

FAILURE MODE EFFECTS ANALYSIS/CRITICAL ITEMS LIST

FMEA NUMBER: EC-MUT-04	ORIGINATOR: JSC	PROJECT: EDFT-04
PART NAME: ECOM ASSY	LRU PART NUMBER: SEG33106880-301,303,305,307	QUANTITY: 1
PART NUMBER: SEG33107096-301	LRU PART NAME: MUT	SYSTEM: DTO 671
DRAWING: SEE P/N	SUBSYSTEM: EVA	EFFECTIVITY: STS-76 & Subsequent

CRITICALITY:

CRITICAL ITEM? YES * NO

SUCCESS PATHS: 2
REMAINING SUCCESS PATHS: 1

CRITICALITY CATEGORY: 1R/2

REDUNDANCY SCREENS:

- A - 1.) C/O PRELAUNCH: PASS
- 2.) C/O ON ORBIT: N/A for NSTS
- B - 3.) DETECTION FLIGHT CREW: PASS
- 4.) DETECTION GROUND CREW: N/A for NSTS
- C - 5.) LOSS OF REDUNDANCY FROM SINGLE CAUSE: PASS

FUNCTION: The ECOM which is used on the end effectors, serves as an interface for attaching compatible end effectors to the ECOM socket located on the MUT base assembly. The ECOM assembly uses two independent spring loaded balls to attach itself to the ECOM socket. Operation of the ECOM assembly requires the crewmember to pull back on the locking collar and rotate to either the locked or release positions which are visually indicated by black on black and a black on white alignment marks, respectively.

FAILURE MODE: Inadvertent release of ECOM assembly on MUT end effector.

CAUSE: Failure of the spring holding the locking collar in the locked position.

FAILURE DETECTION: Tactile.

REMAINING PATHS: Additional spring in the locking collar. (Locking collar has 2 springs to hold it in the locked position.)

EFFECT/MISSION PHASE: EVA

CORRECTIVE ACTION: Discontinue use of MUT.

-FAILURE EFFECTS-

END ITEM: MUT end effector separates from MUT base assembly.

INTERFACE: None.

MISSION: Partial loss of remaining DTO objectives.

CREW/VEHICLE: None for a single failure, however, if 2 failures were to occur possible loose ORUs and/or hardware from the MUT would possibly be free to drift in the cargo bay whether the MUT is used for ORU translation or as a crew restraint device. Loose hardware in the payload bay could either impact the crewmember/vehicle as in the case of translating the ORUs, or could prevent the payload bay doors from closing. Also the possibility of loose hardware impacting the vehicle during landing exists.

FAILURE MODE EFFECTS ANALYSIS/CRITICAL ITEMS LIST

FMEA NUMBER: EC-MUT-04	ORIGINATOR: JSC	PROJECT: EDFT-04
PART NAME: ECOM ASSY	LRU PART NUMBER: SEG33106880- 301,303,305,307	QUANTITY: 1
PART NUMBER: SEG33107096-301	LRU PART NAME: MUT	SYSTEM: DTO 671
DRAWING: SEE P/N	SUBSYSTEM: EVA	EFFECTIVITY: STS-76 & Subsequent

HAZARD INFORMATION:

HAZARD: YES _____ NO _____ *

HAZARD ORGANIZATION CODE: N/A

HAZARD NUMBER: N/A

TIME TO EFFECT: Seconds.

TIME TO DETECT: Seconds.

TIME TO CORRECT: Immediate.

REMARKS:

-RETENTION RATIONALE-

(A) DESIGN: The compatible ECOM used on the end effectors interfaces with the ECOM socket on the MUT base assembly. The ECOM is a push and turn mechanism. The ECOM assembly uses two balls to lock the ECOM in place once it has been mated to the ECOM socket. The balls are locked out by rotating a locking collar which uses two springs to prevent the locking collar from rotating out of the locked position. Alignment marks on ECOM provide visual indication of lock status. Manufacturer's data on the springs specifies a service life of 50,000 cycles at a 0.50 stress range. The stress range of the springs in the ECOM is less than 0.50.

(B) TEST: Requirements specified in JSC 33498A.

Acceptance:

1.) Functional: verified at Predelivery Acceptance Test, Preinstallation acceptance, and Pre/Post environmental test. Minimum of 50 cycles total was performed on all moving parts. The force required to actuate the ECOM was between five (5) and twelve (12) pounds. The torque required to actuate the ECOM was between one (1) and five (5) inch-pounds. The force required to install or remove the ECOM was between two (2) and twelve (12) pounds.

2.) Environmental: Acceptance Vibration

The MUT was subjected to the following vibration in each axis for a duration of 1 minute verified per TPS :

20 Hz	0.01 G ² /Hz
20 to 80 Hz	+3.0 dB/oct
80 to 350 Hz	.040 G ² /Hz
500 to 2000 Hz	-3.0 dB/oct
2000 Hz	0.007 G ² /Hz

load factor 6.1 G rms

Qualification:

- 1.) Vibration: N/A
- 2.) Thermal: Functional verification performed at -100 F and +200 F per TPS.

(C) **INSPECTION:**

Fabrication: All MUT components are verified to be built to print and generally cleaned individually. The MUT is verified to be visually clean at preinstallation acceptance.
Test: Quality Assurance surveillance is required at all tests and inspections.

(D) **FAILURE HISTORY:** This is the first time the MUT has flown and therefore has no failure history. The MUT is similar to the BRT which has successfully flown on STS-69 and STS-72.

(E) **OPERATIONAL USE:**

- 1.) Operational Effect: With a separation in the ECOM connection, the MUT will not function properly.
- 2.) Crew Action: Discontinue use of the MUT and stow away for deorbit and landing.
- 3.) Crew Training: Crew trained in proper use of MUT at WETF.
- 4.) Mission Constraints: When fully extended or placed into a singularity, the crew will not continue to pull against the MUT.
- 5.) In Flight Checkout: Crew can visually verify ECOM lock status.

(F) **MAINTAINABILITY:** The MUT has shelf life of 5 years. The MUT can be removed and replaced if a failure occurs. No on-orbit repair is planned.

PREPARED BY: M. D. Garner

REVISION:

DATE: 2/22/96
