

FAILURE MODE EFFECTS ANALYSIS/CRITICAL ITEMS LIST

FMEA NUMBER: CSD-OHT-04

ORIGINATOR: JSC

PROJECT: Orbiter (ISSA DTO'S)

PART NAME: ORU Handling Tool

LRU/ORU PART NUMBER: 19601-20035-01-02

QUANTITY: 2

PART NUMBER: 19601-20035-01-02

LRU/ORU PART NAME: ORU Handling Tool

SYSTEM: EVA Equip.

1.S.C CONTROL NO: N/A

DRAWING/REF DESIGNATOR: 19601-20035

SUBSYSTEM: Tools

ZONE/LOCATION: Stiddes/PLB

EFFECTIVITY/AFFECT STAGE: STS-63 & SUBS

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: Safety lock mechanism deactivates

CAUSE: contamination, piece part failure, wear

REMAINING PATHS:

Actuator mechanism

EFFECT/ MISSION PHASE: EVA Operations

CORRECTIVE ACTION:

Actuator lock mechanism will prevent ORU release. Once this failure mode is detected discontinue operation with this tool

FAILURE EFFECTS-

END ITEM/LRU/ORU/ASSEMBLY: Actuator no longer held in the locked position

SUBSYSTEM/NEXT ASSEMBLY/INTERFACE: N/A

SYSTEM/END ITEM/MISSION: Partial loss of DTO objective. The tool should not be used if the safety lock mechanism is not functioning properly.

CREW/VEHICLE : No effect unless the Actuator is inadvertently bumped or the Actuator mechanism fails. If the double failure were to occur, tool may release ORU which may impact the crew or vehicle. Possible loss of EVA crew or significant vehicle damage.

FAILURE MODE EFFECTS ANALYSIS/CRITICAL ITEMS LIST

FMEA NUMBER: CSD-OHT-01

ORIGINATOR: JSC

PROJECT: Orbiter (ISSA DTO'S)

PART NAME: ORU Handling Tool

LRU/ORU PART NUMBER: 19601-20035-01/02

QUANTITY: 2

PART NUMBER: 19601-20035-01/02

LRU/ORU PART NAME: ORU Handling Tool

SYSTEM: EVA Equip.

LSC CONTROL NO: N/A

DRAWING/REF DESIGNATOR: 19601-20035

SUBSYSTEM: Tools

ZONE/LOCATION: Middeck PLB

EFFECTIVITY/AFFECT STAGE: STS-63 & SUBS

HAZARD INFORMATION:

HAZARD: YES s NO

HAZARD ORGANIZATION CODE: N/A

HAZARD NUMBER: N/A

TIME TO EFFECT: seconds

TIME TO DETECT: seconds

TIME TO CORRECT: immediate

FAILURE DETECTION/FLIGHT - Visual/ground-none

REMARKS:

-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 Pivots, 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 .

(a) The maximum allowable force to install the OHT to a microconical shall not exceed 3 lbs.

(b) The maximum allowable force required to actuate the OHT hard dock shall not exceed 10 lbs.

(c) The lock button actuation is verified when the actuation lever is in the hard dock position.

(d) The tool's capability to automatically return to the capture mode upon release of the microconical is verified.

(e) Verification that the tool will only disengage from a microconical as a result of rotating the actuation lever to the release position.

(f) 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

DRAWING/REF DESIGNATOR: 19601-20035

SUBSYSTEM: Tools

ZONE/LOCATION: Middeck PLD

EFFECTIVITY/AFFECT STAGE: STS-63 & SUBS

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 - Tool may release ORU (Spartan). Loose equipment could impact the crew or vehicle.
- 2) Crew Action - If failure is detected discontinue use of the tool. If failure occurs, maneuver ORU at designated EVA grasp points on ORU or maneuver vehicle away from loose ORU.
- 3) Crew Training - No special training to alleviate this failure mode.
- 4) Mission Constraint - None
- 5) In Flight Checkout - Inspect at time of use.

(F) MAINTAINABILITY: N/A

PREPARED BY: G. Wright

REVISION:

DATE: 10/26/94

WAIVER NUMBER