

FAILURE MODE EFFECTS ANALYSIS/CRITICAL ITEMS LIST

FMEA NUMBER: EC-OT-01	ORIGINATOR: JSC	PROJECT: EDFT-05
PART NAME: ORU Tether Reel	LRU PART NUMBER: SEG33108541-301	QUANTITY: 1
PART NUMBER: SEG33108541-301	LRU PART NAME: ORU TETHER ASSY	SYSTEM: DTO 671
DRAWING: SEE P/N	SUBSYSTEM: EVA	EFFECTIVITY: STS-80 & Subsequent

CRITICALITY:CRITICAL ITEM? YES * NO SUCCESS PATHS: 2
SUCCESS PATHS REMAINING: 1CRITICALITY CATEGORY: R2 **REDUNDANCY SCREENS:**

- A - 1.) C/O PRELAUNCH: PASS
 B - 3.) DETECTION FLIGHT CREW: N/A (standby redundancy)
 C - 5.) LOSS OF REDUNDANCY FROM SINGLE CAUSE: PASS

FUNCTION: The ORU tether retracting cord clutch is designed to prevent the Vectran cord from being overloaded when attached to an ORU while in the locked position. The clutch is designed to slip between 20 and 25 lbs. The retracting cord shall automatically retract when the force required to slip the clutch is relieved.

FAILURE MODE: Failure of the ORU tether reel clutch to slip.

CAUSE: Piece part defect, contamination, and/or galling causing a failure of the clutch to slip resulting in overload/fracture of the Vectran cord.

FAILURE DETECTION: ~~Failure~~ None

REMAINING PATHS: The primary path is the cord.

EFFECT/MISSION PHASE: EVA

CORRECTIVE ACTION: Discontinue use of the failed ORU tether and restore it for deorbit and landing.

-FAILURE EFFECTS-

END ITEM: ORU tether is no longer operating properly. ORU tether may fail structurally allowing tethered item to drift.

INTERFACE: None.

MISSION: Partial loss of remaining DTO objectives.

CREW/VEHICLE: Possible impact of large ORU with EMU and/or Orbiter if ORU tether breaks and clutch fails.

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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: Immediately.

REMARKS:

-RETENTION RATIONALE-

(A) DESIGN: The retracting cord clutch is designed to prevent overloading the Vectran cord while in the locked position. The retracting cord clutch uses a stainless steel disc and M8351 brake material along with Belleville springs. The clutch is designed to slip between 20 and 75 lbs.

(B) TEST: Applicable requirements from JSC 33795, "Certification and Acceptance Requirements Document, ORU Tether".

Acceptance:

1.) Functional: Verified at Predelivery Acceptance Test, Preinstallation acceptance and Pre-Post environmental test. Minimum of 60 cycles total was performed on all moving parts

- a.) The retracting mechanism was cycled 60 times at PDA.
- b.) Control selector alignment verified at PDA, PIA.
- c.) Clutch slipping between 20 and 75 lbs verified at PDA, PIA, and pre-post environmental testing.

2.) Environmental: Acceptance Vibration

The ORU tether is subjected to the following vibration in each axis for a duration of 1 minute per TPS.

20 to 80 Hz	+3.0 dB/Octave
80 to 350 Hz	0.04 G ² /Hz
350 to 2000 Hz	-3.0 dB/Octave
load factor 6.1 G rms	

3.) The ORU tether vectran cord was load tested to 75 lbs.

4.) Cord visually inspected for damage at PIA.

5.) Acceptance Thermal test functionally verifies assembly at -100 F, per TPS.

Qualification:

1.) Vibration: N/A

2.) Thermal: Functional verification performed at ~~-100~~⁰ F and +200 F per TPS.

3.) Load Test: Cord and knot were load tested to 150% of the limit load
(75 lbs x 1.5 = 112.5 lbs).

(C) INSPECTION:

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

(D) FAILURE HISTORY: The ORU tether is similar to the NHEE that flew on STS-72 with no history of failures.

(E) OPERATIONAL USE:

- 1.) Operational Effect - For a failure of the retracting cord clutch resulting in a rupture of the cord - loss of ORU tether function. Possible loose debris in the payload bay.
- 2.) Crew Action - Discontinue use of the ORU tether. Restow in middeck/spacehab.
- 3.) Crew Training - Crew trained in proper operation of ORU tether at WETF.
- 4.) Mission Constraint - None.
- 5.) In Flight Checkout - None.

(F) MAINTAINABILITY: The ORU tether has a shelf life of 5 years. No on-orbit repair is planned

PREPARED BY: M.D. Garner

REVISION:

DATE: 8/15/96
