APPROVAL SHEET FOR SUSPENDED LOAD OPERATIONS

SLO-KSC- 2001 - 001

TITLE OLF Validation (Palmdale)

DOCUMENT NUMBER/TITLE H70 - 0743 - 03 - 003 - XXX

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DATE 1-8-01

REQUIRED APPROVAL

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NASA SUSPENDED LOAD OPERATION ANALYSIS/APPROVAL (SLOAA)

OPERATION: OLF Validation (Palmdale, California)

SUPPORTING DOCUMENTS: The associated operational procedure/systems assurance analyses are as follows:

1. TPS H70-0743-03-003-XXX, OLF Validation
2. SAA29CL01-025, Systems Assurance Analysis for the Orbiter Lifting Frame (OLF) at the Palmdale Facility

GENERAL DESCRIPTION: This operation involves the validation of the OLF at Palmdale, California. The primary task in the validation procedure is the load testing of the OLF, H70-0743-03-003 orbiter lifting sling, and the three dedicated 50-ton hydrasets. The load test is accomplished by first attaching the H70-0743 sling to the A70-0860 orbiter simulator, and then by hanging dead weights from the simulator via shackles and/or spreader beams. A detailed engineering review and hazards analysis of this operation has been conducted. This work has resulted in hardware and/or procedure modifications that minimize the exposure of employees to working under suspended loads. Due to the uniqueness of the activity and the limitations using present systems, hardware, and facilities, there remain some tasks where suspended load operations are required under specifically approved and controlled conditions. The OLF validation procedure requires a minimum number of personnel under the load to perform the following tasks:

1. Connecting / disconnecting the H70-0768 forward hoist adapters to/from the forward drop legs (2 personnel - 30 minutes per side)
2. Connectiong / disconnecting the aft hoist adapters (a.k.a. ball bats) to the aft drop legs (2 personnel - 30 minutes per side).
3. Positioning the A70-0860 orbiter simulator under the H70-0743 sling and removing when complete (4 personnel - 30 minutes)
4. Connecting / disconnecting the H70-0743 sling to the A70-0860 simulator (2 forward, 2 aft; 2 personnel each attach point - 1 hour).
5. Suspending / removing the A-frames and associated lifting links, shackles and other hardware from the A70-0860 simulator (4 personnel - 2 hours).
6. Suspending / removing the load test weights from the A70-0860 simulator (4 personnel - 2 hours).
7. Performing grounding checks on grounds under A70-0860 (1 personnel - 30 minutes)

RATIONALE/ANALYSIS: The suspended load tasks comply with the NASA Alternate Safety Standard for Suspended Load Operations as follows:

Alternate Standard Requirement #1a: OLF validation at Palmdale cannot be conducted without personnel beneath the suspended load. The tasks performed under the load have been analyzed and evaluated with the determination no feasible engineering design or procedural options are readily available to eliminate the suspended load operation

Alternate Standard Requirement #1b: Secondary support systems to assume support of (catch) the load were evaluated and were not feasible for this operation. Design criteria was too cumbersome to prevent the orbiter sling and weights from being a suspended load and also prevented access to areas of critical work that needed to be performed.

Alternate Standard Requirement #1c: The number of personnel allowed under the suspended load for each task is as stated in the General Description. These personnel are also identified with safety vests (or colored arm bands) to annotate the required personnel for the operation.

Alternate Standard Requirement #1d: Personnel will accomplish the required suspended load tasks as quickly and safely as possible to minimize time exposure; see General Description.

Alternate Standard Requirement #2: Suspended load operations are reviewed and approved on a case-by-case/specific need basis - see General Description and Alternate Standard Requirement #1.

Alternate Standard Requirement #3: Only those suspended load operations approved by the NASA Safety and Mission Assurance Division Chief will be permitted. A list of approved suspended load operations will be maintained by the NASA Safety and Mission Assurance Division.

Alternate Standard Requirement #4: TPS H70-0743-03-003-XXX is written to allow only required personnel under the suspended load. The TPS is available on site for inspection during the operation.

Alternate Standard Requirement #5: A new suspended load operation not covered by this SLOAA, deemed necessary due to unusual or unforeseen circumstances where real time action is required, shall be documented and approved by the NASA Safety and Mission Assurance Division Chief.

Alternate Standard Requirement #6: The three 50 ton hoists at the OLF are designed, tested, inspected, maintained, and operated in accordance with the NASA Safety Standard for Lifting Devices and Equipment, NSS/GO-1740.9. The hoists are designed to a minimum safety factor of 5 (based on the ultimate yield strength) for the hoist load-bearing components. The H70-0743 orbiter lifting sling is designed with a safety factor of 5 against ultimate strength and a safety factor of 3 against yield.

The hoists are equipped with two holding brakes and an emergency over speed brake, each capable of holding the hoist rated capacity.

The hoists were one-time proofloaded at 125 percent of rated capacity, are load tested annually at 100 percent of rated capacity, and have a quarterly, semiannual and annual preventive maintenance program to ensure proper operation.

The wire rope is inspected quarterly for discrepancies. Nondestructive testing of the hoist hooks is performed annually.

When performing the validation procedure, one hoist is connected to the forward attach point of the H70-0743 orbiter lifting sling and two hoists are connected to the aft attach points. The weight of the sling-simulator-load test weight combination does not exceed the capacity of the three hoists. The three hoists simultaneously lift a maximum load of approximately 130 tons which is within their rated capacity.

Alternate Standard Requirement #7: A System Assurance Analysis (SAA) has been completed on the 50 ton hoists at the OLF. The SAA includes a Failure Modes and Effects Analysis/Critical Item List (FMEA/CIL) and a hazard analysis (see Supporting Documents). The SAA identifies no single failure points for the OLF 50 ton hoists.

Alternate Standard Requirement #8: Visual inspections for cracks or other signs of damage or anomalies are performed on the hoist hooks and lifting sling assembly along with crane functional checks prior to each operation per NSS/GO-1740.9.

Alternate Standard Requirement #9: The hoist operators, Emergency (E) stop operators, and mechanical technicians are all trained and have current certifications. Operators will remain at the hoist controls while personnel are under the load.

Alternate Standard Requirement #10: Appropriate control areas are established and maintained prior to and during the operation. Only required personnel (man loaded in the procedure) are permitted in this area.

Alternate Standard Requirement #11: Personnel are briefed just prior to performing the task about the hazard involving the suspended load. A pre task briefing and a safety walkdown of the area are conducted prior to the lift to ensure all systems and personnel are ready to support. All participants are instructed on their specific tasks and warned of the hazards involved. Following any crew change, new personnel are instructed by the task leader on their specific tasks and warned of the hazards involved.

Alternate Standard Requirement #12: Personnel beneath the suspended load will be in radio, visual, or voice contact with the hoist controller and/or signal person. Upon loss of communication, the operation shall stop immediately, personnel shall clear the hazardous area, and the load shall be safed. Operations shall not continue until communications are restored.

Alternate Standard Requirement #13: Ground controllers and E-stop operators are properly positioned during all phases of the lifting operation in full view of the load block, lifting fixtures and fixture attach points. One E-stop operator, remote from the hoist operator, can stop the hoist if a failure indication is observed. Personnel working beneath the load shall remain in continuous sight of the operator and/or signal person.

Alternate Standard Requirement #14: The NASA Safety and Mission Assurance Division shall conduct periodic reviews to ensure the continued safety of suspended load procedures.

Alternate Standard Requirement #15: The NASA Safety and Mission Assurance Division will provide copies of approved SLOAAs, a list of approved suspended load operations, a list of cranes/hoists used for suspended load operations and copies of the associated FMEA/CIL and hazards analyses to NASA Headquarters.

APPROVAL: DATE:

1/8/01

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