIED LIMITS; ALL C/W MONITORED QUANTITIES ARE DISPLAYED VIA GAGES AND/OR CRT DISPLAYS.

REFERENCES: ROCKWELL DWG. VS70-730129, SCHEMATIC DRAWING - CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL, VOL. 1, CAUTION & WARNING, 8/31/84; C&W 2102, CAUTION & WARNING WORKBOOK, 8/5/83; JSC-18691, FDF MALFUNCTION PROCEDURES.



INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/17/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1433 ABORT: 3/3

ITEM: MASTER ALARM  
FAILURE MODE: FAILS TO REMAIN OPEN / INADVERTENT OPERATION

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) MASTER ALARM PBI
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

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

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

LOCATION: 34V73A2 - S1, 34V73A4 - S1, 36V73A7A1 - S51,  
80V73A124 - S3  
PART NUMBER: ME452-0060-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

IF A MASTER ALARM PBI IS FAILED CLOSED, A RESET DISCRETE IS SENT  
TO THE ALARM SYSTEMS, RESETTING ALL AUDIO ALARMS.

THE C/W ANNUNCIATOR LIGHTS WILL REMAIN LIT UNTIL THE OUT-OF-  
LIMITS PARAMETERS ARE WITHIN LIMITS FOR THE SPECIFIED NUMBER OF  
CYCLES.

THIS FAILURE MAY BE CORRECTED BY CYCLING THE C/W POWER; IT HAS  
NO SAFETY IMPACT TO THE CREW, VEHICLE, OR MISSION IF INTERFACING  
SUBSYSTEMS ARE OPERATING CORRECTLY.

REFERENCES: ROCKWELL DWG. VS70-730129, SCHEMATIC DRAWING -  
CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL,  
VOL. 1, CAUTION & WARNING, 8/31/84; C&W 2102, CAUTION & WARNING  
WORKBOOK, 8/5/83; JSC-18691, FDF MALFUNCTION PROCEDURES.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/29/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1434 ABORT: 3/3

ITEM: MASTER ALARM  
FAILURE MODE: FAILS TO CLOSE

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) MASTER ALARM PBI
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

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

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

LOCATION: 34V73A2 - S1, 34V73A4 - S1, 36V73A7A1 - S51,  
80V73A124 - S3

PART NUMBER: ME452-0060-?

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

IF ONE MA PBI FAILS TO RESET AN ALARM TONE, ONE OF THE THREE  
REMAINING MA PBI'S MAY BE USED. IF ALL FOUR ARE FAILED OPEN,  
ALARMS MAY BE RESET BY CYCLING C/W SYSTEM A & B POWER, OR ALARMS  
MAY BE DISABLED.

THIS FAILURE HAS NO SAFETY IMPACT IF INTERFACING SUBSYSTEMS ARE  
OPERATING WITHIN SPECIFIED LIMITS.

REFERENCES: ROCKWELL DRAWING VS70-730129, SCHEMATIC DRAWING -  
CAUTION & WARNING SUBSYSTEM; C&W 2102, CAUTION & WARNING  
WORKBOOK, AUGUST 5, 1983; JSC-18691, FDF MALFUNCTION PROCEDURES,  
ALL VEHICLES, BASIC REV. B, 10/10/85.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/19/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 3/3  
MDAC ID: 1435 ABORT: 3/3

ITEM: C/W A, C/W B  
FAILURE MODE: OPEN CIRCUIT

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W CIRCUIT BREAKERS
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 33V73A13 (PANEL 013) - CB1, CB9  
PART NUMBER: MC454-0026-2030 OR MC454-0032-3130

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

FAILURE OF THE C/W A CIRCUIT BREAKER CAUSES LOSS OF THE PRIMARY  
C&W SYSTEM; FAILURE OF THE C/W B CIRCUIT BREAKER CAUSES LOSS OF  
ALL C/W LIGHTS AND TONES.

LOSS OF C/W ANNUNCIATION HAS NO SAFETY IMPACT IF INTERFACING  
SUBSYSTEMS ARE OPERATING WITHIN THEIR SPECIFIED LIMITS; ALL C/W  
MONITORED QUANTITIES ARE ALSO DISPLAYED VIA GAGES AND/OR CRT  
DISPLAYS.

REFERENCES: ROCKWELL DRAWING VS70-730129, SCHEMATIC DRAWING -  
CAUTION & WARNING SUBSYSTEM; SHUTTLE FLIGHT OPERATIONS MANUAL,  
VOL. 1, CAUTION & WARNING, AUGUST 31, 1984; C&W 2102, CAUTION &  
WARNING WORKBOOK, AUGUST 5, 1983; JSC-12820, NASA - JSC FLIGHT

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/19/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 3/3  
MDAC ID: 1436 ABORT: 3/3

ITEM: C/W A, C/W B, PWR CKT  
FAILURE MODE: FAILS TO OPEN THE CIRCUIT

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W CIRCUIT BREAKERS
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

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

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

LOCATION: 33V73A13 (PANEL 013) - CB1, CB9  
PART NUMBER: MC454-0026-2030 OR MC454-0032-3130

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

FAILURE TO BREAK THE CIRCUIT MAY RESULT IN DAMAGE TO THE C/W  
SYSTEM, DISABLING IT.  
LOSS OF C/W ANNUNCIATION HAS NO SAFETY IMPACT IF INTERFACING  
SUBSYSTEMS ARE OPERATING WITHIN THEIR SPECIFIED LIMITS; ALL C/W  
MONITORED QUANTITIES ARE ALSO DISPLAYED VIA GAGES AND/OR CRT  
DISPLAYS.

REFERENCES: ROCKWELL DRAWING VS70-730129 SCHEMATIC DRAWING -  
CAUTION & WARNING SUBSYSTEM; C&W 2102, CAUTION & WARNING  
WORKBOOK, AUGUST 5, 1983.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1437 ABORT: 3/3

ITEM: C/W LIMIT MODULE  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W LIMIT MODULE
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 83V73A4A1 (BAY 3A)  
PART NUMBER: MC409-0012-0093? (-0103?)

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF PARAMETER LIMIT VALUES HAS NO SAFETY IMPACT IF ALL  
INTERFACING SUBSYSTEMS ARE OPERATING WITHIN LIMITS.

REFERENCES: ROCKWELL DRAWING VS70-730129 SCHEMATIC DRAWING -  
CAUTION & WARNING SUBSYSTEM; C&W 2102, CAUTION & WARNING  
WORKBOOK, AUGUST 5, 1983; JSC-18691, FDF MALFUNCTION PROCEDURES,  
ALL VEHICLES, BASIC REV. B, 10/10/85.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/24/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: /  
MDAC ID: 1438 ABORT: /

ITEM: C/W LIMIT MODULE  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: E.E. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) CAUTION & WARNING
- 3) C/W LIMIT MODULE
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: 83V73A4A1 (BAY 3A)  
PART NUMBER: MC409-0012-0093? (-0103?)

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART FAILURE,  
THERMAL SHOCK, VIBRATION

EFFECTS/RATIONALE:

LOSS OF PARAMETER LIMIT VALUES HAS NO SAFETY IMPACT IF ALL  
INTERFACING SUBSYSTEMS ARE OPERATING WITHIN LIMITS.

REFERENCES: ROCKWELL DRAWING VS70-730129 SCHEMATIC DRAWING -  
CAUTION & WARNING SUBSYSTEM; C&W 2102, CAUTION & WARNING  
WORKBOOK, AUGUST 5, 1983; JSC-18691, FDF MALFUNCTION PROCEDURES,  
ALL VEHICLES, BASIC REV. B, 10/10/85.

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/09/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/1R  
MDAC ID: 1601 ABORT: 3/1R

ITEM: ACA  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ACA
- 3)
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL 014, 015, 016, 06, A6A1  
PART NUMBER: MC434-0283-0003

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

LAMPS WILL NOT BE ILLUMINATED. OTHER DIPLAYS, CRT, AND AUDIBLE ALARM CAN PROVIDE INFORMATION. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO ABSENCE OF A REQUIRED CREW RESPONSE DURING MANUAL MODE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/09/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 3/1R  
MDAC ID: 1602 ABORT: 3/1R

ITEM: ACA PWR CKT  
FAILURE MODE: FAILED OPEN

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ACA
- 3) PWR CKT
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL 014, 015, 016, 06, A6A1  
PART NUMBER: MC434-0283-0003

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

LAMPS WILL NOT BE ILLUMINATE. OTHER DISPLAYS, CRT, AND AUDIBLE ALARM CAN PROVIDE INFORMATION. LOSS OF ALL REDUNDANCY MAY CAUSE LOSS OF CREW/VEHICLE DUE TO ABSENCE OF A REQUIRED CREW RESPONSE DURING MANUAL MODE. CKD CONSIST OF CB, BUS SELECT, INTENSITY SW, RESISTORS, AND TEST SW.

REFERENCES:



INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/09/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 3/3  
MDAC ID: 1603 ABORT: 3/3

ITEM: ACA PWR CKT  
FAILURE MODE: FAILED CLOSED

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ACA
- 3) PWR CKT
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL 014, 015, 016, 06, A6A1  
PART NUMBER: MC434-0283-0003

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

NONE. CKT NORMALLY CLOSED. CKT CONSIST OF CB, BUS SELECT SW,  
INTENSITY SW, RESISTORS, AND TEST SW.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/09/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 3/3  
MDAC ID: 1604 ABORT: 3/3

ITEM: ACA PWR CKT-EVENT  
FAILURE MODE: FAILED OPEN

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ACA
- 3) PWR CKT
- 4) EVENTS
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL 014, 015, 016, 06, A6A1  
PART NUMBER: MC434-0075-0012

CAUSES: CONTAMINATION, SHOCK, VIBRATION

EFFECTS/RATIONALE:

LAMPS WILL NOT BE ILLUMINATE. OTHER DISPLAYS, CRT, AND AUDIBLE ALARM CAN PROVIDE INFORMATION. CKT CONSIST OF CB, BUS SELECT, SW, RESISTORS, AND TEST SW.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 6/18/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 3/3  
MDAC ID: 1701 ABORT: 3/3

ITEM: CIRCUIT BREAKER-PQI  
FAILURE MODE: FAILS OPEN

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) OMS/RCS QUANTITY GAUGE
- 3) CIRCUIT BREAKER
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

CRITICALITIES

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

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

LOCATION: PNL 03  
PART NUMBER: MC454-0026-2030

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

EFFECTS/RATIONALE:

LOSS OF OUTPUT FOR OMS/RCS QUANTITY GAUGE - NOT CRITICAL FOR  
FLIGHT - ONLY ACCURATE SOURCE OF PROPELLANT QUANTITY IS GROUND  
CALCULATIONS. NOTE: THE OMS WORKSHEETS 187, 188, 189, 606, AND  
613 COVER ALL OTHER QUANTITY GAUGE FAILURE MODES.

REFERENCES: (1) 73P880001, (2) JSC 12770, (3) JSC 1174,11.2, (4)  
JSC 19950, (5) JSC 18958

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/13/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1702 ABORT: 3/3

ITEM: SWITCH ROTARY, RCS/OMS PROPELLANT QUANTITY GAUGE  
FAILURE MODE: FAILS TO SWITCH; (POLES STUCK IN ONE OF THREE  
POSITION OR POLES FAIL TO MAKE CONTACT IN ANY POSITION)

LEAD ANALYST: V.J. BURKEMPER SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ELECTRICAL COMPONENTS
- 3) INSTRUMENTATION
- 4) PROP STOR & DIST SUBSYSTEM
- 5) SWITCH ROTARY, RCS/OMS PROPELLANT QUANTITY GAUGE
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL 03 S11  
PART NUMBER: 33V73A3-S11

CAUSES: CONTAMINATION, VIBRATION, PIECE-PART FAILURE, OVERLOAD

EFFECTS/RATIONALE:

LOSE CAPABILITY TO SELECT OMS/RCS/KIT PROPELLANT QUANTITY FOR VISUAL DISPLAY ON METER M12. THERE ARE TWO OTHER REDUNDANT MEASUREMENT PATHS FOR THE OMS AND ONE REDUNDANT PATH FOR RCS. IN THE OMS, ONE PATH IS THROUGH THE GPC THE OTHER HARDWIRED TO THE GSE PNL (J207). LOSS OF ALL QUANTITY PATHS HAVE NO EFFECT SINCE GROUND CALCULATIONS WOULD STILL BE AVAILABLE.

REFERENCES: VS70-943099 REV A EO B12

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/13/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1703 ABORT: 3/3

ITEM: METER, RCS/OMS PROPELLANT QUANTITY GAUGE  
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: V.J. BURKEMPER SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ELECTRICAL COMPONENTS
- 3) INSTRUMENTATION
- 4) PROP STOR & DIST SUBSYSTEM
- 5) METER, RCS/OMS PROPELLANT QUANTITY GAUGE
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL 03 M12  
PART NUMBER: 33V73A3-M12

CAUSES: CONTAMINATION, VIBRATION, PIECE-PART FAILURE, OVERLOAD

EFFECTS/RATIONALE:

LOSE CAPABILITY TO SELECT OMS/RCS/KIT PROPELLANT QUANTITY FOR VISUAL DISPLAY ON METER M12. THERE ARE TWO OTHER REDUNDANT MEASUREMENT PATHS FOR THE OMS AND ONE REDUNDANT PATH FOR RCS. IN THE OMS, ONE PATH IS THROUGH THE GPC THE OTHER HARDWIRED TO THE GSE PNL (J207). LOSS OF ALL QUANTITY PATHS HAVE NO EFFECT SINCE GROUND CALCULATIONS WOULD STILL BE AVAILABLE.

REFERENCES: VS70-943099 REV A EO B12

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/13/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1704 ABORT: 3/3

ITEM: TOTALIZER  
FAILURE MODE: ERRATIC OPERATION

LEAD ANALYST: C.D. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HARDWARE COMPONENTS
- 3) ASSEMBLIES
- 4) PROP STOR & DIST SUBSYSTEM
- 5) PROPELLANT GAGING ASSEMBLY
- 6) TOTALIZER
- 7)
- 8)
- 9)

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

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

LOCATION:

PART NUMBER: 73P880001

CAUSES: IMPROPER INPUT, CONTAMINATION, MANUFACTURING DEFECT,  
MISHANDLING, PIECE-PART FAILURE

EFFECTS/RATIONALE:

ERRATIC OPERATION IS NO EFFECT. LOSS OF LOW QUANTITY WARNING  
COULD ALLOW HELIUM INGESTION AND PROP DEPLETION, HOWEVER PROP  
MANAGEMENT AND TRACKING IS SUCH THAT UNEXPECTED/UNDESIRE  
DEPLETION OF PROP IS UNCREDIBLE. LOSS OF OUTPUT COULD ALLOW  
FAILURE OF  
COMMUNICATION SCREEN AND PASSAGE OF HELIUM INTO AFT COMPARTMENT  
TO GO UNDETECTED (REQUIRES MULTIPLE FAILURES).

REFERENCES: 1) 73P880001 2) JSC 12770 3) JSC 11174, 11.2 4)  
JSC 19950 5) JSC 18958

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/13/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1705 ABORT: 3/3

ITEM: TOTALIZER  
FAILURE MODE: ERRONEOUS INDICATION

LEAD ANALYST: C.D. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HARDWARE COMPONENTS
- 3) ASSEMBLIES
- 4) PROP STOR & DIST SUBSYSTEM
- 5) PROPELLANT GAGING ASSEMBLY
- 6) TOTALIZER
- 7)
- 8)
- 9)

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

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

LOCATION:  
PART NUMBER: 73P880001

CAUSES: IMPROPER INPUT, CONTAMINATION, MANUFACTURING DEFECT,  
MISHANDLING, PIECE-PART FAILURE

EFFECTS/RATIONALE:  
ERRONEOUS INDICATIONS OF PROP QUANTITY OR LOW LEVEL QUANTITY ARE  
NO EFFECT. PROP MANAGEMENT AND TRACKING IS SUCH THAT ACTUAL PROP  
QUANTITY IS KNOWN. ERRONEOUS INDICATION OF COMMUNICATION SCREEN  
FAILURE AND PASSAGE OF HELIUM WOULD RESULT IN THE  
PERFORMANCE OF ULLAGE BURNS PRIOR TO OMS BURNS AND POSSIBLE LOSS  
OF INTERCONNECT CAPABILITY FROM AFFECTED TANK.

REFERENCES: 1) 73P880001 2) JSC 12770 3) JSC 11174, 11.2 4)  
JSC 19950 5) JSC 18958

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 8/13/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1706 ABORT: 3/3

ITEM: TOTALIZER  
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: C.D. PRUST SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) HARDWARE COMPONENTS
- 3) ASSEMBLIES
- 4) PROP STOR & DIST SUBSYSTEM
- 5) PROPELLANT GAGING ASSEMBLY
- 6) TOTALIZER
- 7)
- 8)
- 9)

CRITICALITIES

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

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

LOCATION:

PART NUMBER: 73P880001

CAUSES: LOSS OF INPUT POWER, CONTAMINATION, MANUFACTURING DEFECT, MISHANDLING, PIECE-PART FAILURE

EFFECTS/RATIONALE:

LOSS OF OUTPUT IS NO EFFECT. LOSS OF LOW QUANTITY WARNING COULD ALLOW HELIUM INGESTION AND PROP DEPLETION, HOWEVER PROP MANAGEMENT AND TRACKING IS SUCH THAT UNEXPECTED/UNDESIRE DEPLETION OF PROP IS UNCREDIBLE. LOSS OF OUTPUT COULD ALLOW FAILURE OF COMMUNICATION SCREEN AND PASSAGE OF HELIUM INTO AFT COMPARTMENT TO GO UNDETECTED (REQUIRES MULTIPLE FAILURES).

REFERENCES: 1) 73P880001 2) JSC 12770 3) JSC 11174, 11.2 4) JSC 19950 5) JSC 18958



INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/27/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1801 ABORT: 3/3

ITEM: ILLUMINATION-FLD LTS  
FAILURE MODE: FAILED OPEN

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ILLUMINATION
- 3) FLOOD LIGHTS
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: AVIONIC BAY  
PART NUMBER: MC434-0068-0014

CAUSES: VIBRATION, SHOCK, CONTAMINATION

EFFECTS/RATIONALE:  
NONE, LOSS OF FLOOD LIGHTS NOT CRITICAL, INTERNAL LIGHTING PROVIDES ADEQUATE ILLUMINATION. CRIT 3/2R FOR PAYLOAD BAY AND DOCKING.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/27/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1802 ABORT: 3/3

ITEM: ILLUMINATION-POT  
FAILURE MODE: FAILED OPEN

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ILLUMINATION
- 3) POTENTIOMETERS
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: PNL 06,08, AFT  
PART NUMBER: MC444-0059-1002-1012

CAUSES: VIBRATION, SHOCK, CONTAMINATION

EFFECTS/RATIONALE:

NONE, LOSS OF CAPABILITY TO DIM OR INCREASE ILLUMINATION. NOT  
CRITICAL TO CREW/VEHICLE OR MISSION.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/27/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/3  
MDAC ID: 1803 ABORT: 3/3

ITEM: ILLUMINATION CONTROL CKT  
FAILURE MODE: FAIL OPEN

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ILLUMINATION
- 3) CONTROL CKT
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: AVIONIC BAY  
PART NUMBER:

CAUSES: VIBRATION, SHOCK, CONTAMINATION

EFFECTS/RATIONALE:  
NONE, CREW CAN USE OTHER AVAILABLE LIGHTING. CIRCUIT CONTAINS  
CB, VAR POT, SW, FUSES AND STEP-DN TRANSFORMER

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/27/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C FLIGHT: 3/2R  
MDAC ID: 1804 ABORT: 3/3

ITEM: ILLUMINATION-SPOTLIGHTS  
FAILURE MODE: FAIL OPEN

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ILLUMINATION
- 3) SPOTLIGHTS
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: MID FUSLG  
PART NUMBER: MC434-0062-0011,-0035

CAUSES: SHOCK, VIBRATION, CONTAMINATION

EFFECTS/RATIONALE:  
LOSS OF ILLUMINATION MAY EFFECT THE MISSION OPERATION DUE TO POOR VISIBILITY.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/27/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 3/3  
MDAC ID: 1810 ABORT: 3/3

ITEM: ILLUMINATION PWR CKT  
FAILURE MODE: FAIL OPEN

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ILLUMINATION
- 3) POWER CIRCUIT
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: AVIONIC BAY  
PART NUMBER:

CAUSES: SHOCK, CONTAMINATION, VIBRATION

EFFECTS/RATIONALE:

NONE. LOSS OF ILLUMINATION NOT CRITICAL TO CREW/VEHICLE SAFETY OR MISSION COMPLETION. PWER CIRCUIT CONSIST OF CB, RESISTORS, SW, AND RPC.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT  
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 7/28/87 HIGHEST CRITICALITY HDW/FUNC  
SUBSYSTEM: D&C/EPD&C FLIGHT: 3/3  
MDAC ID: 1811 ABORT: 3/3

ITEM: ILLUMINATION-PWR CKT  
FAILURE MODE: FAIL CLOSED

LEAD ANALYST: W.H. TRAHAN SUBSYS LEAD: W.H. TRAHAN

BREAKDOWN HIERARCHY:

- 1) D&C
- 2) ILLUMINATION
- 3) PWR CKT
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)

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

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

LOCATION: AVIONIC BAY  
PART NUMBER:

CAUSES: SHOCK, CONTAMINATION, VIBRATION

EFFECTS/RATIONALE:

NONE. UNABLE TO VARY THE INTENSITY OF THE ILLUMINATION, OR TURN OFF THE ILLUMINATION. PWR CKT CONSIST OF CB'S, SW, RPC'S, RESISTORS, AND FUSES.

REFERENCES:

APPENDIX D  
POTENTIAL CRITICAL ITEMS

<u>MDAC</u>	<u>ITEM</u>	<u>FAILURE MODE</u>
101	HUDE	ERRONEOUS OUTPUT
102	HUDE	LOSS OF OUTPUT
103	PDU	ERRONEOUS OUTPUT
104	PDU	LOSS OF OUTPUT
106	HUD-RESISTOR CUR LM	FAILS OPEN
107	HUD SW ON/OFF	FAILS OPEN
110	HUD - RPC	FAIL OPEN
1804	ILLUM SPOTLT	FAIL OPEN







**MCDONNELL DOUGLAS ASTRONAUTICS COMPANY - HOUSTON**  
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