# INDEPENDENT ORBITER ASSESSMENT

## ANALYSIS
## OF THE
## GUIDANCE, NAVIGATION,
## AND CONTROL SUBSYSTEM

**19 DECEMBER 1986**

MCDONNELL DOUGLAS ASTRONAUTICS COMPANY
HOUSTON DIVISION

SPACE TRANSPORTATION SYSTEM ENGINEERING AND OPERATIONS SUPPORT

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# INDEPENDENT ORBITER ASSESSMENT ANALYSIS OF THE GUIDANCE, NAVIGATION, AND CONTROL SUBSYSTEM

19 DECEMBER 1986

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## 1.0 EXECUTIVE SUMMARY

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

The function of the GNC hardware is to respond to guidance, navigation, and control software commands to effect vehicle control and to provide sensor and controller data to GNC software. The GNC hardware for which failure modes analysis was performed consists of the following :

- Rotational Hand Controller (RHC)
- Translational Hand Controller (THC)
- Rudder Pedal Transducer Assembly (RPTA)
- Speed Brake Thrust Controller (SBTC)
- Inertial Measurement Unit (IMU)
- Star Tracker (ST)
- Crew Optical Alignment Site (COAS)
- Air Data Transducer Assembly (ADTA)
- Orbiter Rate Gyro Assembly (ORGA)
- SRB Rate Gyro Assembly (SRGA)
- Accelerometer Assembly (AA)
- Aerosurface Servo Amplifier (ASA)
- Reaction Jet Driver (RJD)
- Ascent Thrust Vector Control (ATVC)
- GNC Function Switches and Circuits
- Power Switches and Circuits

The IOA analysis process utilized available GNC 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 sixteen major subdivisions of the GNC 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 : | 3 | 12 | 8 | 67 | 21 | 30 | 141 |

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 : | 3 | 12 | 8 | 1 | - | 24 |

# GNC OVERVIEW ANALYSIS SUMMARY

**RHC**

| CRIT | #FM | #PCI |
|---|---|---|
| 2/1R | 1 | 1 |
| 3/1R | 2 | 0 |
| 3/3 | 2 | 0 |

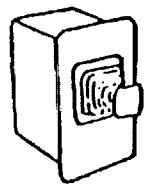
RHC

**GNC ANALYSIS SUMMARY**

| CRIT | #FM | #PCI |
|---|---|---|
| 1/1 | 3 | 3 |
| 2/1R | 12 | 12 |
| 2/2 | 8 | 8 |
| 3/1R | 67 | 1 |
| 3/2R | 21 | 0 |
| 3/3 | 30 | 0 |
| TOTALS | 141 | 24 |

**THC**

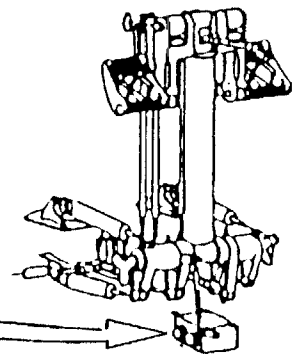
| CRIT | #FM | #PCI |
|---|---|---|
| 2/1R | 2 | 2 |
| 3/1R | 1 | 0 |



THC

**RPTA**

| CRIT | #FM | #PCI |
|---|---|---|
| 2/1R | 1 | 1 |
| 3/1R | 3 | 0 |



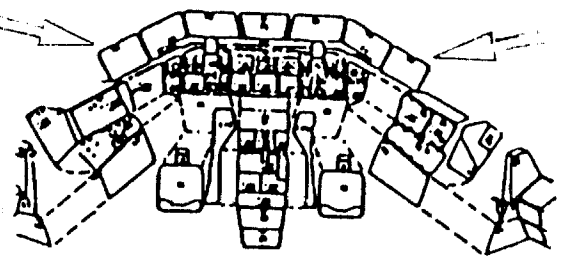
**SBTC**

| CRIT | #FM | #PCI |
|---|---|---|
| 2/1R | 1 | 1 |
| 3/1R | 4 | 0 |

SBTC

**FUNCTION SWITCHES**

| CRIT | #FM | #PCI |
|---|---|---|
| 1/1 | 1 | 1 |
| 2/1R | 3 | 3 |
| 2/2 | 8 | 8 |
| 3/1R | 14 | 0 |
| 3/2R | 21 | 0 |
| 3/3 | 10 | 0 |



FLIGHT STATION

**POWER SWITCHES & CIRCUITS**

| CRIT | #FM | #PCI |
|---|---|---|
| 3/1R | 17 | 0 |
| 3/3 | 17 | 0 |

Figure 1 - GNC OVERVIEW ANALYSIS SUMMARY

# GNC OVERVIEW ANALYSIS SUMMARY CONTINUED

| ADTA | | |
|---|---|---|
| CRIT | #FM | #PCI |
| 3/1R | 2 | 0 |

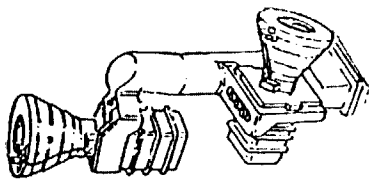
| ATVC | | |
|---|---|---|
| CRIT | #FM | #PCI |
| 2/1R | 2 | 2 |
| 3/1R | 3 | 0 |

| AA | | |
|---|---|---|
| CRIT | #FM | #PCI |
| 3/1R | 2 | 0 |

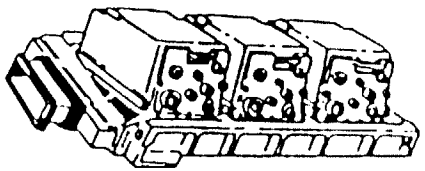
| ST | | |
|---|---|---|
| CRIT | #FM | #PCI |
| 3/1R | 2 | 0 |

| IMU | | |
|---|---|---|
| CRIT | #FM | #PCI |
| 2/1R | 1 | 1 |
| 3/1R | 1 | 1 |

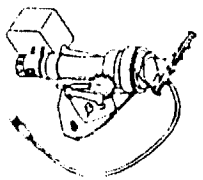
| COAS | | |
|---|---|---|
| CRIT | #FM | #PCI |
| 3/1R | 1 | 0 |
| 3/3 | 1 | 0 |



ST



IMUs



COAS

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

| ORGA | | |
|---|---|---|
| CRIT | #FM | #PCI |
| 3/1R | 2 | 0 |

| RJD | | |
|---|---|---|
| CRIT | #FM | #PCI |
| 1/1 | 2 | 2 |
| 3/1R | 4 | 0 |

| ASA | | |
|---|---|---|
| CRIT | #FM | #PCI |
| 2/1R | 1 | 1 |
| 3/1R | 7 | 0 |

| SRGA | | |
|---|---|---|
| CRIT | #FM | #PCI |
| 3/1R | 2 | 0 |

Figure 1 - GNC OVERVIEW ANALYSIS SUMMARY - CONTINUED

## 2.0 INTRODUCTION

### 2.1 Purpose

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

### 2.2 Scope

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

### 2.3 Analysis Approach

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

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

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

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

Step 4.0 Compare IOA analysis data to 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 GNC Ground Rules and Assumptions

The GNC 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 GNC hardware is to respond to guidance, navigation, and control software commands to effect vehicle control and to provide sensor and controller data to GNC software.

The functions of the GNC software can be divided into flight control, guidance, navigation, hardware data processing, and crew display. The specific tasks of each function, as well as the GNC hardware used to support them, vary with mission phase.

Figure 2 is an overview of the GNC hardware for which failure modes analysis was performed. For the analysis, the hardware was divided into the following three categories:

I. MAJOR COMPONENTS (BLACK BOXES) - This category includes the sensors, manual controllers, and effector interfaces listed below:

| | |
|---|---|
| (1) RHC | (8) ADTA |
| (2) THC | (9) RGA (ORB) |
| (3) RPTA | (10) RGA (SRB) |
| (4) SBTC | (11) AA |
| (5) IMU | (12) ASA |
| (6) ST | (13) RJD |
| (7) COAS | (14) ATVC |

Figures 3 - 16 provide a hardware breakdown of each of the above components.

II. FUNCTION SWITCHES AND CIRCUITS - This category consists of switches/circuits whose primary purpose is to select a particular mode of operation for the GNC software. Twelve groups were identified and are listed below:

| | |
|---|---|
| (1) TRIM ENABLE/INHIBIT SWs | (8) ATT REF PBI |
| (2) TRIM SWs | (9) ENTRY MODE SW CKT |
| (3) TRIM ON/OFF SWs | (10) ABORT MODE CKT |
| (4) SENSE -Z/-X SW | (11) DAP PBIs |
| (5) P,R/Y CSS/AUTO PBIs | (12) FCS CHNL CNTL CKT |
| (6) SPD BK/THROT PBIs | |
| (7) BODY FLAP CNTL CKT | |

III. POWER SWITCHES AND CIRCUITS - This category consists of groups of switches/circuits that provide electrical power to the major components and Flight Control System (FCS) annunciator lamps. Twelve groups were identified and are listed below:

(1) FLT CNTLR PWR CKT
(2) IMU PWR CKT
(3) ST PWR CKT
(4) COAS PWR CKT
(5) ADTA PWR CKT
(6) RGA (ORB) PWR CKT
(7) RGA (SRB) PWR CKT
(8) AA PWR CKT
(9) ASA PWR CKT
(10) RJD PWR CKT
(11) ATVC PWR CKT
(12) FCS SW ANNUN CKT

A brief description of the major components and function switches and circuits is provided below.

1. Three RHCs, two forward and one aft, provide manual attitude control.

2. Two THCs, one at the CDRs station and one aft, provide manual translation control with the use of the RCS system.

3. Two RPTAs, one connected to the CDRs pedals and one to the PLTs, send rudder and nose wheel steering commands to the GPCs.

4. Two SBTCs, one at the CDRs station and one at the PLTs, control the speed brake during entry. The pilot's SBTC can also be used for main engine throttle control during ascent.

5. Three IMUs, attached to the NAV base, provide acceleration and attitude data to the GPCs.

6. Two STs, mounted on the NAV base, are used to align the IMUs and to provide line of site vectors during rendezvous missions.

7. One COAS that can be mounted at the CDRs station or the aft station is a backup to the STs for use in IMU alignment.

8. Four ADTAs, located in the forward avionics bay, provide pressure data to the GPCs. This data is used during entry to calculate angle of attack, relative speed, mach number, and barometric altitude.

9. Four orbiter RGAs, mounted at the bottom of the aft bulkhead, provide attitude rates about each body axis to flight control for stability augmentation during ascent and entry. The RGAs also drive the rate needles of the ADIs during ascent.

10. Four SRB RGAs, two on the left and two on the right SRB, provide pitch and yaw rates to flight control to assist in SRB TVC and to provide stability augmentation during ascent until SRB separation.

11. Four AAs, located in the forward avionics bays, measure normal and lateral body acceleration for use in flight control to provide stability augmentation during ascent and entry.

12. Four ASAs, located in the aft avionics bays, derive aerosurface actuator position error commands and perform fault detection.

13. Four RJDs, two forward and two aft, in response to flight control commands, send signals to open/close the oxidizer and fuel valves associated with each RCS jet.

14. Four ATVCs, located in the aft avionics bays, provide SRB and main engine gimbal control for slewing engine bells prior to liftoff, gimbaling engines to control trajectory during flight, positioning the main engines to a dump position, and stow position.

15. Two TRIM ENABLE/INHIBIT switches, CDRs and PLTs, allow the software to accept or reject trim commands from the panel trim switches and the RHC trim switches.

16. Six TRIM switches, a roll, pitch, yaw set at the CDRs and PLTs station, allow the crew to make small changes in the vehicles attitude via commands to the aerosurfaces.

17. Two panel TRIM ON/OFF switches, CDRs and PLTs, provide power to the associated TRIM switches when in the "ON" position.

18. One SENSE -Z/-X switch located on the aft panel A6, is used onorbit to make the aft RHC, THC, and ADI correspond to the line of sight.

19. Two sets of PITCH, ROLL/YAW CSS/AUTO PBIs exist (eight switches total) that allow the CDR or PLT to select auto or manual (CSS) attitude control during ascent and entry.

20. Two SPD BK/THROT PBIs, CDRs and PLTs station, allow the crew to switch to auto from manual throttle control during ascent and to auto or manual speed brake control during entry.

21. The BODY FLAP CONTROL CIRCUIT consists of two BODY FLAP UP/DOWN switches and two BODY FLAP AUTO/MANUAL PBIs that allow manual or auto control from either the CDRs or PLTs station.

22. Three ATT REF PBIs, located at the CDRs, PLTs, and aft crew stations, allow the crew to select a reference frame from which attitude errors will be displayed on the three Attitude Direction Indicators (ADI). The ATT REF PBI is also used to take "marks" when the COAS is used for IMU alignment.

23. The ENTRY MODE SWITCH CIRCUIT provides capability for the crew to change DAP control modes during entry via the ENTRY MODE switch.

24. The ABORT MODE SWITCH CIRCUIT provides capability for the crew to select and initiate an abort mode during ascent via the ABORT MODE ROTARY switch and the ABORT push button.

25. Forty eight DAP PBIs (24 fwd and 24 aft) provide crew flexibility in selecting translational and rotational control options with the ONORBIT and TRANS DAPS.

26. Four FCS CHANNEL CONTROL CIRCUITS provide power and control to one of four ASAs and ATVCs via the four FCS CHANNEL switches on panel C3.

## 3.2 Interfaces and Locations

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

The GNC 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 GNC into its hardware components, and Figures 3 - 16 are the detailed systems representations.

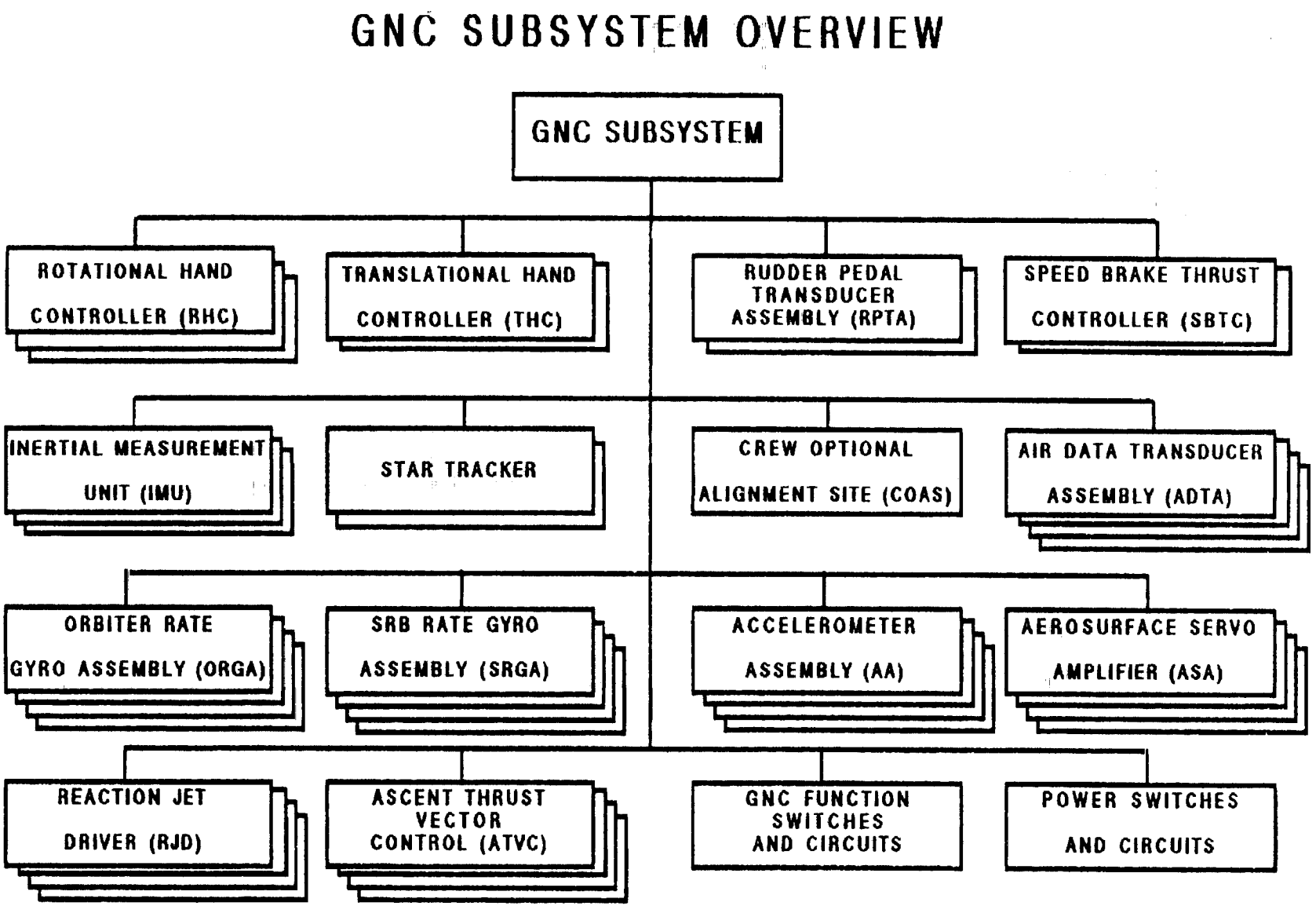



Figure 2 - GNC SUBSYSTEM OVERVIEW

# GNC ROTATIONAL HAND CONTROLLER

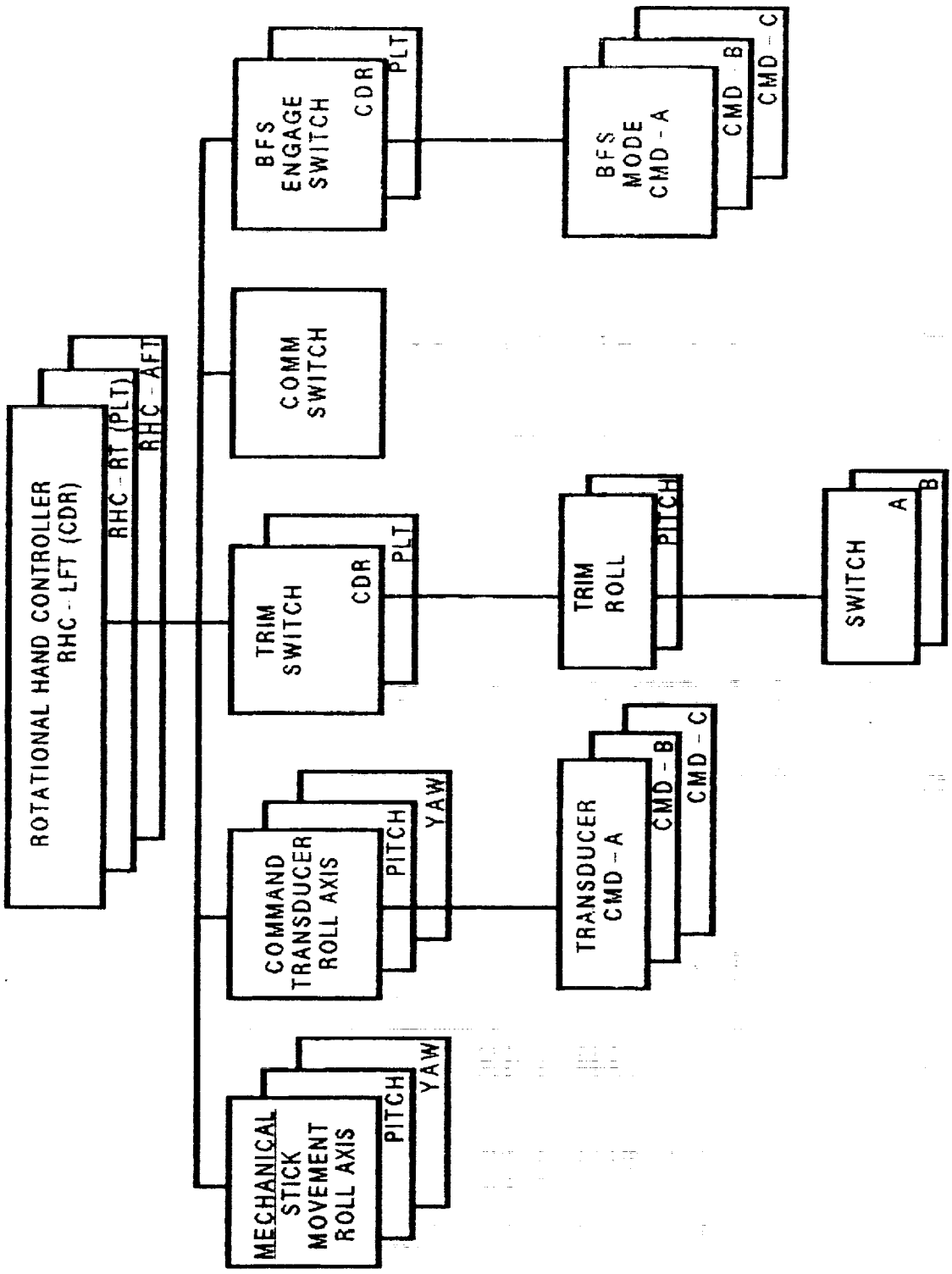



Figure 3 - GNC ROTATIONAL HAND CONTROLLER (RHC)

# GNC TRANSLATIONAL HAND CONTROLLER

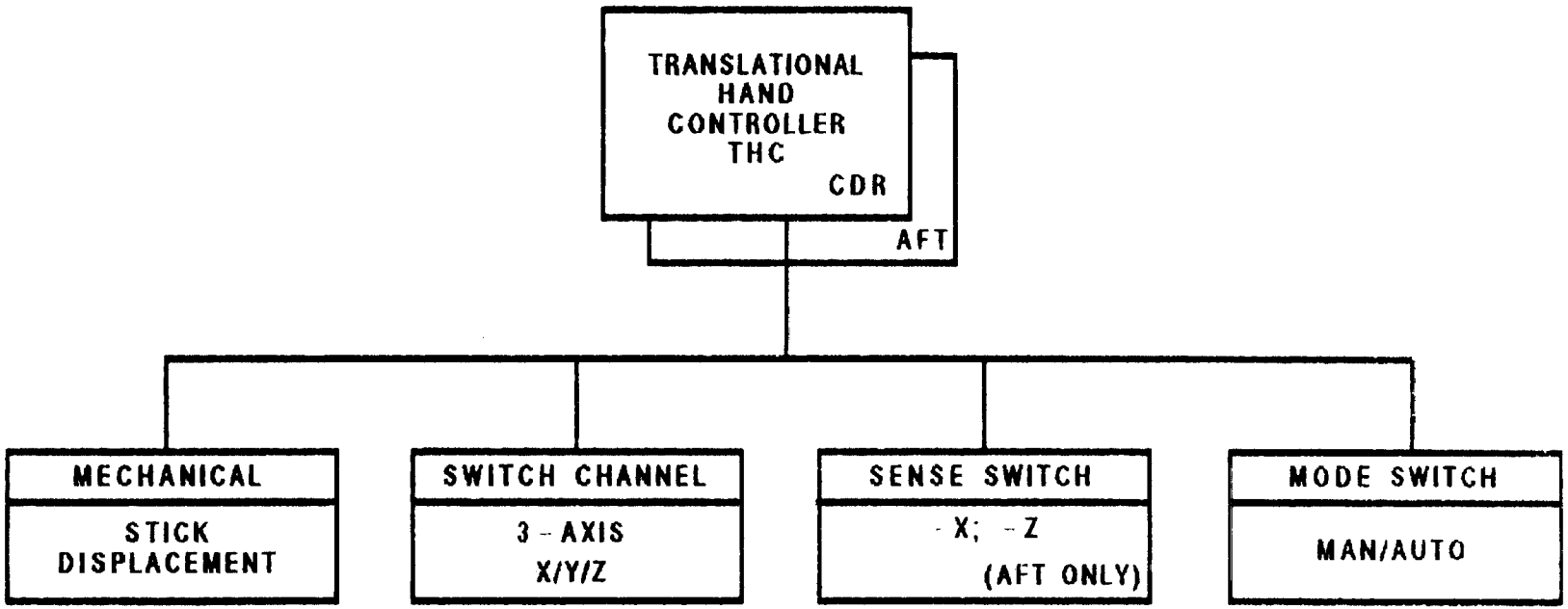



Figure 4 - GNC TRANSLATIONAL HAND CONTROLLER (THC)

# GNC RUDDER PEDAL TRANSDUCER ASSEMBLY

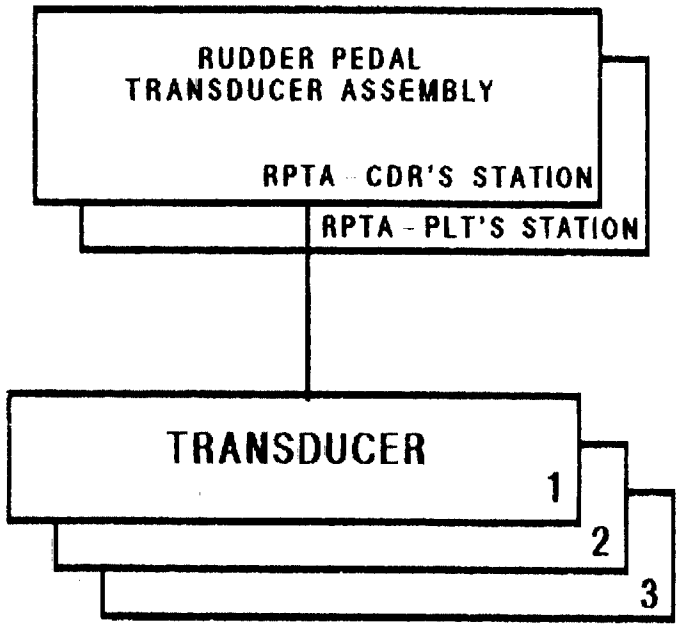



Figure 5 - GNC RUDDER PEDAL TRANSDUCER ASSEMBLY (RPTA)

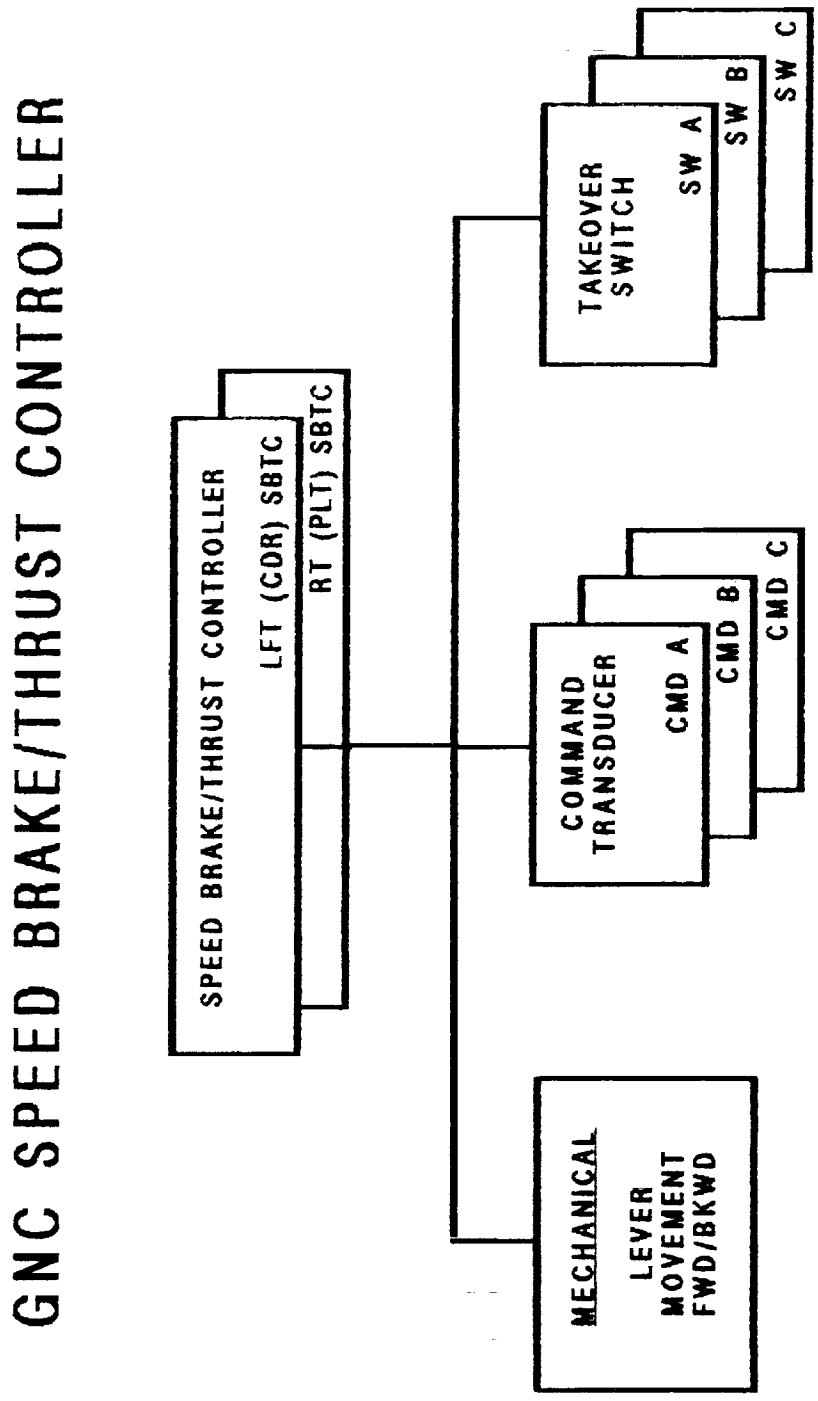



Figure 6 - GNC SPEED BRAKE THRUST CONTROLLER (SBTC)

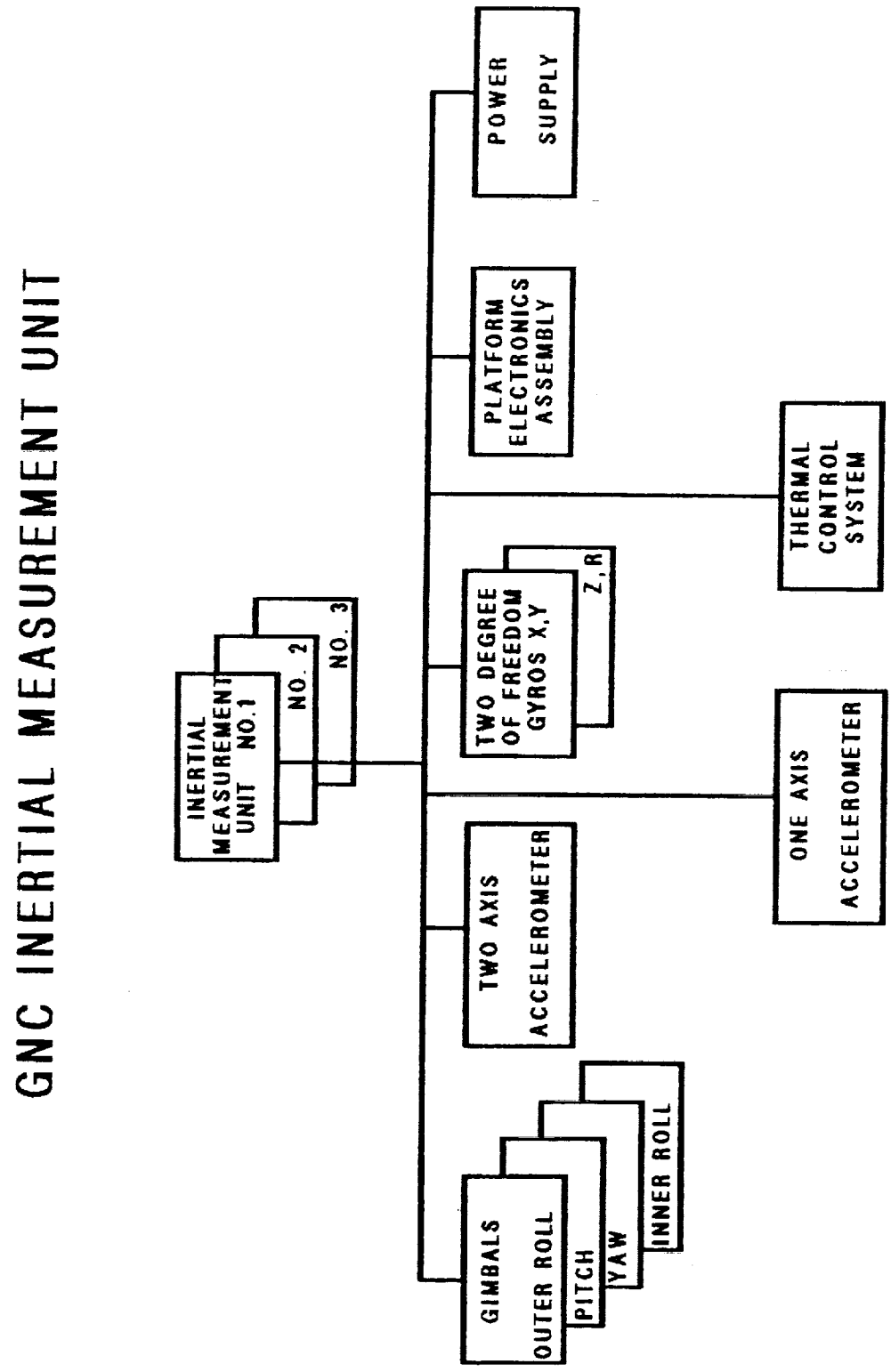



Figure 7 - GNC INERTIAL MEASUREMENT UNIT (IMU)

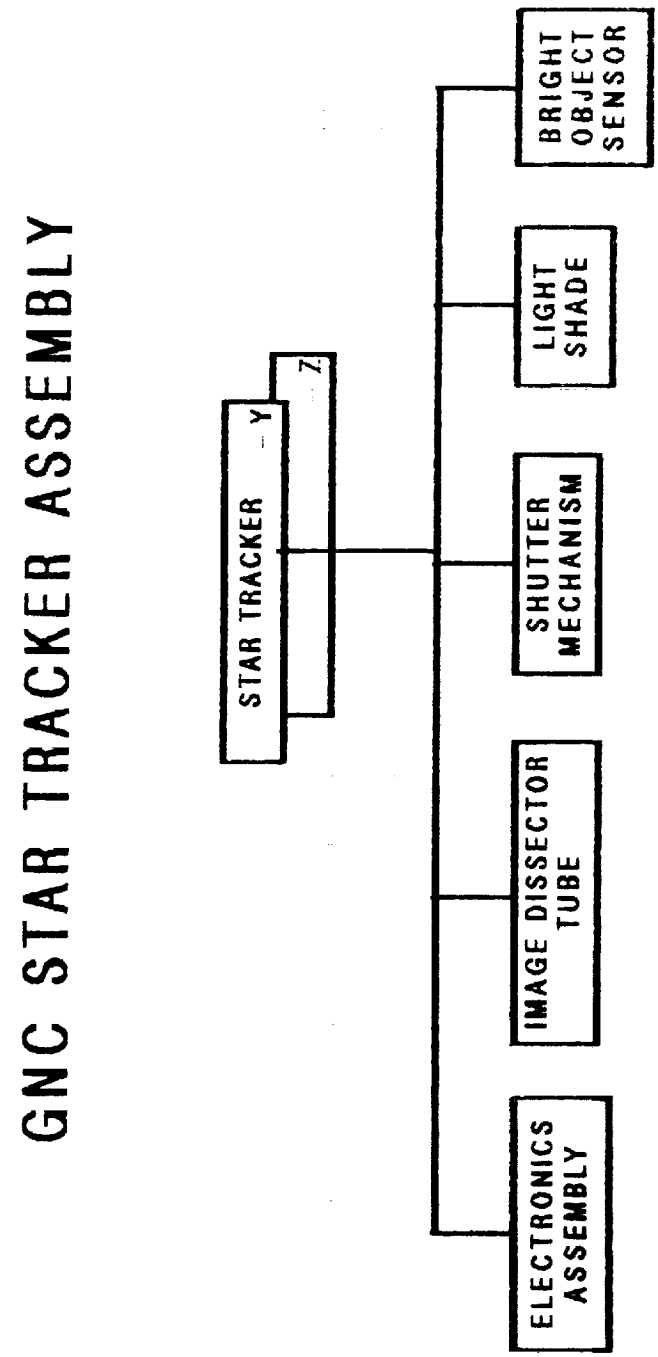



Figure 8 - GNC STAR TRACKER (ST)

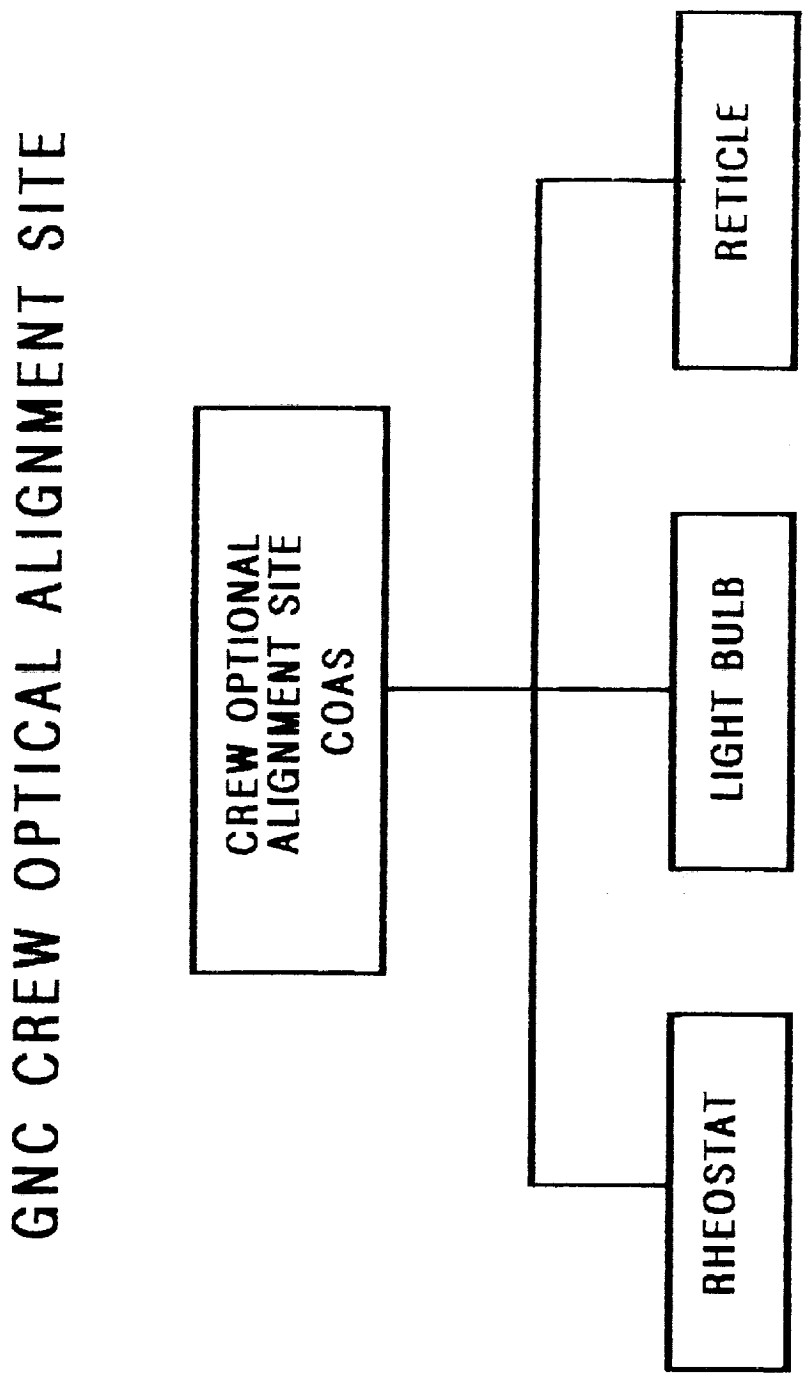



Figure 9 - GNC CREW OPTICAL ALIGNMENT SITE (COAS)

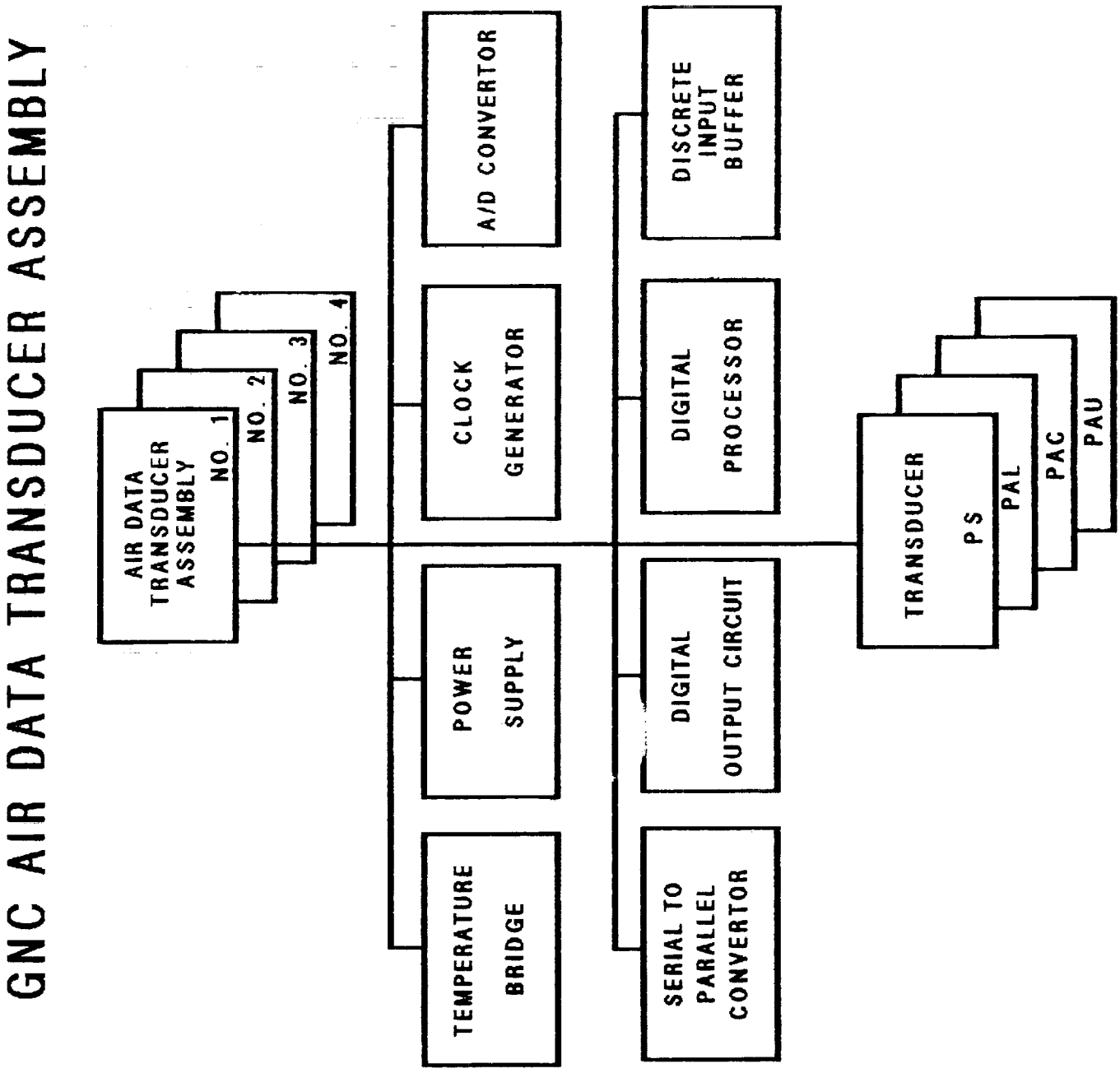



Figure 10 - GNC AIR DATA TRANSDUCER ASSEMBLY (ADTA)

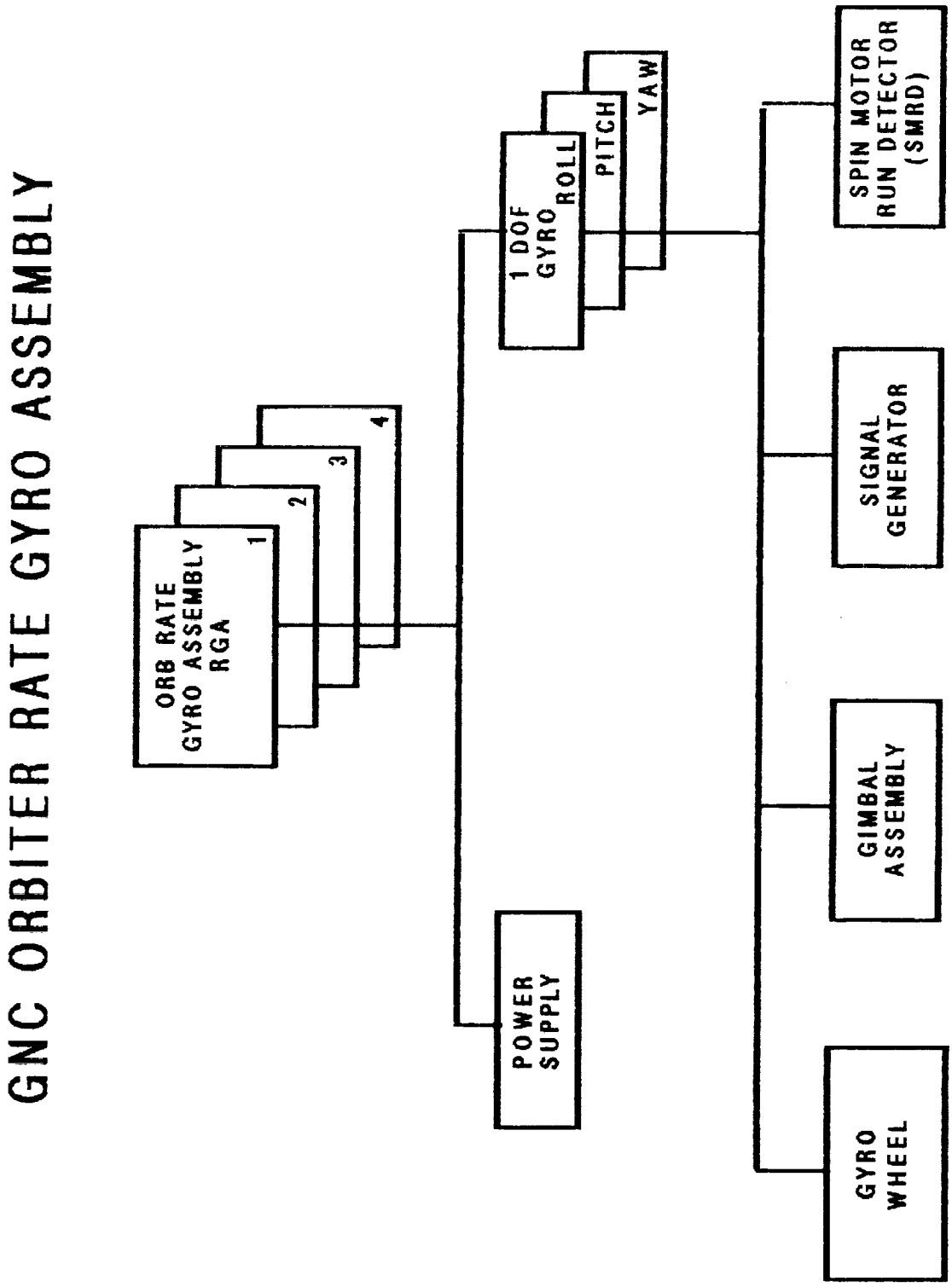



Figure 11 - GNC ORBITER RATE GYRO ASSEMBLY (ORGA)

# GNC SOLID ROCKET BOOSTER RATE GYRO ASSEMBLY

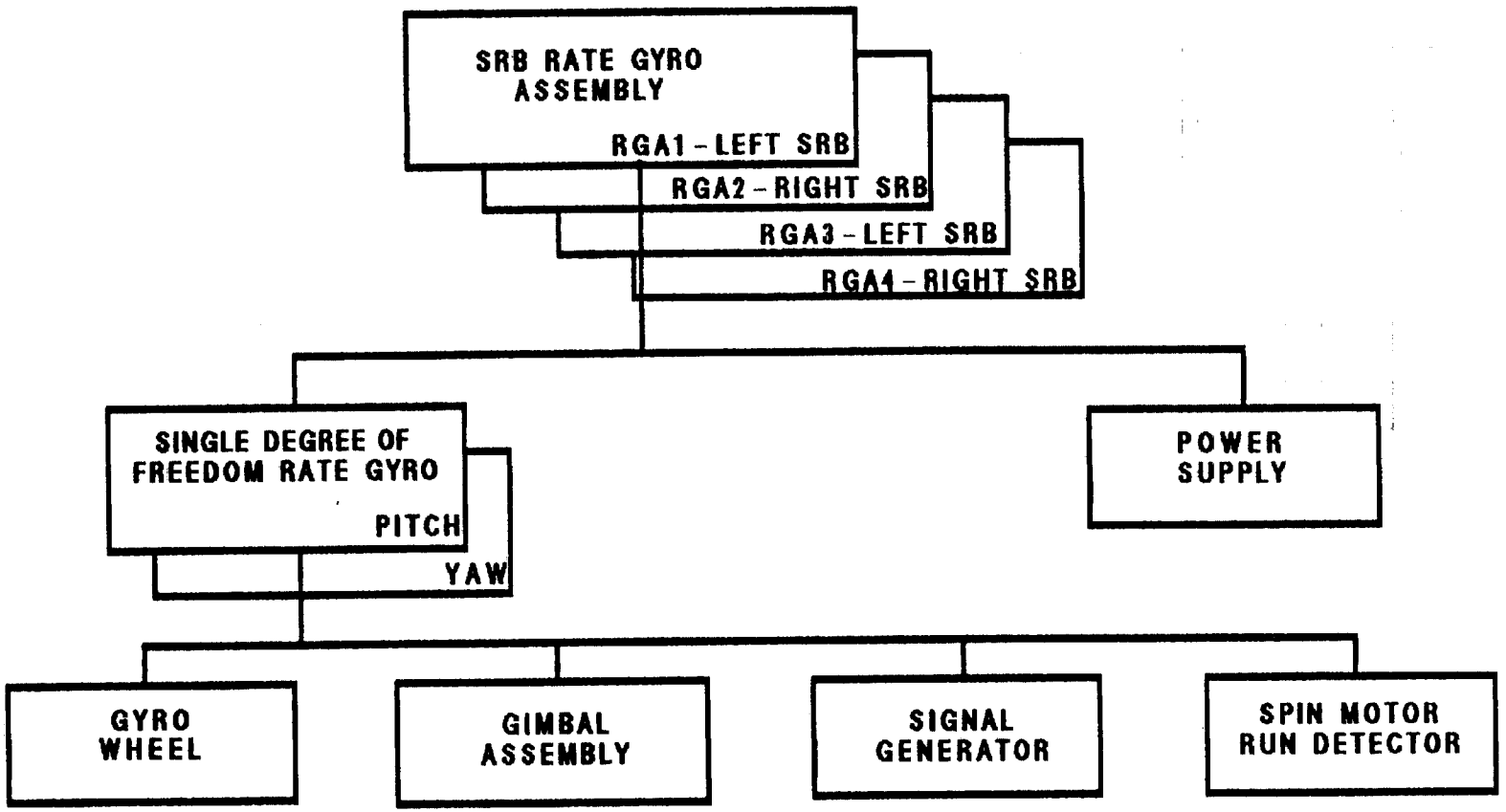



Figure 12 - GNC SRB RATE GYRO ASSEMBLY (SRGA)

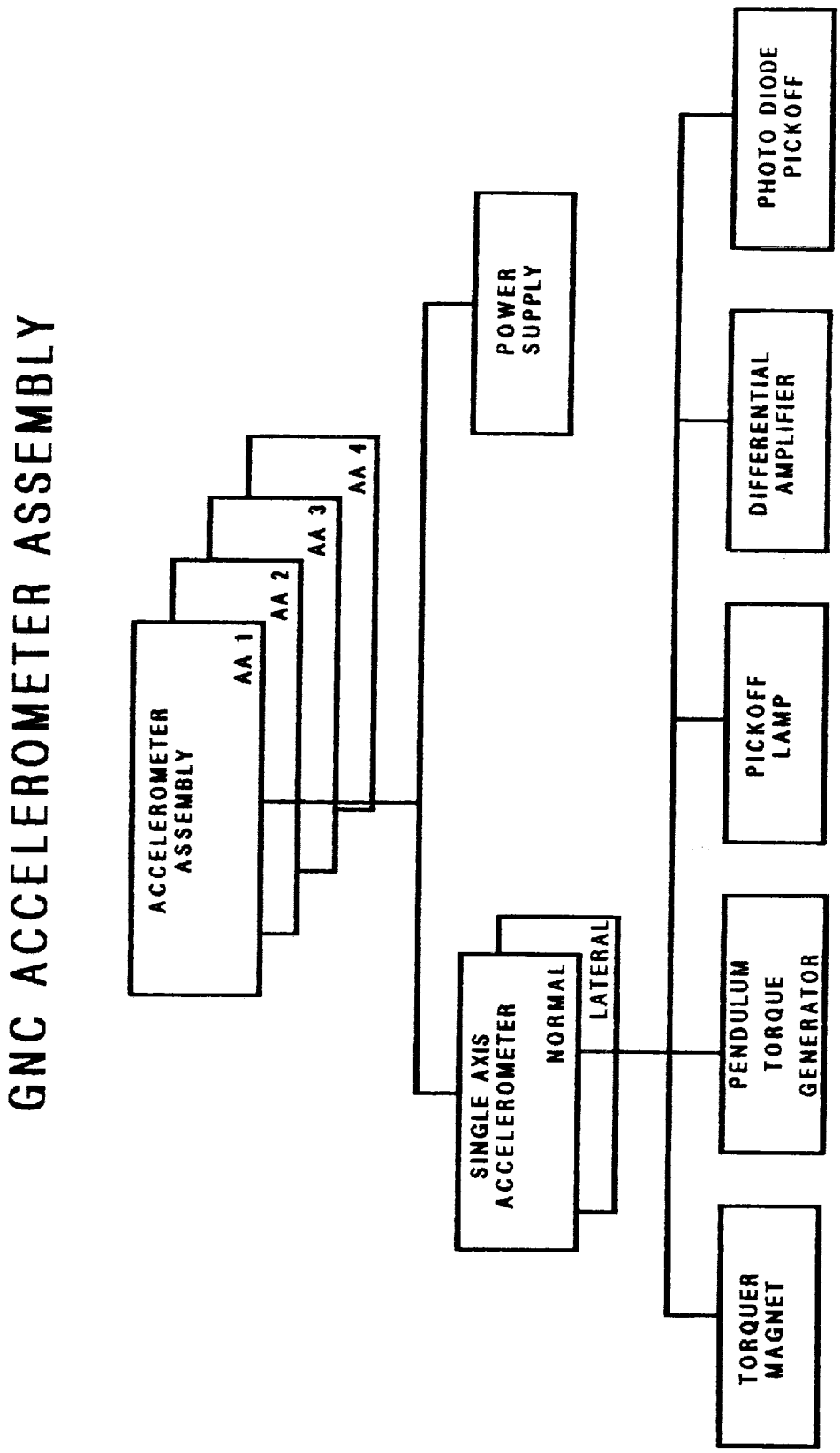



Figure 13 - GNC ACCELEROMETER ASSEMBLY (AA)

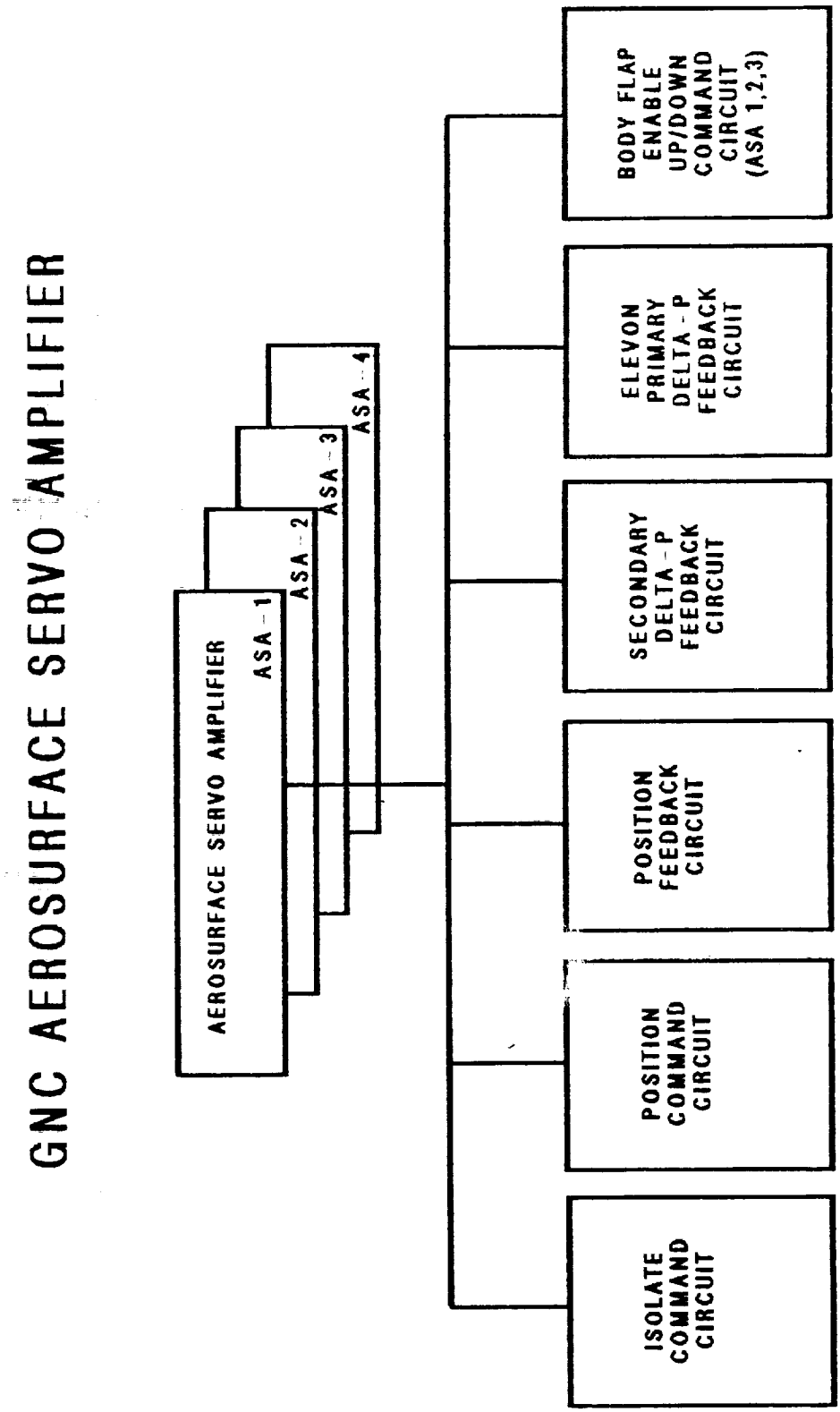



Figure 14 - GNC AEROSURFACE SERVO AMPLIFIER (ASA)

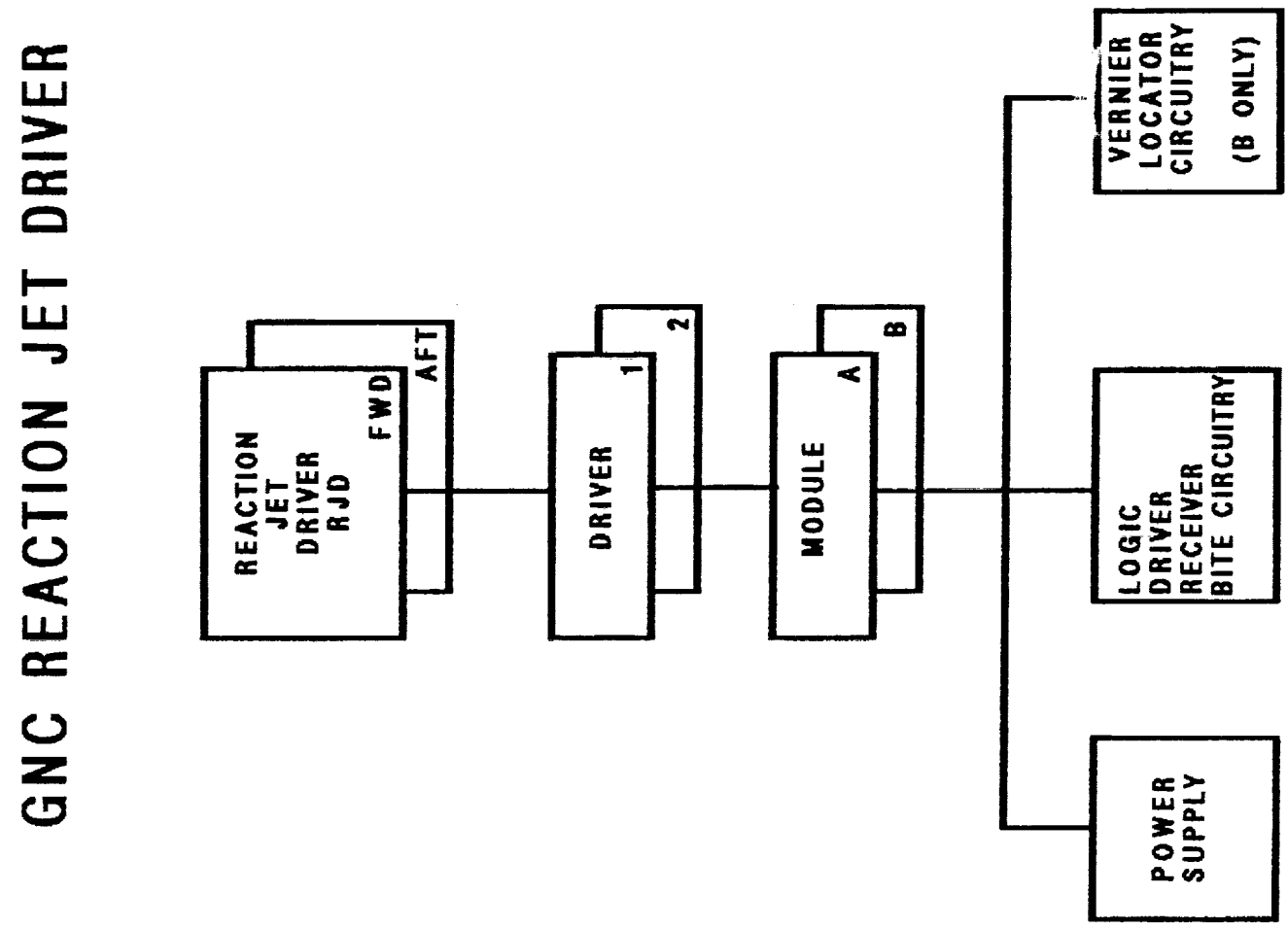



Figure 15 - GNC REACTION JET DRIVER (RJD)

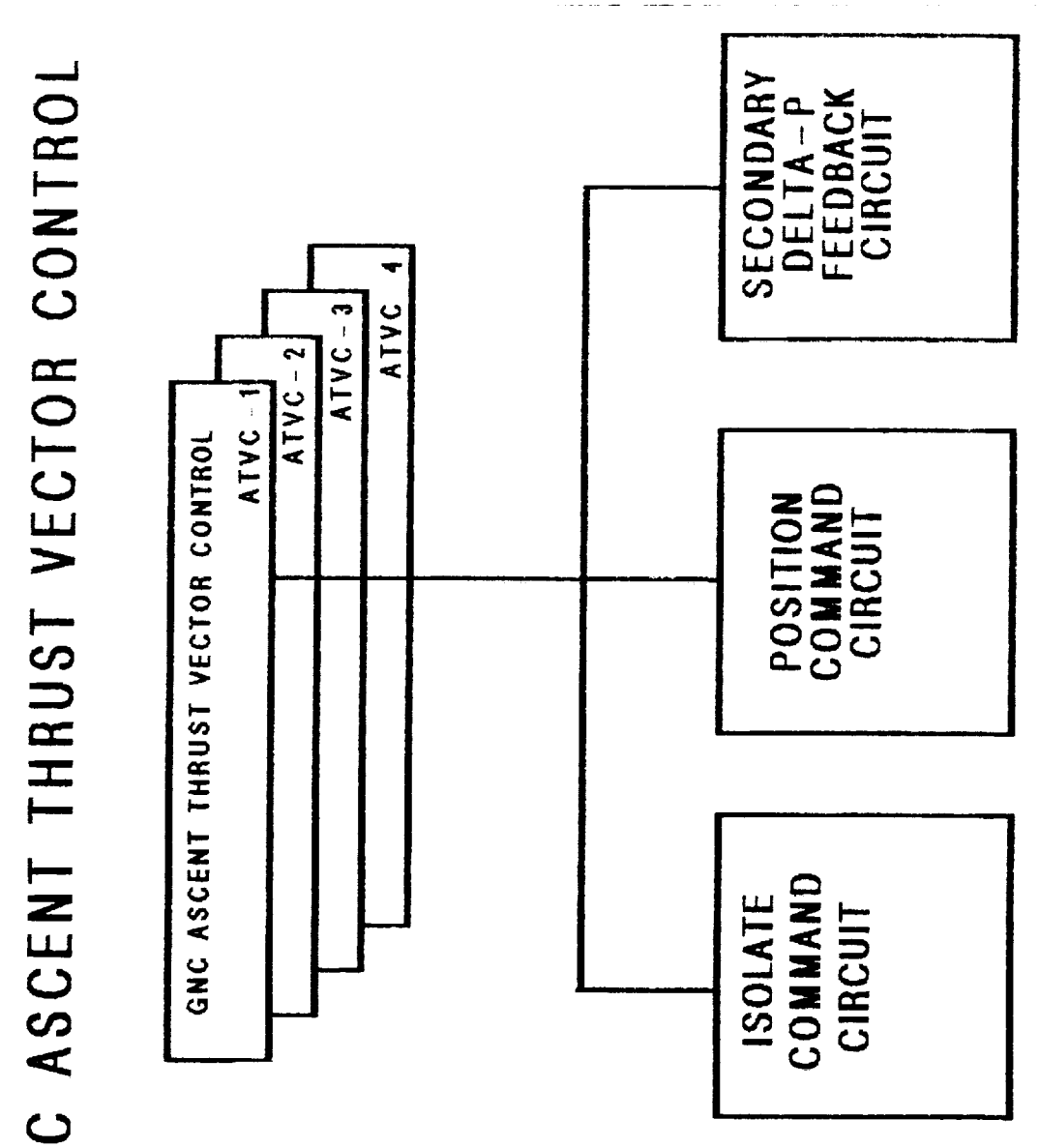



Figure 16 - GNC ASCENT THRUST VECTOR CONTROL (ATVC)

## 4.0 ANALYSIS RESULTS

The GNC analysis was divided into the following three categories:

I. MAJOR COMPONENTS (BLACK BOXES)

II. FUNCTION SWITCHES AND CIRCUITS - primary purpose is to select a particular mode of operation for the GNC software.

III. POWER SWITCHES AND CIRCUITS - these provide electrical power to the GNC major components and DAP annunciation lamps.

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 : | 3 | 12 | 8 | 67 | 21 | 30 | 141 |

Table II Summary of IOA Potential Critical Items

| Criticality: | 1/1 | 2/1R | 2/2 | 3/1R | 3/2R | 3/3 | TOTAL |
|---|---|---|---|---|---|---|---|
| Number | 3 | 12 | 8 | 1 | - | - | 24 |

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

### 4.1 ANALYSIS RESULTS - GNC MAJOR COMPONENTS

Fourteen 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.

TABLE III GNC MAJOR COMPONENTS
Summary of IOA Failure Modes and Criticalities

| Criticality: | 1/1 | 2/1R | 2/2 | 3/1R | 3/2R | 3/3 | TOTAL |
|---|---|---|---|---|---|---|---|
| 1. RHC | - | 1 | - | 2 | - | 2 | 5 |
| 2. THC | - | 2 | - | 1 | - | - | 3 |
| 3. RPTA | - | 1 | - | 3 | - | - | 4 |
| 4. SBTC | - | 1 | - | 4 | - | - | 5 |
| 5. IMU | - | 1 | - | 1* | - | - | 2 |
| 6. ST | - | - | - | 2 | - | - | 2 |
| 7. COAS | - | - | - | 1 | - | 1 | 2 |
| 8. ADTA | - | - | - | 2 | - | - | 2 |
| 9. RGA (ORB) | - | - | - | 2 | - | - | 2 |
| 10. RGA (SRB) | - | - | - | 2 | - | - | 2 |
| 11. AA | - | - | - | 2 | - | - | 2 |
| 12. ASA | - | 1 | - | 7 | - | - | 8 |
| 13. RJD | 2 | - | - | 4 | - | - | 6 |
| 14. ATVC | - | 2 | - | 3 | - | - | 5 |
| TOTAL | 2 | 9 | - | 36 | - | 3 | 50 |

*PCI due to Screen C failure.

TABLE IV GNC MAJOR COMPONENTS
Summary of IOA Potential Critical Items

| Criticality: | 1/1 | 2/1R | 2/2 | 3/1R | 3/2R | TOTAL |
|---|---|---|---|---|---|---|
| Number : | 2 | 9 | - | 1 | - | 12 |

## 4.2 ANALYSIS RESULTS - GNC FUNCTION SWITCHES AND CIRCUITS

Twelve groups of switches and circuits 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 GNC FUNCTION SWITCHES AND CIRCUITS
Summary of IOA Failure Modes and Criticalities

| Criticality: | 1/1 | 2/1R | 2/2 | 3/1R | 3/2R | 3/3 | TOTAL |
|---|---|---|---|---|---|---|---|
| 1. TRIM ENABLE INHIB SW'S | - | - | - | - | - | 2 | 2 |
| 2. TRIM SW'S | - | - | - | - | - | 2 | 2 |
| 3. TRIM ON/OFF SW'S | - | - | - | - | - | 2 | 2 |
| 4. SENSE -Z/-X SW | - | - | - | - | - | 2 | 2 |
| 5. P,R/Y CSS/ AUTO PBI'S | - | - | - | 2 | - | - | 2 |
| 6. SPD BK/THROT PBI | - | - | - | 1 | 1 | - | 2 |
| 7. BODY FLAP CNTL CKT | - | 1 | - | 4 | - | - | 5 |
| 8. ATT REF PBI | - | - | - | 2 | - | - | 2 |
| 9. ENTRY MODE SW | - | - | - | - | - | 2 | 2 |
| 10. ABORT MODE CKT | 1 | 2 | - | 1 | - | - | 4 |
| 11. DAP PBI'S | - | - | 8 | 1 | 20 | - | 29 |
| 12. FCS CHNL CNTL CKT | - | - | - | 3 | - | - | 3 |
| TOTAL | 1 | 3 | 8 | 14 | 21 | 10 | 57 |

TABLE VI GNC FUNCTION SWITCHES AND CIRCUITS
Summary of IOA Potential Critical Items

| Criticality: | 1/1 | 2/1R | 2/2 | 3/1R | 3/2R | TOTAL |
|---|---|---|---|---|---|---|
| Number : | 1 | 3 | 8 | - | - | 12 |

## 4.3 ANALYSIS RESULTS - GNC POWER SWITCHES AND CIRCUITS

Twelve groups of switches and circuits make up this category. Table VII lists the individual groups and summarizes the failure mode criticalities for each group. Table VIII summarizes the number of PCIs for this category.

TABLE VII GNC POWER SWITCHES AND CIRCUITS
Summary of IOA Failure Modes and Criticalities

| Criticality: | 1/1 | 2/1R | 2/2 | 3/1R | 3/2R | 3/3 | TOTAL |
|---|---|---|---|---|---|---|---|
| 1. FLT CNTLR PWR CKT | - | - | - | 1 | - | 1 | 2 |
| 2. IMU PWR CKT | - | - | - | 2 | - | 1 | 3 |
| 3. ST PWR CKT | - | - | - | 2 | - | 1 | 3 |
| 4. COAS PWR CKT | - | - | - | - | - | 3 | 3 |
| 5. ADTA PWR CKT | - | - | - | 1 | - | 2 | 3 |
| 6. RGA (ORB) PWR CKT | - | - | - | 3 | - | - | 3 |
| 7. AA PWR CKT | - | - | - | 2 | - | 2 | 4 |
| 8. ASA PWR CKT | - | - | - | 1 | - | 1 | 2 |
| 9. RJD PWR CKT | - | - | - | 2 | - | 2 | 4 |
| 10. ATVC PWR CKT | - | - | - | 1 | - | 1 | 2 |
| 11. FCS SW ANNUN CKT | - | - | - | 1 | - | 2 | 3 |
| 12. RGA (SRB) PWR CKT | - | - | - | 1 | - | 1 | 2 |
| TOTAL | - | - | - | 17 | - | 17 | 34 |

TABLE VIII GNC POWER SWITCHES AND CIRCUITS
Summary of IOA Potential Critical Items

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

4.4 LIST OF MDAC ANALYSIS WORKSHEET IDENTIFICATION NUMBERS

| | ITEM | MDAC ID'S |
|---|---|---|
| 1. | RHC | 101 - 105 |
| 2. | FLT CNTLR PWR CKT | 110 - 111 |
| 3. | TRIM ENABLE INHIBIT SWs | 120 - 121 |
| 4. | TRIM SWs | 130 - 131 |
| 5. | TRIM ON/OFF SWs | 140 - 141 |
| 6. | SENSE -Z/-X SW | 150 - 151 |
| 7. | P,R/Y CSS/AUTO PBIs | 160 - 161 |
| 8. | THC | 201 - 203 |
| 9. | RPTA | 301 - 304 |
| 10. | SBTC | 401 - 405 |
| 11. | SPD BK/THROT PBI | 410 - 411 |
| 12. | IMU | 501 - 502 |
| 13. | IMU PWR CKT | 510 - 512 |
| 14. | ST | 601 - 602 |
| 15. | ST PWR CKT | 610 - 612 |
| 16. | COAS | 701 - 702 |
| 17. | COAS PWR CKT | 710 - 712 |
| 18. | ADTA | 801 - 802 |
| 19. | ADTA PWR CKT | 810 - 812 |
| 20. | RGA (ORB) | 901 - 902 |
| 21. | RGA (ORB) PWR CKT | 903 - 905 |
| 22. | RGA (SRB) | 950 - 951 |
| 23. | RGA (SRB) PWR CKT | 960 - 961 |
| 24. | AA | 1001 - 1002 |
| 25. | AA PWR CKT | 1010 - 1013 |
| 26. | ASA | 1101 - 1108 |
| 27. | FCS CHNL CNTL CKT | 1110 - 1112 |
| 28. | ASA PWR CKT | 1130 - 1131 |
| 29. | RJD | 1201 - 1208 |
| 30. | RJD PWR CKT | 1211 - 1214 |
| 31. | ATVC | 1301 - 1305 |
| 32. | ATVC PWR CKT | 1310 - 1311 |
| 33. | BODY FLAP CNTL CKT | 1400 - 1404 |
| 34. | DAP PBIs | 1501 - 1586 |
| 35. | FCS SW ANNUN CKT | 1590 - 1593 |
| 36. | ENTRY MODE SW | 1601 - 1602 |
| 37. | ABORT MODE CKT | 1801 - 1804 |
| 38. | ATT REF PB | 1901 - 1902 |

## 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, Controllers Workbook, 2-1-82
3. GNC HS OV 2102, GNC Hardware/Software Overview, 5-17-84
4. JSC-12820, STS operational Flight Rules, PCN-1, 2-14-86
5. VS70-971099, Integrated System Schematic - GNC & Data Processing, OV-099 & OV-103, 4-11-86
6. VS70-790129, Schematic Diagram - Rotational Hand Controller, 10-22-80
7. VS70-790159, Schematic Diagram - Translational Hand Controller, 1-14-81
8. VS70-790149, Schematic Diagram - Rudder Pedal Transducer Assembly, 1-12-81
9. VS70-971099, Schematic Diagram - Speed Brake Thrust Controller, 11-17-80
10. VS70-710109, Schematic Diagram, Inertial Measurement Unit, 11-12-80
11. VS70-710149, Schematic Diagram, Star Tracker, 11-18-80
12. VS70-590309, Schematic Diagram, Air Data Probe Deployment and Heater, 11-12-80
13. VS70-710152, Schematic Diagram, Orbiter Rate Gyro & Navigation Subsystem, 3-24-75
14. VS70-790119, Schematic Diagram, Accelerometer Assembly, 10-30-80
15. VS70-790229, Schematic Diagram, Aerosurface Servo Amplfier, 12-10-80
16. VS70-420109,209,309, Schematic Diagram, RCS Fwd, Aft Right, & Aft Left Modules, March 1980
17. VS70-790239, Schematic Diagram, Ascent Thrust Vector Control-Flt Control Subsystem, 3-18-81

# APPENDIX A
# ACRONYMS

| | | |
|---|---|---|
| AA | - | Accelerometer Assembly |
| ACA | - | Annunciator Control Assembly |
| A/D | - | Analog to Digital |
| ADI | - | Attitude Direction Indicator |
| ADTA | - | Air Data Transducer Assembly |
| AID | - | Analog Input Differential |
| ALC | - | Aft Load Controller |
| AOA | - | Abort Once Around |
| APC | - | Aft Power Controller |
| ASA | - | Aerosurface Servo Amplifier |
| ATO | - | Abort To Orbit |
| ATVC | - | Ascent Thrust Vector Control |
| BF | - | Body Flap |
| BFS | - | Backup Flight System |
| BITE | - | Built-In Test Equipment |
| CB | - | Circuit Breaker |
| CIL | - | Critical Items List |
| CKT | - | Circuit |
| CNTLR | - | Controller |
| COAS | - | Crew Optical Alignment Sight |
| CRIT | - | Criticality |
| CRT | - | Cathode Ray Tube |
| CSS | - | Control Stick Steering |
| C&W | - | Caution and Warning System |
| DAP | - | Digital Auto Pilot |
| DDU | - | Display Driver Unit |
| DEU | - | Display Electronics Unit |
| DISC | - | Discrete |
| DPS | - | Data Processing System |
| DU | - | Display Unit |
| 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 |
| FM | - | Failure Mode |
| FMEA | - | Failure Mode and Effects Analysis |
| FSM | - | Fault Summary Message |
| FSSR | - | Functional Subsystem Software Requirements |
| FSW | - | Flight Software |
| FUNC | - | Function |
| GPC | - | General Purpose Computer |
| GSE | - | Ground Support Equipment |
| H/W | - | Hardware |
| IMU | - | Inertial Measurement Unit |
| IOA | - | Independent Orbiter Assessment |

| | | |
|---|---|---|
| LF | - | Launch Forward |
| LL | - | Launch Left |
| LPS | - | Launch Processing System |
| LR | - | Launch Right |
| LRU | - | Line Replaceable Unit |
| 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 |
| MM | - | Major Mode |
| MSK | - | Manual Select Keyboard |
| MVS | - | Mid Value Select |
| NA | - | Not Applicable |
| NASA | - | National Aeronautics and Space Administration |
| 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 |
| POS | - | Position |
| R | - | Roll |
| RCS | - | Reaction Control System |
| RGA | - | Rate Gyro Assembly |
| RHC | - | Rotational Hand Controller |
| RI | - | Rockwell International |
| RJD | - | Reaction Jet Driver |
| RM | - | Redundancy Management |
| ROT | - | Rotation |
| RPC | - | Remote Power Controller |
| RPTA | - | Rudder Pedal Transducer Assembly |
| RS | - | Redundant Set |
| RTLS | - | Return To Landing Site |
| SBTC | - | Speed Brake Thrust Controller |
| SF | - | Selection Filter |
| SM | - | Systems Management |
| SOP | - | Subsystem Operating Program |
| SRB | - | Solid Rocket Booster |
| SSME | - | Space Shuttle Main Engine |
| ST | - | Star Tracker |
| STS | - | Space Transportation System |
| SW | - | Switch |
| S/W | - | Software |

| | | |
|---|---|---|
| TAL | - | Transatlantic Abort Landing |
| TD | - | Touch Down |
| THC | - | Translational Hand Controller |
| TRANS | - | Translation |
| TVC | - | Thrust Vector Control |
| VDC | - | Volts Direct Current |
| VERN | - | Vernier |
| Y | - | Yaw |

# APPENDIX B

## DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

# APPENDIX B
# DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

## B.1 Definitions

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

INTACT ABORT DEFINITIONS:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

OPS - software operational sequence

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

PHASE DEFINITIONS:

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

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

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

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

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

APPENDIX B
DEFINITIONS, GROUND RULES, AND ASSUMPTIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## B.3 GNC - 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 to be consistent with the existing FMEAs.

   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 generated during the analysis of this subsystem. The information on these worksheets is intentionally similar to the NASA FMEAs. Each of these sheets identifies the hardware item being analyzed, and parent assembly, as well as the function. For each failure mode, the possible causes are outlined, and the assessed hardware and functional criticality for each mission phase is listed, as described in the NSTS 22206, Instructions for Preparation of FMEA and CIL, 10 October 1986. Finally, effects are entered at the bottom of each sheet, and the worst case criticality is entered at the top.

## LEGEND FOR IOA ANALYSIS WORKSHEETS

Hardware Criticalities:

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

Functional Criticalities:

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

Redundancy Screen A:

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

Redundancy Screens B and C:

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

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/11/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 2/1R
MDAC ID: 101 ABORT: 2/1R

ITEM: RHC
FAILURE MODE: PHYSICAL BINDING/JAMMING OF CNTL STICK

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) RHC
3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: 30V73A5,A6,A7
PART NUMBER: MC621-0043-3046

CAUSES: CONTAMINATION,MECH SHOCK,MISHANDLING,VIBRATION

EFFECTS/RATIONALE:
LOSS OF 1 RED RHC FUNCTION. 2 FWD AND 1 AFT RHC'S.
OPS-2 IFM ALLOWS REPLACEMENT OF RHC'S.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/11/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 102 ABORT: 3/1R

ITEM: RHC
FAILURE MODE: NO XDCR OUTPUT ON A CMD CHN.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) RHC
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: | 3/1R | AOA: | 3/1R |
| DEORBIT: | 3/1R | ATO: | 3/1R |
| LANDING/SAFING: | 3/1R | | |

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

LOCATION: 30V73A5,A6,A7
PART NUMBER: MC621-0043-3046

CAUSES: LOSS OF EXCITATION VOLTAGE,TRANSDUCER CIRCUIT FAIL OPEN.

EFFECTS/RATIONALE:
NONE:LOSS OF 1 OF 3 REDUNDANT CHANNELS.
2 FWD AND 1 AFT RHC'S. OPS-2 IFM ALLOWS REPLACEMENT OF RHC'S.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/11/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 103 ABORT: 3/1R

ITEM: RHC
FAILURE MODE: ERRONEOUS XDCR OUTPUT ON A CMD CHN.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) RHC
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: | 3/1R | AOA: | 3/1R |
| DEORBIT: | 3/1R | ATO: | 3/1R |
| LANDING/SAFING: | 3/1R | | |

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

LOCATION: 30V73A5,A6,A7
PART NUMBER: MC621-0043-3046

CAUSES: XDCR CIRCUIT FAILURE,VIBR,TEMP.

EFFECTS/RATIONALE:
NONE:LOSS OF 1 OF 3 REDUNDANT CHANNELS.
2 FWD AND 1 AFT RHC'S. OPS-2 IFM ALLOWS REPLACEMENT OF RHC'S.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/11/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/3
MDAC ID: 104 ABORT: 3/3

ITEM: RHC
FAILURE MODE: NO OUTPUT ON A TRIM SW CHN.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) RHC
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: 30V73A5,A6,A7
PART NUMBER: MC621-0043-3046

CAUSES: SW CONT FAILED OPEN, SW SHORTED TO GROUND.

EFFECTS/RATIONALE:
LOSS OF TRIM SW FUNCTION (BY AXIS). PNL AND RHC TRIM SW'S.
LOSS OF TRIM SW FUNCTION CAUSES SOME INCR IN CREW WORKLOAD.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

| | | | |
|---|---|---|---|
| DATE: | 9/11/86 | HIGHEST CRITICALITY | HDW/FUNC |
| SUBSYSTEM: | GNC | FLIGHT: | 3/3 |
| MDAC ID: | 105 | ABORT: | 3/3 |

ITEM: RHC
FAILURE MODE: TRIM SW CHN FAILS ON.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) RHC
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: 30V73A5,A6,A7
PART NUMBER: MC621-0043-3046

CAUSES: SWITCH CONTACTS SHORTED ( VIBR,MECH SHOCK,CONTAMINATION ).

EFFECTS/RATIONALE:
NONE: 1 OF 2 SW CONT'S ( REDUNDANT CHN'S ) FAILED ON.
TRIM SW CMD ON WITH 2 CHN'S FLD ON, PNL TRIM SW TO INHIBIT.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/3
MDAC ID: 110 ABORT: 3/3

ITEM: CIRCUIT-FLT CNTLR PWR
FAILURE MODE: CB OR SW FAILS CLOSED.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) RHC, SBTC, RPTA, THC
3) FLT CNTLR PWR CIRCUIT
4)
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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: SW'S: PNL F7A5S2, F8A8S1, A6A1S2. CB'S: PNL O14 CB30, 31, O15 CB29, 30, O16 CB22, 23.
PART NUMBER: SW'S (ME452-0102-7352), CB'S (MC454-0026-2075).

CAUSES: CB OR SW CONTACTS SHORTED INTERNALLY (CONTAMINATION, PIECE-PART STRUCTURE FAILURE).

EFFECTS/RATIONALE:
NONE: IF 1 OF 3 OR ALL SW CHN'S FL ON, CNTLR PWR CAN BE TURNED OFF ON ALL 3 CHN'S BY THE 2 REDUNDANT CB'S. IF 1 OF 2 CB'S FL ON, CNTLR POWER CAN BE TURNED OFF WITH THE CNTLR SWITCH.
THIS IS TRUE FOR THE LEFT, RIGHT, AND AFT CNTLR PWR CIRCUIT. B-SCREEN: MCC HAS SUFFICIENT DATA DISPLAYED TO MONITOR THE CNTLR PWR STATUS. POWER FAILED ON MAY EFFECT POWER CONSUMABLES AND MISSION LENGTH.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 111 ABORT: 3/1R

ITEM: CIRCUIT-FLT CNTLR PWR
FAILURE MODE: CB OR SW FAILS OPEN, OR SHORTED TO GROUND.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) RHC, SBTC, RPTA, THC
3) FLT CNTLR PWR CIRCUIT
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: | 3/1R | | |

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

LOCATION: SW'S: PNL F7A5S2, F8A8S1, A6A1S2. CB'S: PNL O14 CB30, 31, O15 CB29, 30, O16 CB22, 23.
PART NUMBER: SW'S (ME452-0102-7352), CB'S (MC454-0026-2075).

CAUSES: CONTAMINATION, VIBR, PIECE-PART STRUCTURAL FAILURE, TEMP, OVERLOAD CURRENT.

EFFECTS/RATIONALE:
NONE: 1 SW CHN FL OPEN, WILL REMOVE PWR FROM ONLY 1 CNTLR CHN. ALL 3 SW CHN'S FL OPEN WILL REMOVE PWR FROM ALL 3 CNTLR CHN'S. THIS PERTAINS TO BOTH LFT, RT, AFT CNTLR PWR CIRCUITS.
2 CB'S FL OPEN, WILL REMOVE PWR FROM ALL CNTLR CHN'S. THIS PERTAINS TO BOTH LFT, RT, AFT CNTLR PWR CIRCUIT. B-SCREEN: MCC HAS SUFFICIENT DATA DIPLAYED TO MONITOR THE CNTLR PWR STATUS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/07/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/3
MDAC ID: 120 ABORT: 3/3

ITEM: SWITCH-TRIM ENABLE/INHIBIT
FAILURE MODE: SWITCH CONTACT FAILS CLOSED (INHIBIT POSITION).

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) TRIM ENABLE/INHIBIT SWITCH
3)
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7)
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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: SW'S: PNL F3 S2, S4. RESISTORS: PNL F6 A12R7, R15, F8 A12R8, R17.
PART NUMBER: SW'S (ME452-0102-7201), RESISTORS (RWR80S1211FR).

CAUSES: SWITCH CONTACT SHORTED INTERNALLY (CONTAMINATION, PIECE-PART STRUCTURE FAILURE).

EFFECTS/RATIONALE:
NONE: 1 OF 2 SWITCH CONTACTS FAILED ON. 2 CONTACTS FAILED ON WILL INHIBIT TRIM. TRIM CAN BE PERFORMED FROM THE OTHER CREWMEMBER'S POSITION.
SUFFICIENT DATA IS ON THE TELEMETRY DOWNLINK AND DISPLAYED IN THE MCC TO MONITOR SYSTEM STATUS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

| | | | |
|---|---|---|---|
| DATE: | 10/07/86 | HIGHEST CRITICALITY | HDW/FUNC |
| SUBSYSTEM: | GNC | FLIGHT: | 3/3 |
| MDAC ID: | 121 | ABORT: | 3/3 |

ITEM: SWITCH-TRIM ENABLE/INHIBIT
FAILURE MODE: SWITCH CONTACT OR CURRENT LIMIT RESISTOR FAILS OPEN OR SHORTED TO GROUND.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) TRIM ENABLE/INHIBIT SWITCH
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: SW'S: PNL F3 S2, S4. RESISTORS: PNL F6 A12R7, R15, F8 A12R8, R17.
PART NUMBER: SW'S (ME452-0102-7201), RESISTORS (RWR80S1211FR).

CAUSES: CONTAMINATION, VIBRATION, PIECE-PART STRUCTURE FAILURE, TEMP, OVERLOAD CURRENT.

EFFECTS/RATIONALE:
NONE: 1 OF 2 SWITCH CONTACTS FAILED OFF WILL RESULT IN INHIBIT SWITCH DISAGREE (TRIM ENABLE). PNL TRIM SWITCHES CAN BE POWERED OFF WITH PWR ON/OFF SWITCHES.
SUFFICIENT DATA IS ON THE TELEMETRY DOWNLINK AND DISPLAYED IN THE MCC TO MONITOR SYSTEM STATUS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/07/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/3
MDAC ID: 130 ABORT: 3/3

ITEM: SWITCH-TRIM
FAILURE MODE: SWITCH CONTACT FAILS CLOSED.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) TRIM SWITCH
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: SW'S: PNL L2 A1S8, S9, S10. PNL C3 A1S15, S16. PNL C3 A7S5.
PART NUMBER: SW'S: (ME452-0102-7205).

CAUSES: SW CONTACT SHORTED INTERNALLY (CONTAMINATION, PIECE-PART STRUCTURE FAILURE).

EFFECTS/RATIONALE:
NONE: 1 OF 2 SW CONTACTS (CHN) FAILED ON. 2 CONTACTS FAILED ON WILL TURN TRIM ON. PNL TRIM SW'S CAN BE POWERED OFF WITH PWR ON/OFF SWITCHES. TRIM SWITCHES ARE USED TO DECREASE CREW WORKLOAD.
SUFFICIENT DATA IS ON THE TELEMETRY DOWNLINK AND DISPLAYED IN THE MCC TO MONITOR SYSTEM STATUS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/07/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/3
MDAC ID: 131 ABORT: 3/3

ITEM: SWITCH-TRIM
FAILURE MODE: SWITCH CONTACT FAILS OPEN, OR SHORTED TO GROUND.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) TRIM SWITCH
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: SW'S: PNL L2 A1S8, S9, S10. PNL C3 A1S15, S16. PNL C3 A7S5.
PART NUMBER: SW'S: (ME452-0102-7205).

CAUSES: CONTAMINATION, VIBRATION, PIECE-PART STRUCTURE FAILURE, TEMP, OVERLOAD CURRENT.

EFFECTS/RATIONALE:
NONE: 1 OF 2 SWITCH CONTACTS (CHN) FAILED OFF WILL RESULT IN TRIM SWITCH DISAGREE STATE. TRIM CAN BE PERFORMED FROM THE OTHER CREWMEMBER'S POSITION. TRIM SWITCHES ARE USED TO DECREASE CREW WORKLOAD.
SUFFICIENT DATA IS ON THE TELEMETRY DOWNLINK AND DISPLAYED IN THE MCC TO MONITOR SYSTEM STATUS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/08/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/3
MDAC ID: 140 ABORT: 3/3

ITEM: SWITCH-TRIM ON/OFF
FAILURE MODE: SWITCH CONTACT FAILS CLOSED.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) TRIM ON/OFF SWITCH
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: SW'S: PNL F3 S3, S5. RESISTORS: PNL F6 A12R8, R16. PNL F8 A12R9, R18.
PART NUMBER: SW'S (ME452-0102-7201), RESISTORS (RWR80S1211FR).

CAUSES: SWITCH CONTACT SHORTED INTERNALLY (CONTAMINATION, PIECE-PART STRUCTURE FAILURE).

EFFECTS/RATIONALE:
NONE: 1 OF 2 SWITCH CONTACTS FAILED ON. 2 CONTACTS FAILED ON WILL ACTIVATE THE CORRESPONDING TRIM SWITCH OUTPUT. TRIM SWITCH OUTPUT CAN BE INHIBITED FROM PANEL INHIBIT SWITCH.
TRIM SWITCH OUTPUT MEASUREMENTS CAN BE USED TO DETERMINE POWER SWITCH STATUS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

| | | | |
|---|---|---|---|
| DATE: | 10/08/86 | HIGHEST CRITICALITY | HDW/FUNC |
| SUBSYSTEM: | GNC | FLIGHT: | 3/3 |
| MDAC ID: | 141 | ABORT: | 3/3 |

ITEM: SWITCH-TRIM ON/OFF
FAILURE MODE: SWITCH CONTACT OR CURRENT LIMIT RESISTOR FAILS OPEN OR SHORTED TO GROUND.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) TRIM ON/OFF SWITCH
3)
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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: SW'S: PNL F3 S3, S5. RESISTORS: PNL F6 A12R8, R16. PNL F8 A12R9, R18.
PART NUMBER: SW'S (ME452-0102-7201), RESISTORS (RWR80S1211FR).

CAUSES: CONTAMINATION, VIBRATION, PIECE-PART STRUCTURE FAILURE, TEMP, OVERLOAD CURRENT.

EFFECTS/RATIONALE:
NONE: 1 OF 2 SWITCH CONTACTS FAIL OFF WILL RESULT IN TRIM SWITCH DISAGREE STATE. TRIM CAN BE PERFORMED FROM THE OTHER CREWMAN'S POSITION.
TRIM SWITCH OUTPUT MEASUREMENTS CAN BE USED TO DETERMINE POWER SWITCH STATUS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/10/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/3
MDAC ID: 150 ABORT: 3/3

ITEM: SWITCH-SENSE
FAILURE MODE: SWITCH CONTACT FAILS CLOSED.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) SENSE SWITCH
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: SW'S: PNL A6 S1. RESISTORS: PNL A6A1 A6R1, A6R2, A6R3.
PART NUMBER: SW: (ME452-0102-7301), RESISTORS (RWR80S1211FR).

CAUSES: SWITCH CONTACT SHORTED INTERNALLY (CONTAMINATION, PIECE-PART STRUCTURE FAILURE ).

EFFECTS/RATIONALE:
NONE: FOR 1 OF 3 CONTACTS FAILED ON, RM WILL FAIL CONTACT AND DOWNMODE TO THE 2-LVL. A 2-LVL DISAGREE STATE WILL INHIBIT THE USE OF THAT POSITION. SWITCH DEFAULT POSITION IS -Z.
LOSS OF SENSE SWITCH FUNCTION MAY INCREASE ONORBIT CREW WORKLOAD AND MISSION COMPLEXITY. SUFFICIENT DATA IS ON THE TELEMETRY DOWNLINK AND DISPLAYED IN THE MCC TO MONITOR SYSTEM STATUS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

| | | | |
|---|---|---|---|
| DATE: | 10/10/86 | HIGHEST CRITICALITY | HDW/FUNC |
| SUBSYSTEM: | GNC | FLIGHT: | 3/3 |
| MDAC ID: | 151 | ABORT: | 3/3 |

ITEM: SWITCH-SENSE
FAILURE MODE: SWITCH CONTACT OR CURRENT LIMIT RESISTOR FAILS OPEN OR SHORTED TO GROUND.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) SENSE SWITCH
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: SW'S: PNL A6 S1. RESISTORS: PNL A6A1 A6R1, A6R2, A6R3.
PART NUMBER: SW: (ME452-0102-7301), RESISTORS (RWR80S1211FR).

CAUSES: CONTAMINATION, VIBRATION, PIECE-PART STRUCTURE FAILURE, TEMP, OVERLOAD CURRENT.

EFFECTS/RATIONALE:
NONE: FOR 1 OF 3 CONTACTS FAILED OFF, RM WILL FAIL CONTACT AND DOWNMODE TO THE 2-LVL. A 2-LVL DISAGREE STATE WILL INHIBIT THE USE OF THAT POSITION. SWITCH DEFAULT POSITION IS -Z.
LOSS OF SENSE SWITCH FUNCTION MAY INCREASE ONORBIT CREW WORKLOAD AND MISSION COMPLEXITY. SUFFICIENT DATA IS ON THE TELEMETRY DOWNLINK AND DISPLAYED IN THE MCC TO MONITOR SYSTEM STATUS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

| | | | |
|---|---|---|---|
| DATE: | 10/10/86 | HIGHEST CRITICALITY | HDW/FUNC |
| SUBSYSTEM: | GNC | FLIGHT: | 3/1R |
| MDAC ID: | 160 | ABORT: | 3/1R |

ITEM: SWITCH- P, R/Y, CSS/AUTO
FAILURE MODE: SWITCH CONTACT FAILS CLOSED.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) P, R/Y, CSS/AUTO SWITCH
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: | 3/3 | AOA: | 3/1R |
| DEORBIT: | 3/1R | ATO: | 3/1R |
| LANDING/SAFING: | 3/1R | | |

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

LOCATION: SW'S: PNL F2 S2, S3, S5, S6. PNL F4 S2, S3, S5, S6. REF DWG VS70-790209.
PART NUMBER: SW'S: (ME452-0061-7141 & 7142). RESISTORS (RWR80S1211FR).

CAUSES: SWITCH CONTACT SHORTED INTERNALLY (CONTAMINAION, PIECE-PART STRUCTURE FAILURE).

EFFECTS/RATIONALE:
NONE: FOR 1 OF 3 CONTACTS FAILED ON, RM WILL FAIL CONTACT AND DOWNMODE TO THE 2-LVL. A 2-LVL DISAGREE STATE WILL INHIBIT THE USE OF THAT POSITION. IF AUTO POSITION FAILED ON, MANUAL OVERRIDE POSSIBLE IF CSS HELD DEPRESSED. NO OVERRIDE FOR CSS FAIL ON. SUFFICIENT DATA IS ON THE TELEMETRY DOWNLINK AND DISPLAYED IN THE MCC FOR MONITORING SYSTEM STATUS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/10/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 161 ABORT: 3/1R

ITEM: SWITCH- P, R/Y, CSS/AUTO
FAILURE MODE: SWITCH CONTACT OR CURRENT LIMIT RESISTOR FAILS OPEN OR SHORTED TO GROUND.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) P, R/Y, CSS/AUTO SWITCH
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: | 3/3 | AOA: | 3/1R |
| DEORBIT: | 3/1R | ATO: | 3/1R |
| LANDING/SAFING: | 3/1R | | |

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

LOCATION: SW'S: PNL F2 S2, S3, S5, S6. PNL F4 S2, S3, S5, S6. REF DWG VS70-790209.
PART NUMBER: SW'S: (ME452-0061-7141 & 7142). RESISTORS (RWR80S1211FR).

CAUSES: CONTAMINATION, VIBRATION, PIECE-PART STRUCTURE FAILURE, TEMP, OVERLOAD CURRENT.

EFFECTS/RATIONALE:
NONE: FOR 1 OF 3 CONTACTS FAILED OFF, RM WILL FAIL CONTACT AND DOWNMODE TO THE 2-LVL. A 2-LVL DISAGREE STATE WILL INHIBIT THE USE OF THAT POSITION. AUTO/CSS CAN BE SELECTED FROM THE OTHER CREWMEMBER'S POSITION.
SUFFICIENT DATA IS ON THE TELEMETRY DOWNLINK AND DISPLAYED IN THE MCC FOR MONITORING SYSTEM STATUS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/05/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 201 ABORT: 3/1R

ITEM: THC
FAILURE MODE: LOSS OF ONE CHANNEL

LEAD ANALYST: TRAHAN, W. H. SUBSYS LEAD: DRAPELA,LES

BREAKDOWN HIERARCHY:
1) GNC
2) THC
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: | 3/3 | ATO: | 3/1R |
| LANDING/SAFING: | 3/3 | | |

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

LOCATION: PNL F5 & A6
PART NUMBER: MC621-0043-3140

CAUSES: TEMP., VIBRATION, MECH SHOCK, PIECE PART FAIL.

EFFECTS/RATIONALE:
NONE. 3LVL REDUNDANT CHANNEL; RESLECTABLE BY CREW
NONE. IN FLIGHT MAINTENANCE ALLOWS INTERCHANGE OF THC'S

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/10/86
SUBSYSTEM: GNC
MDAC ID: 202

HIGHEST CRITICALITY HDW/FUNC
FLIGHT: 2/1R
ABORT: 2/1R

ITEM: THC
FAILURE MODE: IMMOBILE THC

LEAD ANALYST: TRAHAN, W. H. SUBSYS LEAD: DRAPELA,LES

BREAKDOWN HIERARCHY:
1) GNC
2) THC
3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PNL F5 & A6
PART NUMBER: MC621-0043-3140

CAUSES: CONTAMINATION, MECH SHOCK, VIBRATION

EFFECTS/RATIONALE:
OTHER THC AVAILABLE - ONORBIT ONLY. MANUAL - Z TRANSLATION FOR ET SEP INHIBITED - MAY CAUSE VEHICLE DAMAGE.
IN FLIGHT MAINTENANCE ALLOWS INTERCHANGE OF THC'S

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/10/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 2/1R
MDAC ID: 203 ABORT: 2/1R

ITEM: THC
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: TRAHAN, W. H. SUBSYS LEAD: DRAPELA,LES

BREAKDOWN HIERARCHY:
1) GNC
2) THC
3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PNL F5 & A6
PART NUMBER: MC621-0043-3140

CAUSES: TEMP., VIBRATION, MECH SHOCK, PIECE PART FAIL.

EFFECTS/RATIONALE:
NONE. RM USE MAJORITY VOTE SCHEME.
NONE. CAPABILITY TO SEL/DES VIA KEYBOARD.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/16/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 301 ABORT: 3/1R

ITEM: RPTA
FAILURE MODE: NO OUTPUT ON ONE CHANNEL

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) RPTA
3)
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: | 3/1R |
| LANDING/SAFING: | 3/1R | | |

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

LOCATION: 30V73A14,A15
PART NUMBER: MC621-0043-3440

CAUSES: ELECTRICAL SHORT,VIBRATION,CONTAMINATION

EFFECTS/RATIONALE:
NO EFFECT- FDIR WILL DOWNMODE THE SF TO 2-LEVEL AND AVERAGE THE VALUES TO PRODUCE A GOOD OUTPUT.THE OTHER RPTA SF USES MVS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/16/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 302 ABORT: 3/1R

ITEM: RPTA
FAILURE MODE: ERRONEOUS OUTPUT ON ONE CHANNEL

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) RPTA
3)
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: | 3/1R |
| LANDING/SAFING: | 3/1R | | |

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

LOCATION: 30V73A14,A15
PART NUMBER: MC621-0043-3440

CAUSES: ELECTRICAL SHORT,VIBRATION,CONTAMINATION

EFFECTS/RATIONALE:
NO EFFECT- FDIR WILL DOWNMODE THE SF TO 2-LEVEL AND AVERAGE THE VALUES TO PRODUCE A GOOD OUTPUT.THE OTHER RPTA SF USES MVS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/16/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 303 ABORT: 3/1R

ITEM: RPTA
FAILURE MODE: INADVERTENT OUTPUT ON ONE CHANNEL

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) RPTA
3)
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: | 3/1R |
| LANDING/SAFING: | 3/1R | | |

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

LOCATION: 30V73A14,A15
PART NUMBER: MC621-0043-3440

CAUSES: VIBRATION, CONTAMINATION

EFFECTS/RATIONALE:
NO EFFECT- FDIR WILL DOWNMODE THE SF TO 2-LEVEL AND AVERAGE THE VALUES TO PRODUCE A GOOD OUTPUT.THE OTHER RPTA SF USES MVS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/16/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 2/1R
MDAC ID: 304 ABORT: 2/1R

ITEM: RPTA
FAILURE MODE: LOSS OF ONE RPTA

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) RPTA
3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: 30V73A14,A15
PART NUMBER: MC621-0043-3440

CAUSES: FAILURE OF THE MECHANICAL ARM INTERACTION WITH THE RPTA

EFFECTS/RATIONALE:
LEAVES ONE RPTA (3 CHANNELS)-THIS IS ADEQUATE,BUT IF DETECTED EARLY IN THE MISSION,COULD FORCE A EARLY RETURN.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/15/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 2/1R
MDAC ID: 401 ABORT: 2/1R

ITEM: SBTC
FAILURE MODE: PHYSICAL BINDING/JAMMING OF CNTL LEVER

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) SBTC
3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PNL L2 (31V73A2A2), C3 (35V73A3A3).
PART NUMBER: MC621-0043-3240

CAUSES: CONTAMINATION,MECH SHOCK,MISHANDLING,VIBRATION

EFFECTS/RATIONALE:
PLT SBTC MAN THRUST FUNCTION LOST,BACKUP FOR AUTO MODE.
LOST 1 OF 2 SBTC SPD BRK CMD FUNCTION.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/15/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 402 ABORT: 3/1R

ITEM: SBTC
FAILURE MODE: NO XDCR OUTPUT ON A CMD CHN

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) SBTC
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: | 3/3 | AOA: | 3/1R |
| DEORBIT: | 3/1R | ATO: | 3/1R |
| LANDING/SAFING: | 3/1R | | |

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

LOCATION: PNL L2 (31V73A2A2), C3 (35V73A3A3).
PART NUMBER: MC621-0043-3240

CAUSES: LOSS OF EXCITATION VOLTAGE,XDCR CIRCUIT FAIL OPEN

EFFECTS/RATIONALE:
NONE:FOR PLT MAN THRUST FUNCTION,1ST FL IS AUTO GUID DOWNMODE.
NONE:THE SPD BRK CMD FUNCT USES CDR(PLT) PNL L2(C3) SBTC'S.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/15/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 403 ABORT: 3/1R

ITEM: SBTC
FAILURE MODE: ERRONEOUS XDCR OUTPUT ON A CMD CHN

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) SBTC
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: | 3/3 | AOA: | 3/1R |
| DEORBIT: | 3/1R | ATO: | 3/1R |
| LANDING/SAFING: | 3/1R | | |

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

LOCATION: PNL L2 (31V73A2A2), C3 (35V73A3A3).
PART NUMBER: MC621-0043-3240

CAUSES: XDCR CIRCUIT FAILURE,VIBR,TEMP

EFFECTS/RATIONALE:
NONE:FOR PLT MAN THRUST FUNCTION,1ST FL IS AUTO GUID DOWNMODE.
NONE:THE SPD BRK CMD FUNCT USES CDR(PLT) PNL L2(C3) SBTC'S.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/15/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 404 ABORT: 3/1R

ITEM: SBTC
FAILURE MODE: NO OUTPUT ON A TAKEOVER SW CHN

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) SBTC
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: | 3/3 | AOA: | 3/1R |
| DEORBIT: | 3/1R | ATO: | 3/1R |
| LANDING/SAFING: | 3/1R | | |

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

LOCATION: PNL L2 (31V73A2A2), C3 (35V73A3A3).
PART NUMBER: MC621-0043-3240

CAUSES: SW CONT FAILED OPEN,SW SHORTED TO GROUND

EFFECTS/RATIONALE:
NONE:PLT MAN THRUST TAKEOVER,1ST FL IS AUTO GUID DOWNMODE.
NONE:SPD BRK CMD TAKEOVER USES CDR(PLT) PNL L2(C3) SBTC'S.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/15/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 405 ABORT: 3/1R

ITEM: SBTC
FAILURE MODE: TAKEOVER SW CHN FAILS ON

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) SBTC
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: | 3/3 | AOA: | 3/1R |
| DEORBIT: | 3/1R | ATO: | 3/1R |
| LANDING/SAFING: | 3/1R | | |

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

LOCATION: PNL L2 (31V73A2A2), C3 (35V73A3A3).
PART NUMBER: MC621-0043-3240

CAUSES: SWITCH CONTACTS SHORTED(VIBR,MECH SHOCK,CONTAMINATION)

EFFECTS/RATIONALE:
FOR PLT MAN THRUST TAKEOVER,1ST FAILURE IS THE NEED FOR DOWNMODE FROM AUTO TO MANUAL. IF PLT'S SBTC TAKEOVER SWITCH FAILS ON DURING ASCENT, THERE IS NO RECOVERY FROM MANUAL THRUST TAKEOVER. SPD BRK CMD TAKEOVER USES CDR & PLT SBTC'S. IF PLT'S TAKEOVER SW FLS ON DURING ENTRY, PLT HAS MAN CNTL ONLY AND CDR IS IN AUTO UNLESS HE HOLDS IN THE TAKEOVER SW. IF CDR'S TAKEOVER SW FLS ON DURING ENTRY, CDR REMAINS IN MAN AND PLT REMAINS IN AUTO.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/16/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/2R
MDAC ID: 410 ABORT: 3/2R

ITEM: SWITCH-SPD BK/THROT PBI
FAILURE MODE: SWITCH CONTACT FAILS CLOSED.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) SBTC
3) SPD BK/THROT PBI SWITCH
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: SW'S: PNL F2 S8, F4 S8. RESISTORS: F6 A12R6, R14, R22. F8 A12R7, R16, R24.
PART NUMBER: SW'S: (ME452-0061-7140), RESISTORS (RWR80S1211FR).

CAUSES: SWITCH CONTACT SHORTED INTERNALLY (CONTAMINATION, PIECE-PART STRUCTURE FAILURE).

EFFECTS/RATIONALE:
NONE: FOR 1 OF 3 CONTACTS FAILED ON, RM WILL FAIL THE CONTACT AND DOWNMODE TO THE 2-LVL. A 2-LVL DISAGREE STATE WILL INHIBIT THE USE OF THAT SW. IF SW FAILS ON (AUTO MODE), SBTC TAKEOVER SW HELD IN WILL OVERRIDE AUTO.
IF SBTC TAKEOVER SWITCH FAILS ON, NO RECOVERY FROM MANUAL MODE BY THE SPD BK/THROT PBI AUTO SWITCH. SUFFICIENT DATA IS ON THE TELEMETRY DOWNLINK AND DIPLAYED IN THE MCC FOR MONITORING SYSTEM STATUS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

| | | | |
|---|---|---|---|
| DATE: | 10/16/86 | HIGHEST CRITICALITY | HDW/FUNC |
| SUBSYSTEM: | GNC | FLIGHT: | 3/1R |
| MDAC ID: | 411 | ABORT: | 3/1R |

ITEM: SWITCH-SPD BK/THROT PBI
FAILURE MODE: SWITCH CONTACT OR CURRENT LIMIT RESISTOR FAILS OPEN OR SHORTED TO GROUND.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) SBTC
3) SPD BK/THROT PBI SWITCH
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: | 3/1R | | |

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

LOCATION: SW'S: PNL F2 S8, F4 S8. RESISTORS: F6 A12R6, R14, R22. F8 A12R7, R16, R24.
PART NUMBER: SW'S: (ME452-0061-7140), RESISTORS (RWR80S1211FR).

CAUSES: CONTAMINATION, VIBRATION, PIECE-PART STRUCTURE FAILURE, TEMP, OVERLOAD CURRENT.

EFFECTS/RATIONALE:
NONE: 1 OF 3 CONTACTS FAILED OFF. RM WILL FAIL CONTACT AND DOWNMODE TO THE 2-LVL. A 2-LVL DISAGREE STATE WILL INHIBIT THE USE OF THAT POSITION. AUTO MODE CAN BE SELECTED FROM THE OTHER CREWMEMBER'S POSITION.
SUFFICIENT DATA IS ON THE TELEMETRY DOWNLINK AND DIPLAYED IN THE MCC FOR MONITORING SYSTEM STATUS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 2/1R
MDAC ID: 501 ABORT: 2/1R

ITEM: IMU
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: J.M. HIOTT SUBSYS LEAD: L.J. DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) IMU
3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: 30V71A13,30V71A14,30V71A15
PART NUMBER: MC409-0004-0010

CAUSES: SEE ATTACHMENT 501

EFFECTS/RATIONALE:
RM WILL DETECT (FDI, BITE, COMMFAULT) THE FIRST FAILURE AND DESELECT THE FAILED IMU. RM MIGHT NOT ISOLATE A SECOND FAILURE IF THE FAILURE LIES ON THE LINE OF AMBIGUITY, CAUSING LOSS OF VEHICLE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 502 ABORT: 3/1R

ITEM: IMU
FAILURE MODE: NO OUTPUT

LEAD ANALYST: J.M. HIOTT SUBSYS LEAD: L.J. DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) IMU
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: | 3/1R | AOA: | 3/1R |
| DEORBIT: | 3/1R | ATO: | 3/1R |
| LANDING/SAFING: | 3/1R | | |

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

LOCATION: 30V71A13,30V71A14,30V71A15
PART NUMBER: MC409-0004-0010

CAUSES: INTERNAL POWER SUPPLY FAILURE - CONTAMINATION,VIBRATION,MECHANICAL SHOCK,LOSS OF/IMPROPER INPUT,PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
NO EFFECT FOR PASS S/W, IMU'S ARE TRIPLE REDUNDANT-FAILED IMU WILL BE DESELECTED (FDI,COMM FAULT, BITE) BY RM.
NO EFFECT FOR BFS S/W, IMU'S ARE TRIPLE REDUNDANT-FAILED IMU WILL BE DESELECTED (COMM FAULT, BITE, MCC) BY BFS OR CREW.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/29/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 510 ABORT: 3/1R

ITEM: IMU POWER CIRCUIT
FAILURE MODE: ONE BRANCH OF CIRCUIT FAILED OPEN

LEAD ANALYST: J.M. HIOTT SUBSYS LEAD: L.J. DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) IMU
3) IMU POWER CIRCUIT
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: | 3/1R | | |

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

LOCATION:
S10,S11,RPC5,RPC6,RPC7,A4R1,A4R2,A5R1,A5R2,CR11,CR12,CR20,CR21,
CR27,CR28-PNL014,PNL015,PNL016
PART NUMBER: ME452-0102-7201,MC450-0017-
2100,RWR80S1211FR,JANTX1N188R

CAUSES: RESISTOR (RWR80S1211FR) SHORTED TO GROUND, ONE SWITCH CONTACT(ME452-0102-7201) FAILED OPEN, RPC (MC450-0017-2100) FAILED OPEN, DIODE (JANTX1N188R) FAILED OPEN - CONTAMINATION,VIBRATION,MECHANICAL SHOCK,PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
NONE - POWER WILL BE SUPPLIED TO THE IMU THROUGH THE OTHER BRANCH

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/29/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 511 ABORT: 3/1R

ITEM: IMU POWER CIRCUIT
FAILURE MODE: POWER CIRCUIT FAILED OPEN

LEAD ANALYST: J.M. HIOTT SUBSYS LEAD: L.J. DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) IMU
3) IMU POWER CIRCUIT
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: | 3/1R | | |

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

LOCATION: S10,S11-PNL014,PNL015,PNL016
PART NUMBER: ME452-0102-7201

CAUSES: POWER SWTICH JAMMED - PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
LOSS OF ONE IMU - 2 REMAINING IMU'S ARE SUFFICIENT TO PERFORM THE MISSION

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/29/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/3
MDAC ID: 512 ABORT: 3/3

ITEM: IMU POWER CIRCUIT
FAILURE MODE: 1 CIRCUIT FAILED CLOSED

LEAD ANALYST: J.M. HIOTT SUBSYS LEAD: L.J. DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) IMU
3) IMU 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 [N/A] B [N/A] C [N/A]

LOCATION: S10,S11,RPC5,RPC6,RPC7-PNL014,PNL015,PNL016
PART NUMBER: ME452-0102-7201,MC450-0017-2100

CAUSES: SWITCH OR RPC FAILURE - VIBRATION,MECHANICAL SHOCK,PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
IMU CANNOT BE POWERED OFF - POSSIBLE POWER CONSUMPTION PROBLEM

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 601 ABORT: 3/3

ITEM: STAR TRACKER
FAILURE MODE: NO OUTPUT

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) STAR TRACKER
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: | 3/1R | AOA: | 3/3 |
| DEORBIT: | 3/3 | ATO: | 3/3 |
| LANDING/SAFING: | 3/3 | | |

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

LOCATION: 10V71A7(-Y),A6(-Z)
PART NUMBER: MC431-0128-0012

CAUSES: SHUTTER MECHANISM FAILED,IMAGE DISSECTOR TUBE (IDT) FAILED,ST DOOR FAILED CLOSED

EFFECTS/RATIONALE:
LOSS OF ONE ST IS NOT CRITICAL- REDUNDANCY REMAINS WITH THE OTHER ST AND COAS

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 602 ABORT: 3/3

ITEM: STAR TRACKER
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) STAR TRACKER
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: | 3/1R | AOA: | 3/3 |
| DEORBIT: | 3/3 | ATO: | 3/3 |
| LANDING/SAFING: | 3/3 | | |

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

LOCATION: 10V71A7(-Y),A6(-Z)
PART NUMBER: MC431-0128-0012

CAUSES: LENS DEGRADATION,FOCUS FIELD CIRCUIT SHORTED,SHORT IN DEFLECTION COILS,ST MISALIGNED DUE TO VIBRATION OR TEMPERTURE

EFFECTS/RATIONALE:
SELF TEST WILL DETECT ERRORS- THE OTHER ST AND COAS CAN BE USED AS BACKUP

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/25/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/3
MDAC ID: 610 ABORT: 3/3

ITEM: CIRCUIT-STAR TRACKER POWER
FAILURE MODE: CB OR SW FAILS CLOSED

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) STAR TRACKER
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: PANELS 06,014,015
PART NUMBER: 2 CB'S (MC454-0026-2030),2 SW'S (ME452-0102-7101)

CAUSES: INTERNAL SHORT DUE TO CONTAMINATION

EFFECTS/RATIONALE:
NONE - THE WORKING ELEMENT (CB OR SW) CAN BE USED TO TURN THE POWER OFF

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/25/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 611 ABORT: 3/3

ITEM: CIRCUIT-STAR TRACKER POWER
FAILURE MODE: FAILS OPEN

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) STAR TRACKER
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: | 3/1R | AOA: | 3/3 |
| DEORBIT: | 3/3 | ATO: | 3/3 |
| LANDING/SAFING: | 3/3 | | |

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

LOCATION: PANELS 06,014,015
PART NUMBER: 2 CB'S (MC454-0026-2030),2 SW'S (ME452-0102-7101)

CAUSES: INTERNAL SHORT DUE TO CONTAMINATION IN CB OR SW

EFFECTS/RATIONALE:
LOSS OF THAT STAR TRACKER- THE OTHER ST AND COAS CAN BE USED AS BACKUP

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/25/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 612 ABORT: 3/3

ITEM: CIRCUIT-STAR TRACKER POWER
FAILURE MODE: SWITCH SHORTS TO GROUND

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) STAR TRACKER
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: | 3/1R | AOA: | 3/3 |
| DEORBIT: | 3/3 | ATO: | 3/3 |
| LANDING/SAFING: | 3/3 | | |

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

LOCATION: PANELS 06,014,015
PART NUMBER: 2 CB'S (MC454-0026-2030),2 SW'S (ME452-0102-7101)

CAUSES: CONTAMINATION

EFFECTS/RATIONALE:
LOSS OF THAT STAR TRACKER - CB WILL SHUT POWER SUPPLY OFF-THE OTHER ST AND COAS PROVIDE REDUNDANCY

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/02/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/3
MDAC ID: 701 ABORT: 3/3

ITEM: COAS
FAILURE MODE: COAS LIGHT OUT

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) COAS
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: PANEL 01 (CMD'S STATION),OVERHEAD WINDOW W7 (AFT STATION)
PART NUMBER: V620-660-810

CAUSES: LOSS OF POWER,LAMP BROKEN DUE TO VIBRATION,ELECTRICAL SHORT

EFFECTS/RATIONALE:
NO EFFECT - 2 ST'S AVAILABLE - A FLASHLIGHT CAN BE USED TO LIGHT THE RETICLE

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/02/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 702 ABORT: 3/3

ITEM: COAS
FAILURE MODE: RETICLE BROKEN

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) COAS
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: | 3/1R | AOA: | 3/3 |
| DEORBIT: | 3/3 | ATO: | 3/3 |
| LANDING/SAFING: | 3/3 | | |

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

LOCATION: PANEL 01 (CMD'S STATION),OVERHEAD WINDOW W7 (AFT STATION)
PART NUMBER: V620-660-810

CAUSES: VIBRATION,SHOCK

EFFECTS/RATIONALE:
LOSS OF COAS - 2 ST'S AVAILABLE

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

| | | | |
|---|---|---|---|
| DATE: | 10/02/86 | HIGHEST CRITICALITY | HDW/FUNC |
| SUBSYSTEM: | GNC | FLIGHT: | 3/3 |
| MDAC ID: | 710 | ABORT: | 3/3 |

ITEM: CIRCUIT - COAS POWER
FAILURE MODE: CB OR SWITCH FAILS CLOSED

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) COAS
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: PANELS 01, 019, L4
PART NUMBER: 1 CB (MC454-0026-2030), 2 SW'S (ME452-0102-7101)

CAUSES: INTERNAL SHORT DUE TO CONTAMINATION

EFFECTS/RATIONALE:
NONE- THE WORKING ELEMENT(CB OR SW) CAN BE USED TO TURN THE POWER OFF

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/02/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/3
MDAC ID: 711 ABORT: 3/3

ITEM: CIRCUIT - COAS POWER
FAILURE MODE: SWITCH FAILS OPEN

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) COAS
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: PANELS 01, 019, L4
PART NUMBER: 1 CB (MC454-0026-2030), 2 SW'S (ME452-0102-7101)

CAUSES: INTERNAL SHORT DUE TO CONTAMINATION

EFFECTS/RATIONALE:
NONE - THE OTHER POWER SWITCH CAN BE USED

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/02/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/3
MDAC ID: 712 ABORT: 3/3

ITEM: CIRCUIT - COAS POWER
FAILURE MODE: CB FAILS OFF

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) COAS
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: PANELS 01, 019, L4
PART NUMBER: 1 CB (MC454-0026-2030), 2 SW'S (ME452-0102-7101)

CAUSES: INTERNAL SHORT DUE TO CONTAMINATION

EFFECTS/RATIONALE:
LOSS OF THE FWD & AFT POWER CIRCUITS,BUT A FLASHLIGHT CAN BE USED TO LIGHT THE RETICLE - 2 ST'S SERVE AS BACKUP

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 801 ABORT: 3/1R

ITEM: ADTA
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: J.M. HIOTT SUBSYS LEAD: L.J. DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ADTA
3)
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: | 3/1R | | |

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

LOCATION: 82V71A2,81V71A1,81V71A3,81V71A4
PART NUMBER: MC409-0011-0006

CAUSES: ATTACHMENT 801

EFFECTS/RATIONALE:
NO EFFECT: FOR PASS S/W, ERRONEOUS OUTPUT WILL BE DETECTED(FDI,BITE,COMM FAULT) BY RM AND THE ASSOCIATED ADTA WILL BE DESELECTED BY RM
NO EFFECT: FOR BFS, S/W ERRONEOUS OUTPUT WILL BE DETECTED(BITE,COMM FAULT,MCC) AND THE ASSOCIATED ADTA WILL BE DESELECTED BY BFS OR CREW. NOTE: LOSS OF INPUT FROM ONE PROBE(SINGLE PNEUMATIC INPUT INCLUDED) WILL CAUSE LOSS OF TWO ADTA'S

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 802 ABORT: 3/1R

ITEM: ADTA
FAILURE MODE: NO OUTPUT

LEAD ANALYST: J.M. HIOTT SUBSYS LEAD: L.J. DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ADTA
3)
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: | 3/1R | | |

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

LOCATION: 82V71A2,81V71A1,81V71A3,81V71A4
PART NUMBER: MC409-0011-0006

CAUSES: INTERNAL POWER SUPPLY FAILURE

EFFECTS/RATIONALE:
NO EFFECT: FOR PASS S/W, NO OUTPUT WILL BE DETECTED(FDI,BITE,COMM FAULT) BY RM AND THE ASSOCIATED ADTA WILL BE DESELECTED BY RM.
NO EFFECT: FOR BFS S/W, NO OUTPUT WILL BE DETECTED(BITE,COMM FAULT,MCC) AND THE ASSOCIATED ADTA WILL BE DESELECTED BY BFS OR CREW.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/29/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 810 ABORT: 3/1R

ITEM: ADTA POWER CIRCUIT
FAILURE MODE: CIRCUIT FAILED OPEN

LEAD ANALYST: J.M. HIOTT SUBSYS LEAD: L.J. DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ADTA
3) ADTA POWER CIRCUIT
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: | 3/1R | | |

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

LOCATION: CB19-PNL016,CB20-PNL016,CB25-PNL015,CB26-PNL014
PART NUMBER: MC454-0026-2050

CAUSES: CB FAILURE - CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
LOSS OF ONE ADTA - 3 REMAINING ADTA'S ARE SUFFICIENT TO PERFORM MISSION

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/29/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/3
MDAC ID: 811 ABORT: 3/3

ITEM: ADTA POWER CIRCUIT
FAILURE MODE: CIRCUIT FAILED CLOSED

LEAD ANALYST: J.M. HIOTT SUBSYS LEAD: L.J. DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ADTA
3) ADTA 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 [N/A] B [N/A] C [N/A]

LOCATION: CB19-PNL016,CB20-PNL016,CB25-PNL015,CB26-PNL014
PART NUMBER: MC454-0026-2050

CAUSES: CB FAILURE - CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
ADTA CANNOT BE POWERED OFF - POSSIBLE POWER CONSUMPTION PROBLEM

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/3
MDAC ID: 812 ABORT: 3/3

ITEM: ADTA POWER CIRCUIT
FAILURE MODE: RESISTOR (RLR07C5101GR) SHORTS TO GROUND OR OPENS

LEAD ANALYST: J.M. HIOTT SUBSYS LEAD: L.J. DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ADTA
3) ADTA 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 [N/A] B [N/A] C [N/A]

LOCATION: A3R2-PNL014,PNL015,PNL016
PART NUMBER: RLR07C5101GR

CAUSES: VIBRATION, MECHANICAL SHOCK, STRUCTURAL FAILUER

EFFECTS/RATIONALE:
ADTA POWER CIRCUIT CANNOT BE MONITORED BY MDM - NOT CRITICAL TO FLIGHT

REFERENCES: SEE SECTION 1

C-2

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/24/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 901 ABORT: 3/1R

ITEM: RGA
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: TRAHAN, W. H. SUBSYS LEAD: DRAPELA, LES

BREAKDOWN HIERARCHY:
1) GNC
2) RGA (ORB)
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: | 3/3 | AOA: | 3/1R |
| DEORBIT: | 3/1R | ATO: | 3/1R |
| LANDING/SAFING: | 3/1R | | |

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

LOCATION: PLB(33V73A14,15,16B)
PART NUMBER: MC493-0015-0011

CAUSES: TEMP., VIBRATION, MECH SHOCK, PIECE PART STRUCTURE FAIL

EFFECTS/RATIONALE:
NONE. MAX 4 LVL OF REDUNDANCY, POSS LOSS OF MISS DUE TO FLT RULES.
NONE. SECOND FAIL MAY NOT BE ANNUNCIATED, BUT MCC CAN DETECT.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/24/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 902 ABORT: 3/1R

ITEM: RGA
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: TRAHAN, W. H. SUBSYS LEAD: DRAPELA, LES

BREAKDOWN HIERARCHY:
1) GNC
2) RGA (ORB)
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: | 3/3 | AOA: | 3/1R |
| DEORBIT: | 3/1R | ATO: | 3/1R |
| LANDING/SAFING: | 3/1R | | |

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

LOCATION: PLB(33V73A14,15,16)
PART NUMBER: MC493-0015-0011

CAUSES: TEMP., VIBRATION, MECH SHOCK, PIECE PART STRUCTURE FAIL, IMPROPER INPUT.

EFFECTS/RATIONALE:
NONE. MAX 4 LVL OF REDUNDANCY, POSS LOSS OF MISS DUE TO FLT RULES.
NONE. SECOND FAIL MAY NOT BE ANNUNCIATED, BUT MCC CAN DETECT.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/28/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 903 ABORT: 3/1R

ITEM: PWR SW RGA 1,2,3,4
FAILURE MODE: FAILS ON, FAILS OFF

LEAD ANALYST: TRAHAN, W. H. SUBSYS LEAD: DRAPELA, LES

BREAKDOWN HIERARCHY:
1) GNC
2) RGA (ORB)
3) POWER CIRCUIT
4) SWITCHES
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PLB(33V73A14,15,16)
PART NUMBER: VS70-710159

CAUSES: VIBRATION, MECHANICAL SHOCK, CONTAMINATION, PIECE PART STRU FAILURE.

EFFECTS/RATIONALE:
FAIL ON - NO EFFECT EXCEPT ON POWER CONSUMPTION, NO LOSS OF RGA
FAIL OFF - LOSS OF RGA, RM WILL USE OUTPUT FROM OTHER RGA'S.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/28/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 904 ABORT: 3/1R

ITEM: DIODES & RESIST (ORB)
FAILURE MODE: OPEN, FAIL TO CONDUCT

LEAD ANALYST: TRAHAN, W. H. SUBSYS LEAD: DRAPELA, LES

BREAKDOWN HIERARCHY:
1) GNC
2) RGA (ORB)
3) POWER CIRCUIT
4) DIODES ABD RESISTORS
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PLB(33V73A14,15,16)
PART NUMBER: VS70-710159

CAUSES: VIBRATION, MECHANICAL SHOCK, CONTAMINATION, PIECE PART STRU FAILURE.

EFFECTS/RATIONALE:
LOSS OF THE EFFECTED RGA.
NONE: RM WILL DISCARD RGA AND DOWNMODE ON SUB FAILURES.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/28/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 905 ABORT: 3/1R

ITEM: RPC'S (ORB)
FAILURE MODE: FAIL ON, FAIL OFF

LEAD ANALYST: TRAHAN, W. H. SUBSYS LEAD: DRAPELA, LES

BREAKDOWN HIERARCHY:
1) GNC
2) RGA (ORB)
3) POWER CIRCUIT
4) REMOTE POWER CONTROLLERS (RPC'S)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PLB(33V73A14,15,16)
PART NUMBER: VS70-710159

CAUSES: VIBRATION, MECHANICAL SHOCK, CONTAMINATION, PIECE PART STRU FAILURE.

EFFECTS/RATIONALE:
FAIL ON - NO EFFECT EXCEPT ON POWER CONSUMPTION
FAIL OFF - LOSS OF RGA'S 2 OR 3, RGA 1 & 4 HAVE TWO RED RPC'S, POSS LAUNCH DELAY.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/05/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 950 ABORT: 3/1R

ITEM: RGA (SRB)
FAILURE MODE: LOSS OF OUTPUT

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) RGA (SRB)
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: | 3/3 | AOA: | 3/1R |
| DEORBIT: | 3/3 | ATO: | 3/1R |
| LANDING/SAFING: | 3/3 | | |

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

LOCATION: LEFT SRB (RGA1 & 2-131A5,A6); RIGHT SRB(RGA2 & 4-231A5,A6)
PART NUMBER: MC493-0015-0105

CAUSES: TEMP,VIBRATION,MECH SHOCK,LOSS OF INPUT,PIECE PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
NONE - THE FAILED RGA WILL BE DESELECTED BY RM AND THE SEL FILTER WILL DOWNMODE TO MVS AND USE THE REMAINING RGA'S

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/05/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 951 ABORT: 3/1R

ITEM: RGA (SRB)
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) RGA (SRB)
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: | 3/3 | AOA: | 3/1R |
| DEORBIT: | 3/3 | ATO: | 3/1R |
| LANDING/SAFING: | 3/3 | | |

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

LOCATION: LEFT SRB (RGA1 & 2-131A5,A6); RIGHT SRB(RGA2 & 4-231A5,A6)
PART NUMBER: MC493-0015-0105

CAUSES: TEMP,VIBRATION,MECH SHOCK,PIECE PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
NONE - THE FAILED RGA WILL BE DESELECTED BY RM AND THE SEL FILTER WILL DOWNMODE TO MVS AND USE THE REMAINING RGA'S

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/05/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 960 ABORT: 3/1R

ITEM: CIRCUIT - SRB RGA POWER
FAILURE MODE: FAILS OPEN

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) RGA (SRB)
3) POWER CIRCUIT
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: | 3/3 | ATO: | 3/1R |
| LANDING/SAFING: | 3/3 | | |

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

LOCATION:
PART NUMBER:

CAUSES: FAILURES IN THE RPC'S,VOLTAGE SENSING CKT,SWITCH CKT,RELAY,DIODES;GENERIC CAUSES:SHORTS,VIBRATION,MECH SHOCK

EFFECTS/RATIONALE:
LOSS OF THE RGA - BUT ONLY A FAILURE IN TWO COMPONENTS COULD CAUSE TOTAL LOSS OF PWR TO A SINGLE RGA.IF TOTAL PWR IS LOST,THE RGA WILL BE DESELECTED BY RM AND THE SF WILL DOWNMODE TO MVS AND USE THE REMAINING RGA'S.

REFERENCES: ECN NO. 102-8019A

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/05/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/3
MDAC ID: 961 ABORT: 3/3

ITEM: CIRCUIT - SRB RGA POWER
FAILURE MODE: FAILS CLOSED

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) RGA (SRB)
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:
PART NUMBER:

CAUSES: INTERNAL SHORT IN RPC

EFFECTS/RATIONALE:
CAN'T SHUT OFF PWR TO AN SRB PWR BUS PRIOR TO SEP - NO DAMAGE TO ORBITER - MAY CAUSE DAMAGE TO SRB

REFERENCES: ECN NO. 102-8019A

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/15/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1001 ABORT: 3/1R

ITEM: ACCELEROMETER ASSEMBLY
FAILURE MODE: NO OUTPUT ( ON EITHER AXIS OR ON ONE AXIS )

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ACCELEROMETER ASSEMBLY
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: | 3/3 | AOA: | 3/1R |
| DEORBIT: | 3/1R | ATO: | 3/1R |
| LANDING/SAFING: | 3/1R | | |

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

LOCATION: AA1-AREA 81 BAY 1; AA2,3,4-AREA 82 BAY 2
PART NUMBER: MC621-0043-2043

CAUSES: LOSS OF INPUT POWER,POWER SUPPLY FAILURE,PICKOFF LAMP FAILURE,DIFF AMP FAILURE-VIBRATION, SHOCK, EXTREME TEMP. CAN CAUSE INTERNAL FAILURES

EFFECTS/RATIONALE:
NONE - RM WILL NOT USE THE FAILED AA

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/15/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1002 ABORT: 3/1R

ITEM: ACCELEROMETER ASSEMBLY
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ACCELEROMETER ASSEMBLY
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: | 3/3 | AOA: | 3/1R |
| DEORBIT: | 3/1R | ATO: | 3/1R |
| LANDING/SAFING: | 3/1R | | |

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

LOCATION: AA1-AREA 81 BAY 1; AA2,3,4-AREA 82 BAY 2
PART NUMBER: MC621-0043-2043

CAUSES: POWER SUPPLY FAILURE,PICKOFF LAMP FAILURE,DIFF AMP FAILURE-VIBRATION, SHOCK, EXTREME TEMP. CAN CAUSE INTERNAL FAILURES

EFFECTS/RATIONALE:
NONE - RM WILL NOT USE THE FAILED AA

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/15/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/3
MDAC ID: 1010 ABORT: 3/3

ITEM: CIRCUIT-AA'S 1 & 2 POWER
FAILURE MODE: FAILS CLOSED

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ACCELEROMETER ASSEMBLY
3) AA'S 1 & 2 POWER CIRCUITS
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: PANELS 014,015
PART NUMBER: 2 CB'S (MC454-0026-2030)

CAUSES: INTERNAL SHORT IN THE CIRCUIT BREAKER DUE TO CONTAMINATION

EFFECTS/RATIONALE:
AA'S 1 & 2 CAN NOT BE TURNED OFF.NO EFFECT EXCEPT ON ELECTRICAL POWER CONSUMABLES.MAY EFFECT MISSION LENGTH.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/15/86
SUBSYSTEM: GNC
MDAC ID: 1011

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

ITEM: CIRCUIT-AA'S 1 & 2 POWER
FAILURE MODE: FAILS OPEN

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ACCELEROMETER ASSEMBLY
3) AA'S 1 & 2 POWER CIRCUITS
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: | 3/1R | | |

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

LOCATION: PANELS 014,015
PART NUMBER: 2 CB'S (MC454-0026-2030)

CAUSES: PIECE PART STRUCTURAL FAILURE IN CIRCUIT BREAKER

EFFECTS/RATIONALE:
LOSS OF THAT AA-THE DATA FROM THE OTHER 3 AA'S WILL BE USED

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/15/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1012 ABORT: 3/1R

ITEM: CIRCUIT-AA'S 3 & 4 POWER
FAILURE MODE: FAILS OPEN

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ACCELEROMETER ASSEMBLY
3) AA'S 3 & 4 POWER CIRCUIT
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: | 3/1R | | |

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

LOCATION: VS70-971099
PART NUMBER: VS70-971099

CAUSES: SHORT TO GROUND,PIECE PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
AA'S 3 & 4 HAVE TWO POWER CIRCUITS.ONLY A FAILURE ON EACH OF THE CIRCUITS COULD RESULT IN AN OPEN CIRCUIT I.E. BOTH SW CONTACTS,BOTH RPC'S,BOTH RESISTORS,BOTH DIODES,OR VARIOUS COMBINATIONS.
ANY SINGLE FAILURE WOULD RESULT IN LOSS OF ONLY ONE OF THE TWO POWER CIRCUITS.IF TOTAL POWER IS LOST,RM WILL USE DATA FROM THE OTHER 3 AA'S.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/15/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/3
MDAC ID: 1013 ABORT: 3/3

ITEM: CIRCUIT-AA'S 3 & 4 POWER
FAILURE MODE: FAILS CLOSED

LEAD ANALYST: LES DRAPELA SUBSYS LEAD: LES DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ACCELEROMETER ASSEMBLY
3) AA'S 3 & 4 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 [ 1 ] B [ P ] C [ P ]

LOCATION: VS70-971099
PART NUMBER: VS70-971099

CAUSES: INTERNAL SHORT IN SWITCH OR RPC

EFFECTS/RATIONALE:
AA'S 3 & 4 HAVE TWO POWER SUPPLY CIRCUITS.EITHER CIRCUIT COULD BE FAILED CLOSED BY A SINGLE FAILURE IN THE SW OR RPC.THE AA CANNOT BE TURNED OFF EXCEPT BY SHUTTING OFF THE BUSS POWER WHICH EFFECTS OTHER SYSTEMS.ELECTRICAL POWER CONSUMPTION IS AFFECTED.
MAY AFFECT MISSION LENGTH.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/26/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1101 ABORT: 3/1R

ITEM: ASA
FAILURE MODE: ISOL CMD FL OFF IN ONE CHN

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ASA
3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT AV BAY 4(ASA-1), 5(ASA-2), 6(ASA-3,4).
PART NUMBER: MC621-0043-6046

CAUSES: LOSS OF DRIVER POWER, DRIVER CIRCUIT FAIL OFF (VIBR, TEMP, MECH SHOCK).

EFFECTS/RATIONALE:
NONE: LOSS OF 1 OF 4 VLV CHN'S. TWO ISOL VALVE DRIVERS AND THEIR RESPECTIVE CHN MUST FAIL BEFORE AEROSURFACE CONTROL IS AFFECTED. FCS CHECKOUT (OPS-8) WILL DETECT THIS FAILURE PRIOR TO ENTRY. SEC DELTA P >2025 WILL INDICATE ISOL CMD FL IF NO ACTR CHN FL SIGNAL PRESENT.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/01/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1102 ABORT: 3/1R

ITEM: ASA
FAILURE MODE: ISOL CMD FL ON FOR ONE CHN.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ASA
3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT AV BAY 4(ASA-1), 5(ASA-2), 6(ASA-3,4).
PART NUMBER: MC621-0043-6046

CAUSES: ISOL VLV CIRCUIT FL. ERRONEOUS FAULT DETECT or PS FL IND.

EFFECTS/RATIONALE:
NONE: 1 OF 4 ISOL VLV CHN'S COMMANDED TO BYPASS. ACTR SURFACE WILL BE CONTROLLED BY REMAINING CHN'S.
REDUNDANCY SCREEN B IS SATISFIED BY ACTR CHN FAIL SIGNAL.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/26/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 2/1R
MDAC ID: 1103 ABORT: 2/1R

ITEM: ASA
FAILURE MODE: NO POSITION ERR CMD TO ACTR CHN (NULL OUTPUT).

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ASA
3)
4)
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6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT AV BAY 4(ASA-1), 5(ASA-2), 6(ASA-3,4).
PART NUMBER: MC621-0043-6046

CAUSES: SERVO VLV DRIVER CIRCUIT OR PWR FAILURE.

EFFECTS/RATIONALE:
WITH 1 CHN CMD AT 0 (NULL) OUTPUT, OTHER 3 CHN'S WILL CNTRL SURFACE POSITION. WITH 2 UNDETECTED NULL CHN FLS, ASA MAY FAIL GOOD CHN'S AND PRIME SEL FAILED CHN'S DURING ENTRY. MCC MAY NOT BE ABLE TO DETECT TWO NULL FAILURES EXISTING AT THE SAME TIME. FOR PASS B SCREEN REQUIREMENT, SUFFICIENT DATA IS PRESENT IN MCC TO DETERMINE SYSTEM REDUNDANCY.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/26/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1104 ABORT: 3/1R

ITEM: ASA
FAILURE MODE: ERRONEOUS POSITION ERROR CMD TO ACTR.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ASA
3)
4)
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9)

CRITICALITIES

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

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

LOCATION: AFT AV BAY 4(ASA-1), 5(ASA-2), 6(ASA-3,4).
PART NUMBER: MC621-0043-6046

CAUSES: ASA CMD OR FEEDBACK CIRCUIT FAILURE (MECH SHOCK, TEMP, VIBR). ERRONEOUS POSITION CMD FROM GPC/MDM. FDBK XDUCR FL (LOSS OF PWR, OPEN CIR, NON LINEAR).

EFFECTS/RATIONALE:
NONE: THREE FCS CHN'S REMAINING AFTER THE FAILED CHN IS ISOLATED FROM THE ACTR CONTROL CIRCUIT. IF TWO UNDETECTED ERRONEOUS CMDS EXIST, A 2 ON 2 FORCE FIGHT WILL EXIST AND ASA MAY FAIL GOOD CHN'S AND PRIME SELECT FLD CHN'S.
FOR PASS B SCREEN REQUIREMENT, SUFFICIENT DATA IS PRESENT IN MCC TO DETERMINE SYSTEM REDUNDANCY.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/26/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1105 ABORT: 3/1R

ITEM: ASA
FAILURE MODE: NO OUTPUT, OR ERRONEOUS OUTPUT ON ONE POSITION FDBK XDR CHN.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ASA
3)
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6)
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CRITICALITIES

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

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

LOCATION: AFT AV BAY 4(ASA-1), 5(ASA-2), 6(ASA-3,4).
PART NUMBER: MC621-0043-6046

CAUSES: LOSS OF XDCR PWR,OPEN CIRCUIT, NON LINEAR CIRCUIT.

EFFECTS/RATIONALE:
NONE: ONLY 1 FAILURE OF 4 REDUNDANT XDUCR CHANNELS. COULD CAUSE FAILURE (ISOLATION) OF 1 OF 4 FCS ACTR CHN'S.
MULTIFAILURES OF PFB CHN'S WILL AFFECT POSITION CMD'S FROM DAP.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/26/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1106 ABORT: 3/1R

ITEM: ASA
FAILURE MODE: NO OUTPUT/ERRONEOUS OUTPUT ON ONE SEC DELTA P FDBK XDCR CHN.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ASA
3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT AV BAY 4(ASA-1), 5(ASA-2), 6(ASA-3,4).
PART NUMBER: MC621-0043-6046

CAUSES: OPEN CIR, LOSS OF PWR, NON LINEAR CIRCUIT (VIBR, TEMP).

EFFECTS/RATIONALE:
NONE: ONLY 1 FAILURE OF 4 REDUNDANT XDUCR CHN'S. IT WILL INTERFERE WITH NOMINAL OPERATION OF ISOL CMD DRIVER CHN, AND MAY REQUIRE MANUAL CNTL (BYPASS/OVERRIDE) OF THE ISOL CMD.
IT WILL IMPACT SEC DELTA P FDBK FUNCTION TO REDUCE & DISTRIBUTE PRESS DURING SERVO VALVE FORCE FIGHTS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/26/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1107 ABORT: 3/1R

ITEM: ASA
FAILURE MODE: NO OUTPUT/ERRONEOUS OUTPUT ON 1 ELVN PRI DELTA P FDBK XDCR CHN.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ASA
3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT AV BAY 4(ASA-1), 5(ASA-2), 6(ASA-3,4).
PART NUMBER: MC621-0043-6046

CAUSES: LOSS OF XDCR PWR, OPEN CIRCUIT, NONLINEAR CIRCUIT.

EFFECTS/RATIONALE:
NONE:ONLY 1 FAILURE OF 4 REDUNDANT XDCR CHN'S. ELVN PRI DELTA P FDBK IS SUMMED WITH POSITION CMD TO DETERMINE POSITION ERROR CMD TO ACTR SERVO VALVE CHN.
MULTIFAILURES WILL CAUSE RM TO SELECT INCORRECT PRI DELTA P FDBK FOR ASC DAP TO BIAS ELVN LOAD RELIEF SCHEDULE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 9/26/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1108 ABORT: 3/1R

ITEM: ASA
FAILURE MODE: BDY FLP CMD CHN (1 OF 3) INOPERATIVE.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ASA
3)
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9)

CRITICALITIES

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

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

LOCATION: AFT AV BAY 4(ASA-1), 5(ASA-2), 6(ASA-3,4).
PART NUMBER: MC621-0043-6046

CAUSES: PWR SUPPLY FL INHIBIT SIG TO BDY FLAP VLV DRIVERS, NO BDY FLAP ENA CMD, FAILURE OF BDY FLP UP/DWN VLV DRIVE CIRCUIT.

EFFECTS/RATIONALE:
NONE: ONLY 1 FAILURE OF 3 REDUNDANT BDY FLP CMD CHN'S.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/17/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1110 ABORT: 3/1R

ITEM: CIRCUIT-FCS CHN CNTL
FAILURE MODE: SWITCH CONTACT FAILS CLOSED (AT TRANSFER/PREMATURE).

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ASA/ATVC
3) FCS CHANNEL CONTROL CIRCUIT
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: | 3/1R | | |

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

LOCATION: PNL C3 A1 ( SW S6, S7, S8, S9 ). REF VS70-790209 SCH DIAG.
PART NUMBER: SW'S: (ME452-0102-7356). REF VS70-733402.

CAUSES: SWITCH CONTACT SHORTED INTERNALLY (CONTAMINATION, PIECE-PART STRUCTURE FAILURE).

EFFECTS/RATIONALE:
OVERRIDE POSITION: 1 OF 3 CONTACTS FL ON, HAS NO EFFECT. 2 CONT DISAGREE, NO OVERRIDE FOR THAT CHANNEL. 3 CONT FAIL ON, OVERRIDE REMAINS ON, NO DELTA P ISOLATION FOR THAT CHN. OFF POSITION WILL REMOVE THE CHN (ISOLATE CMD ON).
AUTO POSITION: 1 OF 2 CONT FAIL ON, PWR IS APPLIED TO ASA/ATVC THROUGH THEIR RESPECTIVE PWR SW. WHEN SYS NOT REQ, PWR REMOVED BY PWR SW CIRCUIT. SUFFICIENT DATA IS ON THE TELEMETRY DOWNLINK TO MONITOR SYS STATUS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/17/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1111 ABORT: 3/1R

ITEM: CIRCUIT-FCS CHN CNTL
FAILURE MODE: SWITCH CONTACT OR CURRENT LIMIT RESISTOR FAILS OPEN OR SHORTED TO GROUND (AT TRANSFER/PREMATURE).

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ASA/ATVC
3) FCS CHANNEL CONTROL CIRCUIT
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: | 3/1R | | |

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

LOCATION: PNL C3 A1 ( SW S6, S7, S8, S9 ). REF VS70-790209 SCH DIAG.
PART NUMBER: SW'S: (ME452-0102-7356). REF VS70-733402.

CAUSES: CONTAMINATION, VIBRATION, PIECE-PART STRUCTURE FAILURE, TEMP, OVERLOAD CURRENT.

EFFECTS/RATIONALE:
OVERRIDE POSITION: 1 OF 3 CONTACTS FL OFF, HAS NO EFFECT. 2 CONT DISAGREE, NO OVERRIDE FOR THAT CHANNEL. 3 CONT'S FAIL OFF, NO OVERRIDE CAPABILITY FOR CHN. RESET CAPABILITY FROM SPEC 53 (OPS-3) & 801 (OPS-8).
AUTO POSITION: 1 OF 2 CONTACTS FAIL OFF, LOSS OF ONLY 1 DUAL REDUNDANT PWR SOURCE. 2 CONT FL OFF, LOSS OF PWR TO THE ASA/ATVC CHANNEL (1 OF 4 CHANNELS). SUFFICIENT DATA IS ON THE TELEMETRY DOWNLINK TO MONITOR SYSTEM STATUS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/17/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1112 ABORT: 3/1R

ITEM: CIRCUIT-FCS CHN CNTL
FAILURE MODE: DIODE FAILS OPEN.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ASA/ATVC
3) FCS CHANNEL CONTROL CIRCUIT
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: | 3/1R | | |

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

LOCATION: PNL C3 A1 ( SW S6, S7, S8, S9 ). REF VS70-790209 SCH DIAG.
PART NUMBER: SW'S: (ME452-0102-7356). REF VS70-733402.

CAUSES: VIBRATION, TEMP, OVERLOAD CURRENT.

EFFECTS/RATIONALE:
1 DIODE OPEN, LOSS OF ONLY 1 OF THE REDUNDANT CNTL BUS POWER TO ASA (ATVC) WHILE SWITCH IS IN OVERRIDE. 2 DIODES OPEN WILL RESULT IN NO CNTL BUS POWER TO ASA (ATVC) CHN WHILE IN OVERRIDE (ISOLATE CMDS ON).
TWO SERIAL DIODES SHORTED, WAS NOT CONSIDERED A CREDIBLE FAILURE.
OVERIDE CAPABILITY FROM SPEC 53 (OPS-3) AND 801 (OPS-8).
SUFFICIENT DATA IS ON THE TELEMETRY DOWNLINK TO MONITOR SYS STATUS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/27/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1130 ABORT: 3/1R

ITEM: CIRCUIT-ASA'S 1,2,3,4 POWER
FAILURE MODE: POWER CIRCUIT FAILS OPEN (OFF), DURING POWER TRANSFER OR PREMATURELY.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ASA
3) ASA'S 1,2,3,4 POWER CIRCUIT
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: | 3/1R | | |

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

LOCATION: PNL O14 S10, O15 S9, O16 S8,S9. REF VS70-790229 SCH DIAG.
PART NUMBER: SW'S: (ME452-0102-7301). REF VS70-971099, 790229 SCH DIAG'S.

CAUSES: SWITCH CONTACT OR CURRENT LIMIT RESISTOR, RPC(5A,10A), OR DIODE(12A,35A) FAIL OPEN OR SHORTED TO GROUND. GENERIC CAUSES: VIBRATION, INTERNAL PART FAILURE, CONTAMINATION, MECH SHOCK, THERMAL.

EFFECTS/RATIONALE:
EACH OF THE FOUR ASA'S DRIVE A REDUNDANT FCS CHANNEL. A SINGLE FAILURE CAN REMOVE ASA-4 ISOL VALVE DRIVER POWER (VLV FLD CLOSED). TWO FAILURES ARE REQUIRED IN ALL OTHER CASES TO LOSE POWER TO AN ASA POWER SUPPLY OR ISOL VALVE DRIVER CIRCUIT. ACTUATOR ISOLATION VALVES WILL BE COMMANDED OPEN IF POWER IS LOST TO THE ASA POWER SUPPLY. IF POWER IS LOST TO THE ISOL VALVE DRIVERS, THE ACTUATOR ISOLATION VALVES WILL BE COMMANDED TO THE CLOSED POSITION.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/27/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/3
MDAC ID: 1131 ABORT: 3/3

ITEM: CIRCUIT-ASA'S 1,2,3,4 POWER
FAILURE MODE: POWER CIRCUIT FAILS CLOSED (ON), DURING POWER TRANSFER OR PREMATURELY.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ASA
3) ASA'S 1,2,3,4 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: PNL O14 S10, O15 S9, O16 S8,S9. REF VS70-790229 SCH DIAG.
PART NUMBER: SW'S: (ME452-0102-7301). REF VS70-971099, 790229 SCH DIAG'S.

CAUSES: SWITCH CONTACTS OR RPC(5A,10A) SHORTED INTERNALLY.
GENERIC CAUSES: VIBRATION, CONTAMINATION, INTERNAL PART FAILURE.

EFFECTS/RATIONALE:
EACH OF THE FOUR ASA'S DRIVE A REDUNDANT FCS CHNL. IF A SW CONTACT OR RPC SHORTS IN A CLSD (ON) STATE, PWR WILL BE APPLIED TO THE ASA PWR SUPPLY OR ISOLATION VLV DRIVERS. FOR PWR SW CONTACTS SHORTED, ASA PWR SUPPLY CAN BE TURNED OFF BY THE FCS CHNL SW.
THE ISOLATION VALVE DRIVERS WILL REMAIN POWERED (ISOL VALVE COMMANDED TO OPEN) WITH FCS CHANNEL SWITCH OFF. FAILURE WILL EFFECT POWER CONSUMABLES, AND MAY EFFECT MISSION LENGTH.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/21/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1201 ABORT: 3/1R

ITEM: RJDF
FAILURE MODE: NO OUTPUT TO JET

LEAD ANALYST: TRAHAN, W. H. SUBSYS LEAD: DRAPELA, LES

BREAKDOWN HIERARCHY:
1) GNC
2) RJD
3) RJDF
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: FWD BAY
PART NUMBER: MC621-0043-6244

CAUSES: MECH SHOCK, VIBRATION, CONTAMINATION, PIECE PART STRU FAIL

EFFECTS/RATIONALE:
NONE. S/W WILL SELECT ALTERNATE JET.
NONE. ORIENTATION OF JET ON OTHER MANIFOLDS ALLOWS SAME EFFECT.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/21/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1203 ABORT: 3/1R

ITEM: RJDA
FAILURE MODE: NO OUTPUT

LEAD ANALYST: TRAHAN, W. H. SUBSYS LEAD: DRAPELA, LES

BREAKDOWN HIERARCHY:
1) GNC
2) RJD
3) RJDA
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: AFT BAY
PART NUMBER: MC621-0043-6244

CAUSES: MECH SHOCK, VIBRATION, CONTAMINATION, PIECE PART STRU FAIL

EFFECTS/RATIONALE:
NONE. S/W WILL SELECT ALTERNATE JET.
NONE. ORIENTATION OF JET ON OTHER MANIFOLDS ALLOWS SAME EFFECT.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/24/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 1/1
MDAC ID: 1205 ABORT: 3/1R

ITEM: RJDA
FAILURE MODE: INADVERTENT JET FIRING

LEAD ANALYST: TRAHAN, W. H. SUBSYS LEAD: DRAPELA, LES

BREAKDOWN HIERARCHY:
1) GNC
2) RJD
3) RJDA
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT BAY
PART NUMBER: MC621-0043-6244

CAUSES: MECH SHOCK, VIBRATION, CONTAMINATION, PIECE PART STRU FAIL, SHORTED.

EFFECTS/RATIONALE:
S/W WILL SHUT JET DWN. MINIMUM FIRING MAY OCCUR; MAY BE FATAL IF PERSONNEL IN VICINITY OF JET PLUME
MAY CAUSE VEHICLE DAMAGE IF IN CLOSE PROXIMITY OF TGT VEHICLE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/24/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 1/1
MDAC ID: 1206 ABORT: 3/1R

ITEM: RJDF
FAILURE MODE: INADVERTENT JET FIRING

LEAD ANALYST: TRAHAN, W. H. SUBSYS LEAD: DRAPELA, LES

BREAKDOWN HIERARCHY:
1) GNC
2) RJD
3) RJDF
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: FWD BAY
PART NUMBER: MC621-0043-6244

CAUSES: MECH SHOCK, VIBRATION, CONTAMINATION, PIECE PART STRU FAIL, SHORTED.

EFFECTS/RATIONALE:
S/W WILL SHUT JET DWN. MINIMUM FIRING MAY OCCUR; MAY BE FATAL IF PERSONNEL IN VICINITY OF JET PLUME.
MAY CAUSE VEHICLE DAMAGE IF IN CLOSE PROXIMITY OF TGT VEHICLE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/24/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1207 ABORT: 3/1R

ITEM: PC FEEDBACK
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: TRAHAN, W. H. SUBSYS LEAD: DRAPELA, LES

BREAKDOWN HIERARCHY:
1) GNC
2) RJD
3) RJDF
4) CHAMBER PRESSURE FEEDBACK
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: FWD BAY
PART NUMBER: MC621-0043-6244

CAUSES: MECH SHOCK, VIBRATION, CONTAMINATION, PIECE PART STRU FAIL, SHORTED.

EFFECTS/RATIONALE:
NONE. RM WILL DETECT FAIL ON/OFF AND NOT SELECT JET.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/24/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1208 ABORT: 3/1R

ITEM: PC FEEDBACK
FAILURE MODE: ERRONEOUS OUTPUT

LEAD ANALYST: TRAHAN, W. H. SUBSYS LEAD: DRAPELA, LES

BREAKDOWN HIERARCHY:
1) GNC
2) RJD
3) RJDA
4) CHAMBER PRESSURE FEEDBACK
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT BAY
PART NUMBER: MC621-0043-6244

CAUSES: MECH SHOCK, VIBRATION, CONTAMINATION, PIECE PART STRU FAIL, SHORTED.

EFFECTS/RATIONALE:
NONE. RM WILL DETECT FAIL ON/OFF AND NOT SELECT JET.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/19/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/3
MDAC ID: 1211 ABORT: 3/3

ITEM: POWER CIRCUIT
FAILURE MODE: CIRCUIT FAIL CLOSE (INADVERENT OUTPUT)

LEAD ANALYST: TRAHAN, W. H. SUBSYS LEAD: DRAPELA, LES

BREAKDOWN HIERARCHY:
1) GNC
2) RJD
3) RJDF
4) POWER CIRCUIT
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: FWD BAY
PART NUMBER: VS70-420109,209,309

CAUSES: MECH SHOCK, VIBRATION, CONTAMINATION, PIECE PART STRU FAIL, SHORTED.

EFFECTS/RATIONALE:
NONE. POWER SUPPLIED FOR LOGIC BUT NO CMDS FROM GPC. MAY BE ADDITIONAL POWER CONSUMPTION.
NONE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/19/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/3
MDAC ID: 1212 ABORT: 3/3

ITEM: POWER CIRCUIT
FAILURE MODE: CIRCUIT FAIL CLOSE (INADVERENT OUTPUT)

LEAD ANALYST: TRAHAN, W. H. SUBSYS LEAD: DRAPELA, LES

BREAKDOWN HIERARCHY:
1) GNC
2) RJD
3) RJDA
4) POWER CIRCUIT
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: AFT BAY
PART NUMBER: VS70-420109,209,309

CAUSES: MECH SHOCK, VIBRATION, CONTAMINATION, PIECE PART STRU FAIL, SHORTED.

EFFECTS/RATIONALE:
NONE. POWER SUPPLIED FOR LOGIC BUT NO CMDS FROM GPC. MAY BE ADDITIONAL POWER CONSUMPTION.
NONE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/19/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1213 ABORT: 3/1R

ITEM: POWER CIRCUIT
FAILURE MODE: CIRCUIT FAIL OPEN (NO OUTPUT)

LEAD ANALYST: TRAHAN, W. H. SUBSYS LEAD: DRAPELA, LES

BREAKDOWN HIERARCHY:
1) GNC
2) RJD
3) RJDA
4) POWER CIRCUIT
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT BAY
PART NUMBER: VS70-420109,209,309

CAUSES: MECH SHOCK, VIBRATION, CONTAMINATION, PIECE PART STRU FAIL, SHORTED TO GROUND.

EFFECTS/RATIONALE:
NONE. JETS ON THAT MANIFOLD WILL NOT FIRE.
OTHER MANIFOLDS ARE AVAILABLE. CREW CAN DISABLE THAT MANIFOLD.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

| | | | |
|---|---|---|---|
| DATE: | 11/19/86 | HIGHEST CRITICALITY | HDW/FUNC |
| SUBSYSTEM: | GNC | FLIGHT: | 3/1R |
| MDAC ID: | 1214 | ABORT: | 3/1R |

ITEM: POWER CIRCUIT
FAILURE MODE: CIRCUIT FAIL OPEN (NO OUTPUT)

LEAD ANALYST: TRAHAN, W. H. SUBSYS LEAD: DRAPELA, LES

BREAKDOWN HIERARCHY:
1) GNC
2) RJD
3) RJDF
4) POWER CIRCUIT
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: FWD BAY
PART NUMBER: VS70-420109,209,309

CAUSES: MECH SHOCK, VIBRATION, CONTAMINATION, PIECE PART STRU FAIL, SHORTED TO GROUND.

EFFECTS/RATIONALE:
NONE. JETS ON THAT MANIFOLD WILL NOT FIRE.
OTHER MANIFOLDS ARE AVAILABLE. CREW CAN DISABLE THAT MANIFOLD.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/01/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1301 ABORT: 3/1R

ITEM: ATVC
FAILURE MODE: ISOL CMD FL OFF IN ONE CHN.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ATVC
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: | 3/3 | AOA: | 3/1R |
| DEORBIT: | 3/3 | ATO: | 3/1R |
| LANDING/SAFING: | 3/3 | | |

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

LOCATION: AFT AV BAY 4(ATVC-1), 5(ATVC-2), 6(ATVC-3,4).
PART NUMBER: MC621-0043-6541

CAUSES: LOSS OF DRVR PWR, DRVR CIRCUIT FL OFF (VIBR, TEMP, MECH SHOCK).

EFFECTS/RATIONALE:
NONE: LOSS OF 1 OF 4 VLV CHN'S. TWO ISOL VLV DRIVERS AND THEIR RESPECTIVE CHN MUST FL BEFORE ASC THRUST VECTOR CNTL IS AFFECTED. NO WAY TO DETECT ISOL VLV FLD OFF. SEC DELTA P >2200 WILL INDICATE ISOL CMD FL IF NO ACTR CHN FL SIGNAL PRESENT.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/01/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1302 ABORT: 3/1R

ITEM: ATVC
FAILURE MODE: ISOL CMD FL ON FOR ONE CHN.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ATVC
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: | 3/3 | AOA: | 3/1R |
| DEORBIT: | 3/3 | ATO: | 3/1R |
| LANDING/SAFING: | 3/3 | | |

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

LOCATION: AFT AV BAY 4(ATVC-1), 5(ATVC-2), 6(ATVC-3,4).
PART NUMBER: MC621-0043-6541

CAUSES: ISOL VLV CIRCUIT FL, ERRONEOUS FAULT DETECT, FALSE PS FL IND.

EFFECTS/RATIONALE:
NONE: 1 OF 4 ISOL VLV CHN'S COMMANDED TO BYPASS. THRUST VECTOR CONTROL WILL BE MAINTAINED BY REMAINING CHN'S.
REDUNDANCY SCREEN B IS SATISFIED BY ACTR CHN FAIL SIGNAL.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/01/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 2/1R
MDAC ID: 1303 ABORT: 2/1R

ITEM: ATVC
FAILURE MODE: NO POSITION CMD TO ACTR CHN (NULL OUTPUT).

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ATVC
3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT AV BAY 4(ATVC-1), 5(ATVC-2), 6(ATVC-3,4).
PART NUMBER: MC621-0043-6541

CAUSES: SERVO VLV DRVR PWR OR CIRCUIT FAILURE (MECH SHOCK, TEMP, VIBR).

EFFECTS/RATIONALE:
WITH 1 CHN CMD AT 0 (NULL) OUTPUT, OTHER 3 CHN'S WILL MAINTAIN THRUST VECTOR CNTL. DURING FLIGHT, SUFFICIENT MCC DATA AVAILABLE TO SATISFY REDUNDANCY SCREEN B FOR PASS. MCC MAY NOT BE ABLE TO DETECT TWO NULL FAILURES EXISTING AT THE SAME TIME.
FOR 3.8 SEC DURING ENGINE IGNITION TO L/O, FORCED ATVC OVERRIDE IS IN EFFECT. WITH TWO UNDETECTED FLD CHN CMDS, A 2 ON 2 FORCE FIGHT WILL EXIST AND ATVC MAY FAIL GOOD CHN'S AND PRIME SELECT FLD CHN'S DURING ASCENT CAUSING LOSS OF VEHICLE CONTROL.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/01/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 2/1R
MDAC ID: 1304 ABORT: 2/1R

ITEM: ATVC
FAILURE MODE: ERRONEOUS POSITION CMD TO ACTR.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ATVC
3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: AFT AV BAY 4(ATVC-1), 5(ATVC-2), 6(ATVC-3,4).
PART NUMBER: MC621-0043-6541

CAUSES: ATVC CMD CIRCUIT FAILURE (MECH SHOCK, TEMP, VIBR). ERRONEOUS POSITION CMD FROM GPC/MDM. SEC DELTA P REDUNDANT CHANNEL EQUALZATION CIRCUIT FAILURE (ERRONEOUS OUTPUT). SEC DELTA P XDCR CIRCUIT FAILURE (ERRONEOUS OUTPUT).

EFFECTS/RATIONALE:
3 CMD CHN'S REMAIN AFTER THE FLD CMD IS DETECTED AND ISOLATED FROM THE ACTR CONTROL CIRCUIT. DURING FLIGHT, SUFFICIENT MCC DATA IS AVAILABLE TO SATISFY REDUNDANCY SCREEN B FOR PASS.
FOR 3.8 SEC DURING ENGINE IGNITION TO L/O, FORCED ATVC OVERRIDE IS IN EFFECT. IF TWO UNDETECTED CHN CMD FL'S EXIST, A 2 ON 2 FORCE FIGHT WILL EXIST AND ATVC MAY FAIL GOOD CHN'S AND PRIME SELECT FLD CHN'S DURING ASCENT.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/01/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1305 ABORT: 3/1R

ITEM: ATVC
FAILURE MODE: NO OUTPUT/ERRONEOUS OUTPUT ON ONE SEC DELTA P FDBK XDCR CHN.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ATVC
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: | 3/3 | AOA: | 3/1R |
| DEORBIT: | 3/3 | ATO: | 3/1R |
| LANDING/SAFING: | 3/3 | | |

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

LOCATION: AFT AV BAY 4(ATVC-1), 5(ATVC-2), 6(ATVC-3,4).
PART NUMBER: MC621-0043-6541

CAUSES: OPEN CIRCUIT, LOSS OF PWR, NON LINEAR CIRCUIT (VIBR, TEMP).

EFFECTS/RATIONALE:
NONE: ONLY 1 FAILURE OF 4 REDUNDANT XDCR CHN'S. WILL INTERFERE WITH NOMINAL OPERATION OF THE ISOL CMD DRIVER CHN, AND MAY REQUIRE MANUAL CNTL (BYPASS/OVERRIDE) OF THE ISOL CMD CHN. FAILURE WILL IMPACT SEC DELTA P FDBK FUNCTION TO REDUCE AND DISTRIBUTE PRESS DURING SERVO VALVE FORCE FIGHTS. SUFFICIENT MCC DATA AVAILABLE TO SATISFY REDUNDANCY SCREEN B FOR PASS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

| | | | |
|---|---|---|---|
| DATE: | 10/28/86 | HIGHEST CRITICALITY | HDW/FUNC |
| SUBSYSTEM: | GNC | FLIGHT: | 3/1R |
| MDAC ID: | 1310 | ABORT: | 3/1R |

ITEM: CIRCUIT- ATVC'S 1,2,3,4 POWER
FAILURE MODE: POWER CIRCUIT FAILS OPEN (OFF), DURING POWER TRANSFER OR PREMATURELY.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ATVC
3) ATVC'S 1,2,3,4 POWER CIRCUIT
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: | 3/3 | ATO: | 3/1R |
| LANDING/SAFING: | 3/3 | | |

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

LOCATION: PNL O14 S1, S2, S3, S4. REF VS70-790239 SCH DIAG.
PART NUMBER: SW'S: (ME452-0102-7301). REF VS70-971099, -790239 SCH DIAG'S.

CAUSES: SWITCH CONTACT OR CURRENT LIMIT RESISTOR, RPC(5A,3A), OR DIODE(12A) FAIL OPEN OR SHORTED TO GROUND. GENERIC CAUSES: VIBRATION, INTERNAL PART FAILURE, CONTAMINATION, MECH SHOCK, THERMAL.

EFFECTS/RATIONALE:
EACH OF THE FOUR ATVC'S DRIVE A REDUNDANT FCS CHANNEL. A SINGLE FAILURE CAN REMOVE ATVC ISOL VALVE DRIVER POWER ( VLV FLD CLOSED). TWO FAILURES ARE REQUIRED TO LOSE POWER TO AN ATVC POWER SUPPLY.
ACTUATOR ISOLATION VALVES WILL BE COMMANDED OPEN IF POWER IS LOST TO THE ATVC POWER SUPPLY. IF POWER IS LOST TO THE ISOL VALVE DRIVERS, THE ACTUATOR ISOLATION VALVES WILL BE COMMANDED TO THE CLOSED POSITION.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

| | | | |
|---|---|---|---|
| DATE: | 10/28/86 | HIGHEST CRITICALITY | HDW/FUNC |
| SUBSYSTEM: | GNC | FLIGHT: | 3/3 |
| MDAC ID: | 1311 | ABORT: | 3/3 |

ITEM: CIRCUIT- ATVC'S 1,2,3,4 POWER
FAILURE MODE: POWER CIRCUIT FAILS CLOSED (ON), DURING POWER TRANSFER OR PREMATURELY.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ATVC
3) ATVC'S 1,2,3,4 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: PNL O14 S1, S2, S3, S4. REF VS70-790239 SCH DIAG.
PART NUMBER: SW'S: (ME452-0102-7301). REF VS70-971099, -790239 SCH DIAG'S.

CAUSES: SWITCH CONTACTS OR RPC(5A,3A) SHORTED INTERNALLY.
GENERIC CAUSES: VIBRATION, CONTAMINATION, INTERNAL PART FAILURE.

EFFECTS/RATIONALE:
EACH OF THE ATVC'S DRIVE A REDUNDANT FCS CHNL. IF A SW CONTACT OR RPC SHORTS IN A CLSD (ON) STATE, PWR WILL BE APPLIED TO THE ATVC PWR SUPPLY OR ISOLATION VLV DRIVERS. FOR PWR SW CONTACTS SHORTED, ATVC PWR SUPPLY CAN BE TURNED OFF BY THE FCS CHN SW.
THE ISOLATION VALVE DRIVERS WILL REMAIN POWERED (ISOL VALVE COMMANDED TO OPEN) WITH FCS CHANNEL SWITCH OFF. FAILURE WILL EFFECT POWER CONSUMABLES, AND MAY EFFECT MISSION LENGTH.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/30/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1400 ABORT: 3/1R

ITEM: CIRCUIT-BODY FLAP CNTL
FAILURE MODE: BODY FLAP UP/DOWN SWITCH CONTACT OR CURRENT LIMIT RESISTOR FAILS OPEN OR SHORTED TO GROUND.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) BODY FLAP CNTL CIRCUIT
3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PNL L2 A1S7, C3 A1S10, F2 S9, F4 S9. REF VS70-790209, 971099 SCH DIAG'S.
PART NUMBER: SW'S: (ME452-0102-7255, ME452-0061-7140), RESISTORS (RWR80S1211FR).

CAUSES: CONTAMINATION, VIBRATION, PIECE-PART STRUCTURE FAILURE, TEMP, OVERLOAD CURRENT.

EFFECTS/RATIONALE:
IF 1 OF 2 SWITCH CONTACTS FAIL OFF (DISAGREE), THE OUTPUT COMMAND WILL BE SET OFF (ZERO OUTPUT). BODY FLAP CAN BE COMMANDED FROM THE OTHER CREWMEMBER'S POSITON.
SUFFICIENT DATA IS ON THE TELEMETRY DOWNLINK AND DISPLAYED IN THE MCC TO MONITOR SYSTEM STATUS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/30/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1401 ABORT: 3/1R

ITEM: CIRCUIT-BODY FLAP CNTL
FAILURE MODE: BODY FLAP UP/DOWN SWITCH CONTACT FAILS CLOSED.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) BODY FLAP CNTL CIRCUIT
3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PNL L2 A1S7, C3 A1S10, F2 S9, F4 S9. REF VS70-790209, 971099 SCH DIAG'S.
PART NUMBER: SW'S: (ME452-0102-7255, ME452-0061-7140), RESISTORS (RWR80S1211FR).

CAUSES: CONTAMINATION, PIECE-PART STRUCTURE FAILURE, VIBRATION.

EFFECTS/RATIONALE:
IF 1 OF 2 SWITCH CONTACTS FAILS CLOSED (ON), A DISAGREE CONDITION WILL EXIST AND NO OUTPUT COMMAND WILL BE ISSUED BY THE SOFTWARE. IF TWO SWITCH CONTACTS FAIL CLOSED (ON), AN ON COMMAND WILL BE ISSUED BY THE SOFTWARE.
UP COMMAND WILL OVERRIDE A DOWN COMMAND. THE BODY FLAP PBI SWITCH CAN MODE THE DAP FROM MANUAL TO AUTO. SUFFICIENT DATA IS ON THE TELEMETRY DOWNLINK AND DISPLAYED IN THE MCC TO MONITOR SYSTEM STATUS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/30/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1402 ABORT: 3/1R

ITEM: CIRCUIT-BODY FLAP CNTL
FAILURE MODE: BODY FLAP AUTO/MAN PBI SWITCH CONTACT OR CURRENT LIMIT RESISTOR FAILS OPEN OR SHORTED TO GROUND.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) BODY FLAP CNTL CIRCUIT
3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PNL L2 A1S7, C3 A1S10, F2 S9, F4 S9. REF VS70-790209, 971099 SCH DIAG'S.
PART NUMBER: SW'S: (ME452-0102-7255, ME452-0061-7140), RESISTORS (RWR80S1211FR).

CAUSES: CONTAMINATION, VIBRATION, PIECE-PART STRUCTURE FAILURE, TEMP, OVERLOAD CURRENT.

EFFECTS/RATIONALE:
FOR 1 OF 3 CONTACTS FAILED OFF (NO OUTPUT), RM WILL FAIL THE CONTACT AND DOWNMODE TO THE 2-LVL. A 2-LVL RM DISAGREE CONDITION WILL INHIBIT THE USE OF THE SWITCH (ZERO OUTPUT).
AUTO/MAN MODES CAN BE SELECTED FROM THE OTHER CREWMEMBER'S POSITION. SUFFICIENT DATA IS ON THE TELEMETRY DOWNLINK AND DISPLAYED IN THE MCC FOR MONITORING SYSTEM STATUS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/30/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1403 ABORT: 3/1R

ITEM: CIRCUIT-BODY FLAP CNTL
FAILURE MODE: BODY FLAP AUTO/MAN PBI SWITCH CONTACT FAILS CLOSED.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) BODY FLAP CNTL CIRCUIT
3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PNL L2 A1S7, C3 A1S10, F2 S9, F4 S9. REF VS70-790209, 971099 SCH DIAG'S.
PART NUMBER: SW'S: (ME452-0102-7255, ME452-0061-7140), RESISTORS (RWR80S1211FR).

CAUSES: CONTAMINATION, PIECE-PART STRUCTURE FAILURE, VIBRATION.

EFFECTS/RATIONALE:
FOR 1 OF 3 CONTACTS FAILED ON, RM WILL FAIL THE CONTACT AND DOWNMODE TO THE 2-LVL. A 2-LVL RM DISAGREE STATE WILL INHIBIT THE USE OF THE SWITCH (ZERO OUTPUT). IF THREE SWITCH CONTACTS FAIL CLOSED (ON), AN ON COMMAND WILL BE ISSUED BY THE SOFTWARE.
IF CDR'S OR PLT'S BODY FLAP PBI SWITCH FAILS ON, THE DAP WILL REMAIN IN THE LAST MODE SELECTED UNTIL FAILURE IS REMOVED.
SUFFICIENT DATA IS ON THE TELEMETRY DOWNLINK AND DISPLAYED IN THE MCC FOR MONITORING SYSTEM STATUS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

| | | | |
|---|---|---|---|
| DATE: | 11/13/86 | HIGHEST CRITICALITY | HDW/FUNC |
| SUBSYSTEM: | GNC | FLIGHT: | 2/1R |
| MDAC ID: | 1404 | ABORT: | 2/1R |

ITEM: CIRCUIT-BODY FLAP CNTL
FAILURE MODE: BODY FLAP UP/DOWN CMD SWITCH JAMMED.

LEAD ANALYST: ROBERT O'DONNELL SUBSYS LEAD: LESTER DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) BODY FLAP CNTL CIRCUIT
3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PNL L2 A1S7, C3 A1S10, F2 S9, F4 S9. REF VS70-790209, 971099 SCH DIAG'S.
PART NUMBER: SW'S: (ME452-0102-7255, ME452-0061-7140), RESISTORS (RWR80S1211FR).

CAUSES: CONTAMINATION, MECHANICAL SHOCK, PIECE-PART STRUCTURE FAILURE.

EFFECTS/RATIONALE:
IF THE BODY FLAP SWITCH FAILS ON IN THE UP POSITION, A CONTINUOUS UP CMD WILL BE ISSUED BY THE BF CMD SOP TO THE DAP. UP COMMAND WILL OVERRIDE A DOWN CMD.
IF EITHER OF THE BODY FLAP PBI'S FAIL ON IN MAN MODE, THERE IS NO WAY TO BRING THE BODY FLAP DOWN OR RETURN TO AUTO.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/21/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/2R
MDAC ID: 1501 ABORT: 3/2R

ITEM: A/B DAP PBI'S (FWD & AFT)
FAILURE MODE: SWITCH CONTACT FAILED CLOSED

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) DAP PBIs
3) A/B PBI'S (FWD & AFT)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANELS C3 & A6
PART NUMBER: VS70-971099

CAUSES: SHORT, STRAY PARTICLE

EFFECTS/RATIONALE:
FIRST TWO FAILURES: NONE. THIRD FAILURE: ONORBIT DAP SELECTION COULD NOT BE CHANGED. HOWEVER, THE PARAMETER CHANGES CAN BE MADE VIA KEYBOARD.
IF FAILURE OCCURRED WHILE OPPOSITE POSITION WAS SELECTED, AN UNEXPECTED CHANGE COULD OCCUR.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/21/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/2R
MDAC ID: 1502 ABORT: 3/2R

ITEM: A/B DAP PBI'S (FWD & AFT)
FAILURE MODE: SWITCH CONTACT FAILED OPEN

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) A/B PBI'S (FWD & AFT)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANELS C3 & A6
PART NUMBER: VS70-971099

CAUSES: SHORT TO GROUND, BROKEN CONTACT, FAILED RESISTOR

EFFECTS/RATIONALE:
FIRST FAILURE: NONE. SECOND FAILURE: PBI WOULD BE INOPERATIVE, BUT OTHER PANEL COULD BE USED.
ALSO, THE PARAMETERS CAN BE CHANGED VIA THE KEYBOARD.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/21/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1510 ABORT: 3/1R

ITEM: FWD AUTO/MAN PBI'S
FAILURE MODE: SWITCH CONTACT FAILED CLOSED

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) FWD AUTO/MAN PBI'S
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL C3
PART NUMBER: S3,S4;ME452-0061-4152,3

CAUSES: SHORT,STRAY PARTICLE

EFFECTS/RATIONALE:
FIRST TWO FAILURES: NONE. THIRD FAILURE: MODE WOULD REMAIN IN FAILED POSN.
IF FAILURE OCCURRED WHILE OPPOSITE POS WAS SELECTED, AN UNEXPECTED MODE CHANGE COULD OCCUR, POSSIBLY AT A CRITICAL TIME, E. G., ET SEP.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/21/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/2R
MDAC ID: 1511 ABORT: 3/2R

ITEM: FWD AUTO/MAN PBI'S
FAILURE MODE: SWITCH CONTACT FAILED OPEN

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) FWD AUTO/MAN PBI'S
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL C3
PART NUMBER: S3,S4;ME452-0061-4152,3

CAUSES: SHORT, BROKEN CONTACT, FAILED RESISTOR

EFFECTS/RATIONALE:
FIRST FAILURE: NONE. SECOND FAILURE: INABILITY TO PERFORM MODE CHANGES
IN TRANS DAP, THE CREW CAN FLY IN EITHER AUTO OR MAN. AFT PANEL COULD BE USED ON ORBIT.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/21/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/2R
MDAC ID: 1515 ABORT: 3/2R

ITEM: AFT AUTO/MAN PBI'S
FAILURE MODE: SWITCH CONTACT FAILED CLOSED

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) AFT AUTO/MAN PBI'S
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL A6
PART NUMBER: S10,S11;ME452-0061-7142,7183

CAUSES: SHORT, STRAY PARTICLE

EFFECTS/RATIONALE:
FIRST TWO FAILURES: NONE. THIRD FAILURE: MODE WOULD REMAIN IN FAILED POSITION.
IF FAILURE OCCURRED WHILE OPPOSITE POS WAS SELECTED, AN UNEXPECTED CHANGE COULD OCCUR. BOTH AUTO AND MAN ARE USED ON ORBIT.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/21/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/2R
MDAC ID: 1516 ABORT: 3/2R

ITEM: AFT AUTO/MAN PBI'S
FAILURE MODE: SWITCH CONTACT FAILED OPEN

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) AFT AUTO/MAN PBI'S
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL A6
PART NUMBER: S10,S11;ME452-0061-7142,7183

CAUSES: SHORT TO GROUND, BROKEN CONTACT, FAILED RESISTOR

EFFECTS/RATIONALE:
FIRST FAILURE: NONE. SECOND FAILURE: MODE CHANGES WOULD HAVE TO BE DONE WITH FWD PANEL.
BOTH AUTO AND MAN ARE NECESSARY FOR ORBIT OPS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/2R
MDAC ID: 1520 ABORT: 3/2R

ITEM: NORM/VERN PBI'S (FWD & AFT)
FAILURE MODE: SWITCH CONTACT FAILED CLOSED

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) NORM/VERN PBI'S (FWD & AFT)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANELS C3 & A6
PART NUMBER: VS70-971099

CAUSES: SHORT, STRAY PARTICLE

EFFECTS/RATIONALE:
FIRST TWO FAILURES: NONE. THIRD FAILURE: RCS JET SELECTION WOULD REMAIN IN FAILED POS.
IF FAILURE OCCURRED WHILE OPPOSITE POS WAS SELECTED, AN UNEXPECTED CHANGE COULD OCCUR.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

| | | | |
|---|---|---|---|
| DATE: | 10/22/86 | HIGHEST CRITICALITY | HDW/FUNC |
| SUBSYSTEM: | GNC | FLIGHT: | 3/2R |
| MDAC ID: | 1521 | ABORT: | 3/2R |

ITEM: NORM/VERN PBI'S (FWD & AFT)
FAILURE MODE: SWITCH CONTACT FAILED OPEN

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) NORM/VERN PBI'S (FWD & AFT)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANELS C3 & A6
PART NUMBER: VS70-971099

CAUSES: SHORT TO GROUND, BROKEN CONTACT, FAILED RESISTOR

EFFECTS/RATIONALE:
FIRST FAILURE: NONE. SECOND FAILURE: CHANGE WOULD HAVE TO BE DONE WITH OTHER PNL.
TRANSLATION REQUIRES NORM JETS. IF NORM JETS CANNOT BE ENABLED VIA PBI'S, TRANSITION TO OPS 3 COULD EFFECT THIS CHANGE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/2R
MDAC ID: 1530 ABORT: 3/2R

ITEM: FWD DISC RATE ROT PBI'S
FAILURE MODE: SWITCH CONTACT FAILED CLOSED

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) FWD DISC RATE ROT PBI'S
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL C3
PART NUMBER: VS70-971099

CAUSES: SHORT, STRAY PARTICLE

EFFECTS/RATIONALE:
FIRST FAILURE: NONE. SECOND FAILURE: ROT MODE WOULD REMAIN IN FAILED POS.
IF FAILURE OCCURRED WHILE ANOTHER MODE WAS SELECTED, AN UNEXPECTED CHANGE COULD OCCUR.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/2R
MDAC ID: 1531 ABORT: 3/2R

ITEM: FWD DISC RATE ROT PBI'S
FAILURE MODE: SWITCH CONTACT FAILED OPEN

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) FWD DISC RATE ROT PBI'S
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL C3
PART NUMBER: VS70-971099

CAUSES: SHORT TO GROUND, BROKEN CONTACT, FAILED RESISTOR

EFFECTS/RATIONALE:
FAILED POSITION COULD NOT BE SELECTED ON TRANS DAP, BUT THE AUTO SYSTEM PROVIDES REDUNDANCY.
AFT PBI COULD BE USED ON ORBIT DAP.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/2R
MDAC ID: 1535 ABORT: 3/2R

ITEM: FWD PULSE ROT PBI'S
FAILURE MODE: SWITCH CONTACT FAILED CLOSED

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) FWD PULSE ROT PBI'S
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL C3
PART NUMBER: VS70-971099

CAUSES: SHORT, STRAY PARTICLE

EFFECTS/RATIONALE:
FIRST FAILURE: NONE. SECOND FAILURE: ROT MODE WOULD REMAIN IN FAILED POS.
IF FAILURE OCCURRED WHILE ANOTHER MODE WAS SELECTED, AN UNEXPECTED CHANGE COULD OCCUR.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/22/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/2R
MDAC ID: 1536 ABORT: 3/2R

ITEM: FWD PULSE ROT PBI'S
FAILURE MODE: SWITCH CONTACT FAILED OPEN

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) FWD PULSE ROT PBI'S
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL C3
PART NUMBER: VS70-971099

CAUSES: SHORT TO GROUND, BROKEN CONTACT, FAILED RESISTOR

EFFECTS/RATIONALE:
FAILED POSITION COULD NOT BE SELECTED ON TRANS DAP, BUT THE AUTO SYSTEM PROVIDES REDUNDANCY.
AFT PBI COULD BE USED ON ORBIT DAP.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

| | | | |
|---|---|---|---|
| DATE: | 10/24/86 | HIGHEST CRITICALITY | HDW/FUNC |
| SUBSYSTEM: | GNC | FLIGHT: | 3/2R |
| MDAC ID: | 1540 | ABORT: | 3/2R |

ITEM: AFT DISC RATE ROT PBI'S
FAILURE MODE: SWITCH CONTACT FAILED CLOSED

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) AFT DISC RATE ROT PBI'S
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL A6
PART NUMBER: VS70-971099

CAUSES: SHORT, STRAY PARTICLE

EFFECTS/RATIONALE:
FIRST FAILURE: NONE. SECOND FAILURE: ROT MODE WOULD REMAIN IN FAILED POS.
IF FAILURE OCCURRED WHILE WHILE ANOTHER MODE WAS SELECTED, AN UNEXPECTED CHANGE COULD OCCUR.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/24/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/2R
MDAC ID: 1541 ABORT: 3/2R

ITEM: AFT DISC RATE ROT PBI'S
FAILURE MODE: SWITCH CONTACT FAILED OPEN

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) AFT DISC RATE ROT PBI'S
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL A6
PART NUMBER: VS70-971099

CAUSES: SHORT TO GROUND, BROKEN CONTACT, FAILED RESISTOR

EFFECTS/RATIONALE:
PBI WOULD BE INOPERATIVE.
FWD PBI COULD BE USED.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/24/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/2R
MDAC ID: 1545 ABORT: 3/2R

ITEM: AFT PULSE ROT PBI'S
FAILURE MODE: SWITCH CONTACT FAILED CLOSED

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) AFT PULSE ROT PBI'S
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL A6
PART NUMBER: VS70-971099

CAUSES: SHORT, STRAY PARTICLE

EFFECTS/RATIONALE:
FIRST FAILURE: NONE. SECOND FAILURE: ROT MODE WOULD REMAIN IN FAILED POS.
IF FAILURE OCCURRED WHILE ANOTHER MODE WAS SELECTED, AN UNEXPECTED CHANGE COULD OCCUR.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/24/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/2R
MDAC ID: 1546 ABORT: 3/2R

ITEM: AFT PULSE ROT PBI'S
FAILURE MODE: SWITCH CONTACT FAILED OPEN

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) AFT PULSE ROT PBI'S
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL A6
PART NUMBER: VS70-971099

CAUSES: SHORT TO GROUND, BROKEN CONTACT, FAILED RESISTOR

EFFECTS/RATIONALE:
PBI WOULD BE INOPERATIVE.
FWD PBI COULD BE USED.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/24/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/2R
MDAC ID: 1550 ABORT: 3/2R

ITEM: ACCEL ROT PBI'S (FWD & AFT)
FAILURE MODE: SWITCH CONTACT FAILED CLOSED

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) ACCEL ROT PBI'S (FWD & AFT)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANELS C3 & A6
PART NUMBER: VS70-971099

CAUSES: SHORT, STRAY PARTICLE

EFFECTS/RATIONALE:
FIRST FAILURE: NONE. SECOND FAILURE: ROT MODE WOULD REMAIN IN FAILED POS.
IF FAILURE OCCURRED WHILE ANOTHER MODE WAS SELECTED, AN UNEXPECTED CHANGE COULD OCCUR.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/24/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/2R
MDAC ID: 1551 ABORT: 3/2R

ITEM: ACCEL ROT PBI'S (FWD & AFT)
FAILURE MODE: SWITCH CONTACT FAILED OPEN

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) ACCEL ROT PBI'S (FWD & AFT)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANELS C3 & A6
PART NUMBER: VS70-971099

CAUSES: SHORT TO GROUND, BROKEN CONTACT, FAILED RESISTOR

EFFECTS/RATIONALE:
PBI WOULD BE INOPERATIVE.
PBI ON OPPOSITE PANEL COULD BE USED.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

| | | | |
|---|---|---|---|
| DATE: | 10/24/86 | HIGHEST CRITICALITY | HDW/FUNC |
| SUBSYSTEM: | GNC | FLIGHT: | 3/2R |
| MDAC ID: | 1560 | ABORT: | 3/2R |

ITEM: TRANSLATION PBI'S (FWD & AFT)
FAILURE MODE: SWITCH CONTACT FAILED CLOSED

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) TRANSLATION PBI'S (FWD & AFT)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANELS C3 & A6
PART NUMBER: VS70-971099

CAUSES: SHORT, STRAY PARTICLE

EFFECTS/RATIONALE:
FIRST FAILURE: NONE. SECOND FAILURE: TRANS MODE WOULD REMAIN IN FAILED POS.
IF FAILURE OCCURRED WHILE ANOTHER MODE WAS SELECTED, AN UNEXPECTED CHANGE COULD OCCUR.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

| | | | |
|---|---|---|---|
| DATE: | 10/24/86 | HIGHEST CRITICALITY | HDW/FUNC |
| SUBSYSTEM: | GNC | FLIGHT: | 3/2R |
| MDAC ID: | 1561 | ABORT: | 3/2R |

ITEM: TRANSLATION PBI'S (FWD & AFT)
FAILURE MODE: SWITCH CONTACT FAILED OPEN

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) TRANSLATION PBI'S (FWD & AFT)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANELS C3 & A6
PART NUMBER: VS70-971099

CAUSES: SHORT TO GROUND, BROKEN CONTACT, FAILED RESISTOR

EFFECTS/RATIONALE:
PBI WOULD BE INOPERATIVE.
PBI ON OPPOSITE PANEL COULD BE USED.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/30/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/2R
MDAC ID: 1570 ABORT: 3/2R

ITEM: A/B PBI'S (FWD & AFT)
FAILURE MODE: PBI STUCK IN DEPRESSED POSITION

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) A/B PBI'S (FWD & AFT)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANELS C3 & A6
PART NUMBER: VS70-971099

CAUSES: BREAKAGE, JAMMING, BROKEN SPRING

EFFECTS/RATIONALE:
FAILED MODE WOULD BE PERMANENTLY SELECTED.
THE ABILITY TO CHANGE PARAMETERS VIA KEYBOARD PROVIDES REDUNDANCY.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

| | | | |
|---|---|---|---|
| DATE: | 10/30/86 | HIGHEST CRITICALITY | HDW/FUNC |
| SUBSYSTEM: | GNC | FLIGHT: | 2/2 |
| MDAC ID: | 1575 | ABORT: | 2/2 |

ITEM: FWD AUTO PBI
FAILURE MODE: PBI STUCK IN DEPRESSED POSITION

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) FWD AUTO PBI
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL C3
PART NUMBER: S3,ME452-0061-4142

CAUSES: BREAKAGE, JAMMING, BROKEN SPRING

EFFECTS/RATIONALE:
MAN MODE COULD BE SELECTED TEMPORARILY ONLY BY MOVING RHC.
AUTO SYSTEM PROVIDES REDUNDANCY ON TRANS DAP, BUT NOT ONORBIT.
BOTH AUTO AND MAN ARE USED ON ORBIT.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/30/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 2/2
MDAC ID: 1576 ABORT: 2/2

ITEM: FWD MAN PBI
FAILURE MODE: PBI STUCK IN DEPRESSED POSITION

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) FWD MAN PBI
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL C3
PART NUMBER: S4,ME452-0061-4183

CAUSES: BREAKAGE, JAMMING, BROKEN SPRING

EFFECTS/RATIONALE:
MANUAL MODE WOULD BE PERMANENTLY SELECTED.
MANUAL IS BACKUP TO AUTO ON TRANS DAP, BUT NOT ONORBIT.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/30/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 2/2
MDAC ID: 1577 ABORT: 2/2

ITEM: AFT AUTO/MAN PBI'S
FAILURE MODE: PBI STUCK IN DEPRESSED POSITION

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) AFT AUTO/MAN PBI'S
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: | 2/2 | AOA: | 3/3 |
| DEORBIT: | 3/3 | ATO: | 2/2 |
| LANDING/SAFING: | 3/3 | | |

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

LOCATION: PANEL A6
PART NUMBER: S10,S11;ME452-0061-7142,7183

CAUSES: BREAKAGE, JAMMING, BROKEN SPRING

EFFECTS/RATIONALE:
FAILED MODE WOULD BE PERMANENTLY SELECTED.
BOTH AUTO AND MANUAL ARE USED FOR ORBIT OPS.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/30/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 2/2
MDAC ID: 1580 ABORT: 2/2

ITEM: NORM/VERN PBI'S (FWD & AFT)
FAILURE MODE: PBI STUCK IN DEPRESSED POSITION

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) NORM/VERN PBI'S (FWD & AFT)
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: | 2/2 | AOA: | 3/3 |
| DEORBIT: | 3/3 | ATO: | 2/2 |
| LANDING/SAFING: | 3/3 | | |

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

LOCATION: PANELS C3 & A6
PART NUMBER: VS70-971099

CAUSES: BREAKAGE, JAMMING, BROKEN SPRING

EFFECTS/RATIONALE:
FAILED MODE WOULD BE PERMANENTLY SELECTED. IF NORM JAMMED, PROX OPS WOULD BE IMPACTED.
IF VERN JAMMED, TRANSLATION COULD NOT BE PERFORMED WITHOUT GOING TO OPS 3.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/30/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 2/2
MDAC ID: 1581 ABORT: 2/2

ITEM: FWD PULSE & D RATE ROT PBI'S
FAILURE MODE: PBI STUCK IN DEPRESSED POSITION

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) FWD PULSE & DISC RATE ROT PBI'S
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PANEL C3
PART NUMBER: VS70-971099

CAUSES: BREAKAGE, JAMMING, BROKEN SPRING

EFFECTS/RATIONALE:
FAILED MODE WOULD BE PERMANENTLY SELECTED.
AUTO MODE WOULD STILL BE FUNCTIONAL. AUTO PROVIDES REDUNDANCY ON TRANS DAP.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/30/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 2/2
MDAC ID: 1582 ABORT: 2/2

ITEM: AFT PULSE & D RATE ROT PBI'S
FAILURE MODE: PBI STUCK IN DEPRESSED POSITION

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) AFT PULSE & DISC RATE ROT PBI'S
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: | 2/2 | AOA: | 3/3 |
| DEORBIT: | 3/3 | ATO: | 2/2 |
| LANDING/SAFING: | 3/3 | | |

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

LOCATION: PANEL A6
PART NUMBER: VS70-971099

CAUSES: BREAKAGE, JAMMING, BROKEN SPRING

EFFECTS/RATIONALE:
FAILED MODE WOULD BE PERMANENTLY SELECTED.
AUTO MODE WOULD STILL BE FUNCTIONAL.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

| | | | |
|---|---|---|---|
| DATE: | 10/30/86 | HIGHEST CRITICALITY | HDW/FUNC |
| SUBSYSTEM: | GNC | FLIGHT: | 2/2 |
| MDAC ID: | 1585 | ABORT: | 2/2 |

ITEM: ACCEL ROT PBI'S (FWD & AFT)
FAILURE MODE: PBI STUCK IN DEPRESSED POSITION

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) ACCEL ROT PBI'S (FWD & AFT)
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: | 2/2 | AOA: | 3/3 |
| DEORBIT: | 3/3 | ATO: | 2/2 |
| LANDING/SAFING: | 3/3 | | |

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

LOCATION: PANELS C3 & A6
PART NUMBER: VS70-971099

CAUSES: BREAKAGE, JAMMING, BROKEN SPRING

EFFECTS/RATIONALE:
FAILED MODE WOULD BE PERMANENTLY SELECTED.
AUTO MODE WOULD STILL BE FUNCTIONAL.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 10/30/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 2/2
MDAC ID: 1586 ABORT: 2/2

ITEM: TRANSLATION PBI'S (FWD & AFT)
FAILURE MODE: PBI STUCK IN DEPRESSED POSITION

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GN&C
2) DAP PBIs
3) TRANSLATION PBI'S (FWD & AFT)
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: | 2/2 | AOA: | 3/3 |
| DEORBIT: | 3/3 | ATO: | 2/2 |
| LANDING/SAFING: | 3/3 | | |

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

LOCATION: PANELS C3 & A6
PART NUMBER: VS70-971099

CAUSES: BREAKAGE, JAMMING, BROKEN SPRING

EFFECTS/RATIONALE:
FAILED MODE WOULD BE PERMANENTLY SELECTED.
AUTO MODE WOULD STILL BE FUNCTIONAL.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

| | | | |
|---|---|---|---|
| DATE: | 11/10/86 | HIGHEST CRITICALITY | HDW/FUNC |
| SUBSYSTEM: | GNC | FLIGHT: | 3/3 |
| MDAC ID: | 1590 | ABORT: | 3/3 |

ITEM: FC ANNUNCIATOR CIRCUIT
FAILURE MODE: NO OUTPUT

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) FC ANNUNCIATOR CIRCUIT
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: PNLS C3,F2,F4,A6
PART NUMBER: MC424-0263-0001

CAUSES: LAMP BURNED OUT, OPEN LAMP DRIVER CIRCUIT

EFFECTS/RATIONALE:
THERE ARE DUAL REDUNDANT LAMPS FOR EACH ANNUNCIATOR.
IF LAMP DRIVER FAILS, THERE IS SUFFICIENT INFORMATION ON BOARD AND/OR AT THE MCC TO DETERMINE THE STATE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/10/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/3
MDAC ID: 1591 ABORT: 3/3

ITEM: FC ANNUNCIATOR CIRCUIT
FAILURE MODE: INADVERTENT OUTPUT

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) FC ANNUNCIATOR CIRCUIT
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: PNLS C3,F2,F4,A6
PART NUMBER: MC424-0263-0001

CAUSES: LAMP DRIVER ACTIVATED WITH NO INPUT FROM FSW.

EFFECTS/RATIONALE:
THIS IS AN EXTREMELY IMPROBABLE FAILURE MODE. THERE WOULD BE SUFFICIENT DATA
ON BOARD AND/OR AT THE MCC TO DETERMINE THE CORRECT STATE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

| | | | |
|---|---|---|---|
| DATE: | 11/10/86 | HIGHEST CRITICALITY | HDW/FUNC |
| SUBSYSTEM: | GNC | FLIGHT: | 3/1R |
| MDAC ID: | 1593 | ABORT: | 3/1R |

ITEM: FC ANNUNCIATOR CIRCUIT
FAILURE MODE: NO OUTPUT FROM ACA

LEAD ANALYST: K. PIETZ SUBSYS LEAD: L. DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) FC ANNUNCIATOR CIRCUIT
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: | 3/1R | AOA: | 3/1R |
| DEORBIT: | 3/1R | ATO: | 3/1R |
| LANDING/SAFING: | 3/1R | | |

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

LOCATION: PNLS C3,F2,F4,A6
PART NUMBER: MC424-0263-0001

CAUSES: CONTAMINATION, SHORT, PIECE PART STRUCTURE FRACTURE

EFFECTS/RATIONALE:
LOSS OF FUNCTION OF ONE ACA WOULD AFFECT MANY MORE SYSTEMS THAN THE FCS, BUT WOULD NOT AFFECT MISSION, CREW, OR VEHICLE. THE EXTREMELY UNLIKELY LOSS OF ALL 5 ACA'S COULD CREATE SUFFICIENT CONFUSION TO JEAPORDIZE CREW/VEHICLE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/3
MDAC ID: 1601 ABORT: 3/3

ITEM: ENTRY MODE SWITCH CIRCUIT
FAILURE MODE: ERRONEOUS OUTPUT (INCORRECT NUMBER OF CONTACTS ENERGIZED)

LEAD ANALYST: J.M. HIOTT SUBSYS LEAD: L.J. DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ENTRY MODE SWITCH CIRCUIT
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 [N/A] B [N/A] C [N/A]

LOCATION: PNL L2
PART NUMBER: ME452-0102-7459,RWR80S1211FR,JANTXV1N4246

CAUSES: CONTACT FAILED OPEN OR CLOSED, RESISTOR (RWR80S1211FR) SHORTED OR OPEN, DIODE (JANTXV1N4246) FAILED CLOSED. - CONTAMINATION, MECHANICAL SHOCK, PIECE PART STRUCTURAL FAILURE

EFFECTS/RATIONALE:
FIRST FAILURE RM WILL SELECT CORRECT MODE - FAULT MESSAGE "G51 RL MODE SW" DISPLAYED TO CREW

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/03/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/3
MDAC ID: 1602 ABORT: 3/3

ITEM: ENTRY MODE SWITCH CIRCUIT
FAILURE MODE: JAMMED SWITCH

LEAD ANALYST: J.M. HIOTT SUBSYS LEAD: L.J. DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ENTRY MODE SWITCH CIRCUIT
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 [N/A] B [N/A] C [N/A]

LOCATION: S25-PNLL2
PART NUMBER: ME452-0102-7459

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

EFFECTS/RATIONALE:
CONTOL MODE CAN BE RETURNED TO AUTO BY OPTION 42X ON OVERIDE DISPLAY. LOW GAIN AND NO Y JET OPTIONS NO LONGER AVAILABLE. NOT CRITICAL TO VEHICLE OR MISSION

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

| | | | |
|---|---|---|---|
| DATE: | 11/19/86 | HIGHEST CRITICALITY | HDW/FUNC |
| SUBSYSTEM: | GNC | FLIGHT: | 3/1R |
| MDAC ID: | 1801 | ABORT: | 3/1R |

ITEM: ABORT MODE SWITCH CIRCUIT
FAILURE MODE: ABORT MODE ROTARY SWITCH, S1 OR ABORT MODE PUSH BUTTON SWITCH, S2 CONTACT FAILED OPEN OR A1R2,A1R2,AIR3 SHORTED TO GROUND

LEAD ANALYST: J.M. HIOTT SUBSYS LEAD: L.J. DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ABORT MODE SWITCH CIRCUIT
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: | 3/3 | AOA: | 3/1R |
| DEORBIT: | 3/3 | ATO: | 3/1R |
| LANDING/SAFING: | 3/3 | | |

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

LOCATION: PNL6-S1MS2,A1R1,A1R2,A1R3
PART NUMBER: ME452-0093-5030,ME452-0061-4187,RW8051211FR

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

EFFECTS/RATIONALE:
FIRST FAILURE - NO EFFECT, SECOND FAILURE - DESIRED ABORT MODE CANNOT BE SELECTED AND INITIATED VIA S1 & S2, DESIRED ABORT MODE CAN STILL BE SELECTED AND INITIATED VIA MM601 OR OVERIDE DISPLAY IF TIME PERMITS
'

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/19/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 2/1R
MDAC ID: 1802 ABORT: 2/1R

ITEM: ABORT MODE SWITCH CIRCUIT
FAILURE MODE: ABORT MODE ROTARY SWITCH, S1 OR ABORT MODE PUSH BUTTORN, S2 CONTACT FAILED CLOSED

LEAD ANALYST: J.M. HIOTT SUBSYS LEAD: L.J. DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ABORT MODE SWITCH CIRCUIT
3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PNLF6
PART NUMBER: ME452-0093-5030,ME452-0061-4187

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

EFFECTS/RATIONALE:
FIRST FAILURE - NO EFFECT, SECOND FAILURE - WRONG ABORT MODE MAY BE INITIATED CAUSING LOSS OFF VEHICLE

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

| | | | |
|---|---|---|---|
| DATE: | 11/19/86 | HIGHEST CRITICALITY | HDW/FUNC |
| SUBSYSTEM: | GNC | FLIGHT: | 2/1R |
| MDAC ID: | 1803 | ABORT: | 2/1R |

ITEM: ABORT MODE SWITCH CIRCUIT
FAILURE MODE: ABORT MODE PUSH BUTTON SWITCH, S2, FAILED OPEN OR ROTARY SWITCH, S1, FAILED OPEN IN THE POSITION REQUIRED FOR ABORT.

LEAD ANALYST: J.M. HIOTT SUBSYS LEAD: L.J. DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ABORT MODE SWITCH CIRCUIT
3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PNL F6A8
PART NUMBER: ME452-0093-5030,ME452-0061-4187

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

EFFECTS/RATIONALE:
THE DESIRED ABORT MODE CANNOT BE SELECTED AND INITIATED USING S1 AND S2 - THE ABORT CAN STILL BE SELECTED AND INITIATE VIA MM601 OR THE OVERIDE DISPLAY

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

| | | | |
|---|---|---|---|
| DATE: | 11/19/86 | HIGHEST CRITICALITY | HDW/FUNC |
| SUBSYSTEM: | GNC | FLIGHT: | 1/1 |
| MDAC ID: | 1804 | ABORT: | 1/1 |

ITEM: ABORT MODE SWITCH CIRCUIT
FAILURE MODE: ABORT MODE PUSH BUTTON SWITCH FAILED CLOSED OR ROTARY SWITCH FAILED CLOSED IN A POSITION OTHER THAN THE REQUIRED ABORT MODE.

LEAD ANALYST: J.M. HIOTT SUBSYS LEAD: L.J. DRAPELA

BREAKDOWN HIERARCHY:
1) GNC
2) ABORT MODE SWITCH CIRCUIT
3)
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PNLF6
PART NUMBER: ME452-0093-5030,ME452-0061-4187

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

EFFECTS/RATIONALE:
THE WRONG ABORT MODE MIGHT BE INITIATED CAUSING LOSS OF VEHCILE

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/06/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1901 ABORT: 3/1R

ITEM: ATT REF PB
FAILURE MODE: CIRCUIT FAIL OPEN

LEAD ANALYST: TRAHAN, W. H. SUBSYS LEAD: DRAPELA, LES

BREAKDOWN HIERARCHY:
1) GNC
2) SWITCH CIRCUIT
3) ATT REF PB
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PLN F6,F8,A6
PART NUMBER: VS70-710149

CAUSES: CONTAMINATION, VIBRATION, TEMP, PIECE PART STRU FAIL.

EFFECTS/RATIONALE:
NONE. TWO OTHER PUSHBUTTONS ARE AVAILABLE.

REFERENCES:

INDEPENDENT ORBITER ASSESSMENT
ORBITER SUBSYSTEM ANALYSIS WORKSHEET

DATE: 11/06/86 HIGHEST CRITICALITY HDW/FUNC
SUBSYSTEM: GNC FLIGHT: 3/1R
MDAC ID: 1902 ABORT: 3/1R

ITEM: ATT REF PB
FAILURE MODE: CIRCUIT FAIL CLOSED

LEAD ANALYST: TRAHAN, W. H. SUBSYS LEAD: DRAPELA, LES

BREAKDOWN HIERARCHY:
1) GNC
2) SWITCH CIRCUIT
3) ATT REF PB
4)
5)
6)
7)
8)
9)

CRITICALITIES

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

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

LOCATION: PLN F6,F8,A6
PART NUMBER: VS70-710149

CAUSES: CONTAMINATION, VIBRATION, TEMP PIECE PART STRU FAIL, RESISTOR OR CONTACT SHORT.

EFFECTS/RATIONALE:
FIRST FAILURE, NO EFFECT. SECOND FAILURE A CONTINUIOUS UPDATE OF REF FRAME OR COAS MARK. MAY LOSE COAS FUNCITIONAL CAPABILITY. ADDITIONAL POWER CONSUMPTION. TWO OTHER REFERENCES AVAILABLE (INTL, LVLH) FOR ATTITUDE DISPLAY. CREW CAN DESELECT COAS FUNCTION VIA KYBD.

REFERENCES:

# APPENDIX D
# POTENTIAL CRITICAL ITEMS

| MDAC | ITEM | FAILURE MODE |
|---|---|---|
| 101 | RHC | PHYSICAL BINDING/JAMMING OF CNTL STICK |
| 202 | THC | IMMOBILE THC |
| 203 | THC | ERRONEOUS OUTPUT |
| 304 | RPTA | LOSS OF ONE RPTA |
| 401 | SBTC | PHYSICAL BINDING/JAMMING OF CNTL LEVER |
| 501 | IMU | ERRONEOUS OUTPUT |
| 502 | IMU | NO OUTPUT |
| 1103 | ASA | NO POSITION ERR CMD TO ACTR CHN (NULL OUTPUT) |
| 1205 | RJDA | INADVERTENT JET FIRING |
| 1206 | RJDF | INADVERTENT JET FIRING |
| 1303 | ATVC | NO POSITION CMD TO ACTR CHN (NULL OUTPUT) |
| 1304 | ATVC | ERRONEOUS POSITION CMD TO ACTR. |
| 1404 | CIRCUIT-BODY FLAP CNTL | BODY FLAP UP/DOWN CMD SWITCH JAMMED |
| 1575 | FWD AUTO PBI | PBI STUCK IN DEPRESSED POSITION |
| 1576 | FWD MAN PBI | PBI STUCK IN DEPRESSED POSITION |
| 1577 | AFT AUTO/MAN PBIs | PBI STUCK IN DEPRESSED POSITION |
| 1580 | NORM/VERN PBIs (FWD & AFT) | PBI STUCK IN DEPRESSED POSITION |
| 1581 | FWD PULSE & DISC RATE ROT PBIs | PBI STUCK IN DEPRESSED POSITION |
| 1582 | AFT PULSE & DISC RATE ROT PBIs | PBI STUCK IN DEPRESSED POSITION |
| 1585 | ACCEL ROT PBIs (FWD & AFT) | PBI STUCK IN DEPRESSED POSITION |
| 1586 | TRANS PBIs (FWD & AFT) | PBI STUCK IN DEPRESSED POSITION |
| 1802 | ABORT MODE SWITCH CIRCUIT | ABORT MODE ROTARY SWITCH, S1 OR ABORT MODE PUSH BUTTORN, S2 CONTACT FAILED CLOSED |
| 1803 | ABORT MODE SWITCH CIRCUIT | ABORT MODE PUSH BUTTON SWITCH, S2, FAILED OPEN OR ROTARY SWITCH, S1, FAILED OPEN IN THE POSITION REQUIRED FOR ABORT |
| 1804 | ABORT MODE SWITCH CIRCUIT | ABORT MODE PUSH BUTTON SWITCH FAILED CLOSED OR ROTARY SWITCH FAILED CLOSED IN A POSITION OTHER THAN THE REQUIRED ABORT MODE |