

SRB CRITICAL ITEMS LIST

SUBSYSTEM: ELECTRICAL AND INSTRUMENTATION

ITEM NAME: Forward OF MDM or Forward OF EMDM

PART NO.: 10400-0452-802 or  
10400-0941-801 or  
10400-0452-803

FM CODE: A49

ITEM CODE: 50-02-01-04

REVISION: Basic

CRITICALITY CATEGORY: 1R

REACTION TIME: Immediate

NO. REQUIRED: 1

DATE: March 1, 2002

CRITICAL PHASES: Boost

SUPERCEDES: Apri 5, 2000

FMEA PAGE NO.: D-192F

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SHEET 1 OF 5

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CN 044

FAILURE MODE AND CAUSES: [1] Arm command to RSS Safe and Arm fails off  
AND [2] Erroneous ARM position indication for RSS Safe and Arm caused by:

- [1]
  - o DOL Module Open
  - o Wiring Harness Open or Short to Ground
- AND
- [2]
  - o DIH fails ON

FAILURE EFFECT SUMMARY:

Loss of ability to transfer firing energy causing inability to destruct when commanded resulting in loss of vehicle,mission, and/or crew and/or loss of life to the public. Critical effects happen only if extremely tight timing of both failures occurs. Failure of Arm command must occur after rotation to Arm has begun and before Arm position has been reached.

REDUNDANCY SCREENS AND MEASUREMENTS

- 1) Pass - Reading can be verified during ground turnaround operations.
- 2) Fail - Erroneous RSS Safe and Arm Assembly ARM indication is not detectable.
- 3) Pass

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Supersedes:

DRD 1.4.2.1-b

## RATIONALE FOR RETENTION:

## A. DESIGN:

## 1. System Description for MDM/EMDM

## SYSTEM DESCRIPTION, FWD MDM or EMDM

- MDM Design Controls – All Modules:

The MDM was designed to Contract End Item (CEI) specification EB4027348 Part I (the EMDM to X8259535 Part I) and incorporates printed circuit board layout to accommodate "stress free" solder joint construction to the requirements of EB4029777 and EB4021936 or M825969 (EMDM) (NHB5300.4 (3A/3A-1) (All failure causes)

- MDM Redundancy Isolation – All Modules:

The MDM or EMDM is designed so that each MDM module is separate from, and redundant to, the opposite side. Design of the circuitry is such that a failure in either channel will not affect the other channel. Only the wiring harness crossovers penetrate the central partition through small openings at the bottom of the partition. An extensive analysis of the effects of possible circuit failures involving the crossover wires was performed by Honeywell and reported in their report "Failure Effects of Cross Strap Wiring for SRB-MDM" dated July 15, 1977.

In flight configuration, power to each DOL Module is provided separately by its associated IOM Power Module which in turn is supplied through each Core Power Supply from SRB power buses O/I A or B. The power supply in the forward MDM (EMDM) is commanded to separate in flight configuration and power is not cross strapped.

In addition to the electrical isolation, physical isolation is accomplished by a metal partition which forms part of the chassis. The partition separates the Core Power Supply Modules, the IOM Power Supply Modules, and the motherboards from the units of the other side.  
(All failure causes)

- Qualification

The MDM and EMDM have been verified by analysis and test to assure that the design goals have been met. The MDM and EMDM are qualified as part of the IEA per the environments listed in the Components Test Requirements Specification SE-019-107-2H and certified by the IEA COQ: IEA A-E&I-2121 and MDM Qualified as an internal component of the Forward IEA.  
(All failure causes)

## 2. Component Description

## COMPONENT DESIGN

Each MDM (EMDM) is designed and built using high reliability parts, including gate arrays, procured, screened and derated to the levels as specified in MSFC 85M03936 or MIL-STD-975. Hybrid microcircuit screening includes 100 percent precap visual inspection and Particle Impact Noise Detection (PIND) testing per M4027078. Reliability was enhanced for the SRB MDM (EMDM) hybrids by limiting the number of rework cycles allowed, not allowing delidding and not allowing particle removal through a punched hole. Also, except for the hybrids on each MIA, all hybrids were fabricated in the Honeywell Hybrid Facility. (All failure causes)

## B. TESTING

### 1) VENDOR RELATED:

- Box Level Testing

Power transistors of 4 watts and greater have received 100 percent PIND testing since the implementation of Change Order No. 7 to contract NAS8-36100. The effectivity of this requirement started at new build MDM S/N 66 and is for all subsequent MDMs and EMDMs. (DIH fails On)

Insertable/removable connector pins are push tested for proper insertion to 3.0 +/-0.5 pounds per Note 9 on drawing 8000758-901. Connector pins in the EMDM are push tested to the requirements of 10STD-0013. (Wiring Harness Open or Short to Ground)

- Acceptance Test - New MDMs

Each new build MDM (EMDM) is acceptance tested , including vibration and thermal test, per Honeywell Acceptance Test Procedure TP4027152 or T8259634 (EMDM) (All failure causes)

- Acceptance Test – Repair / Refurbished MDM

Repaired MDMs (EMDMs) are tested to the level required to verify the repair per the Acceptance Test Procedure TP4027152 or T8259634 (EMDM) (All failure causes)

Prior to installation in the IEA, each MDM (EMDM) gets bench tested at room temperature prior to installation per IEA L3 Test Procedure 5136116-GTSP. (All failure causes)

After installation in the IEA, the MDM (EMDM) is subjected to Forward IEA Acceptance Test, including vibration and thermal, per IEA L3 Procedure 5135105-GTSP. (All failure causes)

### 2) KSC RELATED:

As part of the Forward IEA, Forward MDM's are recertified for reuse by USASRB per 10SPC-0131 and 10REQ-0051.

If anomalies are noted, the Forward IEA's are returned to the vendor L3 for repair and acceptance testing.

## 3) SYSTEM FUNCTIONAL/FAILURE MODE UNIQUE:

Forward Skirt ACO Test - verifications of the SRB Forward MDM (EMDM) data buses, Operational Modes, MDM Lock/Unlock, and RSS Safe and Arm Device circuits are performed per 10REQ-0021, paras. 1.2.2.1.2, 1.2.2.2.1, 1.2.2.2.2.1, 1.2.2.14.1. (DOL Module Open)

Shuttle Interface Test - SRB MDM (EMDM) ignition Safe and Arm Device circuits and MDM Lock/Unlock verifications are performed per OMRSD File V, Vol. 1, Requirement Numbers B75MD0.011 and B75MD0.020. (All failure causes)

Terminal Countdown Demonstration Test - SRB MDM (EMDM) pre-launch and Lockout verifications are performed per OMRSD File II, Vol. 1, Requirement Numbers S00FE0.185 and S00FNO.040. (All failure causes)

Launch Countdown to requirements of Launch Commit Criteria - SRB MDM (EMDM) pre-launch and Lockout verifications are performed per OMRSD File II, Vol. 1, Requirement Numbers S00FE0.185 and S00FNO.040. (All failure causes)

In addition, each time the MDM (EMDM) is powered up an initialization sequence verifies that the failure mode does not exist. (All failure causes)

Last Test for Failure Mode Prior to Launch

The DOL Module BITE tests of the MDM (EMDM) pre-launch verification are conducted at T-3 Hrs per OMRSD File II, Vol. 1 Requirement Number S00FE0.185. (DOL Module Open)

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The above referenced OMRSD testing is performed every flight.

## C. VENDOR RELATED INSPECTION

## 1) HONEYWELL RELATED:

All Honeywell built hybrids in each MDM and EMDM are subjected to in-process inspections per the requirements of MIL-STD-833 and Honeywell Manufacturing Specification M-4027078. Precap visual inspection for all the hybrids is conducted by Honeywell. Higher level assemblies such as modules, harnesses, and the box are all inspected by Honeywell and USASRB quality representative inspectors. (DOLModuleOpen)

Applicable Mandatory Inspection and Manufacturing Checkout (MCO) Points

- o 100 percent Precap visual inspection of hybrids is performed by Honeywell Quality per QCD F84-7, MEB 1118, MEB 1152, and MEB 1203 or QCD F84-7 and QEB 122 (EMDM) (DOL Module Open)
- o 100 percent visual inspection of multi-layer printed wiring boards is performed by Honeywell Quality and verified by USASRB Quality. (DOL Module Open & DIH fails On)
- o Honeywell Quality and USASRB Quality inspect each Shop Replaceable Unit (SRU) for solder and component mounting prior to conformal coating and module closure per SIP 1198 or 1477 (EMDM). (All failure causes)
- o Honeywell Quality and USASRB Quality inspect all chassis (LRU) units after installation of SRU modules for preclose inspection per SIP 1198 or 1477 (EMDM). (All failure causes)
- o MDM harness wires are inspected 100 percent with 7X minimum scope by Honeywell Quality per Q.C.D. S1675-1 or QCD SO336-2 (EMDM). (Wire harness Open or Short to Ground)
- o Each wire shall be individually inspected for damage with a 7X minimum scope by Honeywell Quality per Q.C.D. S1675-1 or Q.C.D. SO336-2 (EMDM) (Wire harness Open or Short to Ground)
- o Final acceptance test is witnessed by Honeywell Quality. Test set-up and test data is verified by USASRB Quality per SIP 1198 or 1477 (EMDM). (All failure causes)

Refurbishment

The same inspections and tests are applicable to refurbished units, depending on the degree of refurbishment required per SIP 1198 or SIP 1477 (EMDM). (All failure causes)

Critical Processes

Wire Wrapping per M4004453 or M8259658 (EMDM)

X-ray laminography per EB 8259664 (EMDM only)

Soldering per EB4021936 or M8259659 (EMDM)

## 2) KSC RELATED INSPECTIONS:

The MDM (EMDM) is inside the Sealed IEA at this point in the process and is not accessible for visual inspection. Inspection and buyoff of data for Fwd IEA (Data Pack) and OMRSD Required test listed in 10REQ-0051 for each Failure Mode constitutes the only inspections applicable at this time in the process.  
(All failure causes)

## D. FAILURE HISTORY

Failure Histories may be obtained from the PRACA database.

## E. OPERATIONAL USE

Not applicable to this failure mode.