# FAILURE MODE EFFECTS ANALYSIS/CRITICAL ITEMS LIST

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|---|---|---|
| FMEA NUMBER: EC-ECOM-07 | ORIGINATOR: JSC | PROJECT: EDFT-05 |
| PART NAME: ECOM Assembly | LRU PART NUMBER: SEG33107096-301 | QUANTITY: 2 |
| PART NUMBER: SEG33107096-301 | LRU PART NAME: ECOM ASSY | SYSTEM: DTO 671 |
| DRAWING: SEE P/N | SUBSYSTEM: EVA | EFFECTIVITY: STS-80 & 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
B - 2.) DETECTION FLIGHT CREW: N/A
C - 3.) LOSS OF REDUNDANCY FROM SINGLE CAUSE: PASS

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FUNCTION: The ECOM assembly serves as an interface for attaching compatible items which have an ECOM socket. The ECOM assembly uses two balls to secure itself to the ECOM socket. The ECOM assembly mechanism utilizes redundant springs to hold it in the correct (lock, unlock) position. Operation of the ECOM assembly requires the crewmember to pull back on the locking collar and rotate to either the locked or release positions. Alignment marks on ECOM provide visual indication of lock status.

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FAILURE MODE: Inadvertent release of ECOM assembly from the ECOM socket.
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 ball stack.

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## -FAILURE EFFECTS-

END ITEM: ECOM assembly separates from ECOM socket.
INTERFACE: None.
MISSION: Partial loss of remaining DTO objectives.
CREW/VEHICLE: None for a single failure, however, if 2 failures were to occur (both springs fail) possible loose ORUs and/or hardware from the ball stack would possibly be free to drift in the cargo bay. 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.

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## 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:** The ECOM Assembly is used on the MUT, BRT, Ball Stack, and ORU Tether. This FMEA is generically written to address worst case failure of the ECOM Assembly.

## -RETENTION RATIONALE-

**(A) DESIGN:** The ECOM assembly interfaces with a compatible ECOM socket which is either bolted to another item at one end or attached to an end effector at the other. The ECOM assembly 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 assembly 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 assembly is less than 0.50. ECOM is designed to withstand loads of 125 lbs tension and shear and 1800 in-lbs bending and torsion.

**(B) TEST:** Requirements specified in JSC 33794, "Certification and Acceptance Requirements Document, Ball Stack".

Acceptance:

1.) Functional: Verified at Predelivery Acceptance Test, Preinstallation acceptance, and Pre/Post environmental test. Minimum of 10 cycles total was performed on all moving parts. The force required to actuate the ECOM assembly was between five (5) and twelve (12) pounds. The torque required to actuate the ECOM assembly was between one (1) and five (5) inch-pounds. The force required to install or remove the ECOM assembly was between two (2) and twelve (12) pounds.

2.) Environmental: Acceptance Vibration/Thermal

The ball stack was subjected to the following minimal vibration in each axis for a duration of 1 minute verified per TPS when it is installed on a higher assembly.

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|---|---|
| 20 to 80 Hz | +3.0 dB/Oct |

80 to 350 Hz .040 G2/Hz
350 to 2000 Hz -3.0 dB/Oct
load factor 6.1 G rms

Acceptance Thermal:

The ECOM is functionally verified during acceptance thermal testing at a higher assembly level.

Qualification:

1.) Vibration: N/A
2.) Thermal: Functional verification performed at -100 F and +250 F per TPS.

(C) **INSPECTION:**
Fabrication: All ball stack components are verified to be built to print and generally cleaned individually. The ball stack is verified to be visually clean at preinstallation acceptance.
Test: Quality Assurance surveillance is required at all tests and inspections.

(D) **FAILURE HISTORY:** The ECOM assembly has flown on all EDFT flights with no failures.

(E) **OPERATIONAL USE:**
1.) Operational Effect: With a separation in the ECOM connection, the item will not function properly. Item will be free in payload bay during EVA operations.
2.) Crew Action: Discontinue use of the equipment and stow away for deorbit and landing.
3.) Crew Training: Crew trained in proper use of ECOM at WETF.
4.) Mission Constraints: None.
5.) In Flight Checkout: Crew can visually verify ECOM lock status.

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**PREPARED BY:** M. D. Garner **REVISION:** **DATE:** 8/15/96

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