

FAILURE MODE EFFECTS ANALYSIS/CRITICAL ITEMS LIST

FMEA NUMBER: CSD-OHT-06

ORIGINATOR: JSC

PROJECT: Orbiter (ISSA DTO'S)

PART NAME: ORU Handling Tool
PART NUMBER: 19601-20035-01 02
LSC CONTROL NO: N/A
ZONE/LOCATION: Middeck PLB

LRU/ORU PART NUMBER: 19601-20035-01-02
LRU/ORU PART NAME: ORU Handling Tool
DRAWING/REF DESIGNATOR: 19601-20035
EFFECTIVITY/AFFECT STAGE: STS-63 & SUBS

QUANTITY: 2
SYSTEM: EVA Equip.
SUBSYSTEM: Tools

CRITICALITY:

CRITICAL ITEM? Yes
CRITICALITY CATEGORY 1R/2

SUCCESS PATHS: 2
SUCCESS PATH REMAINING: 1

END ITEM NAME: N/A
END ITEM FUNCTIONAL: N/A
END ITEM CAPABILITY: N/A

END ITEM FAILURE TOLERANCE: N/A

REDUNDANCY SCREENS:

1. C/O PRELAUNCH: Pass
2. C/O ON ORBIT: N/A
3. DETECTION FLIGHT CREW: N/A
4. DETECTION GROUND CREW: N/A
5. LOSS OF REDUNDANCY FROM SINGLE CAUSE: Pass
6. ON-ORBIT RESTORABILITY: N/A

FUNCTION: (End Item and ORU/LRU)

Tool used by an EVA crewmember to aid in the handling and transport of ORU's. Tool will grasp and rigidly secure itself to a microconical fitting.

FAILURE MODE CODE: N/A

FAILURE MODE: Contingency release - Unable to disengage from hard or soft dock

CAUSE: contamination, piece part failure, wear

REMAINING PATHS:

none

EFFECT/ MISSION PHASE: EVA Operations

CORRECTIVE ACTION:

none.

FAILURE EFFECTS-

END ITEM/LRU/ORU/ASSEMBLY: Unable to move actuator from lock to release position.
Unable to release tool from microconical fitting/ORU.

SUBSYSTEM/NEXT ASSEMBLY/INTERFACE: N/A

SYSTEM/END ITEM/MISSION: Tool can not be stowed properly.

CREW/VEHICLE: If contingency release also fails the tool can not be returned to it's original stowage location. The Tool may release during deorbit/landing due to forces at those times and impact the vehicle.

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HAZARD INFORMATION:

HAZARD: YES NO

HAZARD ORGANIZATION CODE: N/A for NSTS.

HAZARD NUMBER: OHT-01

TIME TO EFFECT: hours

TIME TO DETECT: seconds

TIME TO CORRECT: minutes

FAILURE DETECTION/FLIGHT - Visual/ground-none

REMARKS:

Analysis is currently in work to verify that the OHT can remain on Spartan for landing. If this is verified the criticality of this failure mode changes to 1R/3.

-RATIONALE FOR ACCEPTABILITY-

(A) DESIGN: The ORU Handling Tool (OHT) design incorporates a soft dock and hard dock position. The soft dock is latch, not a detent, and therefore requires a distinct actuation to be moved to the release position. Placing the OHT in hard dock actuates the tool's collets and rigidizes the tool to the microconical fitting. The OHT design also incorporates a lock that must be activated by the crew that can lock the actuator in the hard dock position. The OHT handle also acts as a guard for the actuator in order to prevent inadvertent activation by the crew. The OHT design utilizes the following materials 15-5PH CRES (Body, Carrier, Pin, Adjustment Sleeve, Nut, Alignment Key), 304 CRES (Rocker), 302 CRES (Spring), MP35N AL (Plunger, Ring, Pin Collet Pivot, Collet), 7075-T7 AL (Handle, Actuator), 6061-T6 AL (Bezel), Copper-Beryllium (Retainer, Sleeve). Dry film lubricant is used on all moving parts.

The tool is designed to withstand and function properly after application of a 187 lb. limit load. For STS-63 loads are operationally limited to the loads defined below to prevent damage to Spartan's structure.

Fx	Fy	Fz	Mx	My	Mz
50 lbs.	15 lbs.	15 lbs.	1000 in-lbs.	1000 in-lbs.	1000 in-lbs.
15 lbs.	50 lbs.	15 lbs.	1000 in-lbs.	1000 in-lbs.	1000 in-lbs.
15 lbs.	15 lbs.	50 lbs.	1000 in-lbs.	1000 in-lbs.	1000 in-lbs.

Verification of the limit loads is done by test and analysis with a safety factor of 1.5 applied.

(B) TEST:

(1) Acceptance :

- The maximum allowable force to install the OHT to a microconical shall not exceed 3 lbs.
- The maximum allowable force required to actuate the OHT hard dock shall not exceed 10 lbs.
- The lock button actuation is verified when the actuation lever is in the hard dock position.
- The tool's capability to automatically return to the capture mode upon release of the microconical is verified.
- Verification that the tool will only disengage from a microconical as a result of rotating the actuation lever to the release position.
- The contingency release function is verified.

Turnaround:

The OHT preflight checkout tests will be performed in accordance with it's PIA requirements.

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LSC CONTROL NO: N/A

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SUBSYSTEM: Tools

ZONE/LOCATION: Middeck, PLB

EFFECTIVITY/AFFECT STAGE: STS-63 & SUB5

The OHT is subjected to the following AVT for a duration of 1 minute per axis. The OHT performance is verified prior to and following the test.

Frequency (Hz)

Level:

20

+3db/oct

80 to 350

040 G2/Hz

350 to 2000

-3db/oct

(2) Certification

Thermal

The tool shall be tested to withstand nonoperating temperatures between -200 °F to +250 °F.

The functional test listed in acceptance shall be performed at -200 °F and +250 °F.

Cycle

A 200 cycle functional test shall be performed. The functional tests listed in acceptance shall be verified at the completion of the cycle test.

(C) INSPECTION:

Fabrication - Critical part dimensions, tolerances, application of lubricants, etc. will be inspected to ensure compliance with the part's drawing. All OHT parts shall be verified to be visibly clean.

Test - Quality Assurance surveillance is required at all tests and inspection. Discrepancy reports are written on all noncompliance's.

(D) FAILURE HISTORY: None

(E) OPERATIONAL USE:

- 1) Operational effect - Unable to release tool from ORU.
- 2) Crew Action - If failure occurs, jettison ORU (Spartan).
- 3) Crew Training - Crew will receive training in the operation of the contingency release mechanism.
- 4) Mission Constraint - None
- 5) In Flight Checkout - The contingency release mechanism can not be checked out on orbit until it's use is required.

(F) MAINTAINABILITY: N/A

PREPARED BY: G. Wright

REVISION:

DATE: 10/26/94

WAIVER NUMBER