

APPROVAL SHEET FOR SUSPENDED LOAD OPERATIONS

SLO-KSC-1998-001

TITLE Install or Remove the Lightweight Payload Bay Door
Strongback (H70-0889) at the Orbiter Processing Facility (OPF)

DOCUMENT NUMBER/TITLE OMF V9023.001, Orbiter Payload Bay Door
Operations - Horizontal

PREPARED BY Malcolm Glenn

DATE 2/24/99

REQUIRED APPROVAL

CONTRACTOR	<input type="checkbox"/> DESIGN	<input type="checkbox"/> R & QA	<input type="checkbox"/> OPERATIONS	<input type="checkbox"/> SAFETY
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**NASA SUSPENDED LOAD OPERATION
ANALYSIS/APPROVAL (SLOAA)**

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OPERATION: Install or Remove the Lightweight Payload Bay Door Strongback (H70-0889) at the Orbiter Processing Facility (OPF)

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

1. OMI V9023.001, Orbiter Payload Bay Door Operations-Horizontal.
2. SAA09FY091-001, System Assurance Analysis of the 30-Ton Bridge Cranes at the Orbiter Processing Facility, High Bays 1 and 2.
3. SAA09FY091-007, System Assurance Analysis of the 30-Ton Bridge Cranes at the Orbiter Processing Facility High Bay 3.

GENERAL DESCRIPTION: Installation or removal of the lightweight strongbacks requires three persons under the suspended load (strongback) to prevent/detect binding and install/remove ball lock pins securing the strongback to the orbiter payload bay door.

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

Alternate Standard Requirement #1a: These tasks cannot be conducted without placing personnel beneath the suspended strongback because there is no other access to the strongback attach points.

There are no design, operational or procedure means to eliminate personnel exposure to the suspended load with the existing strongback because of the need to have hands on and eyes on the strongback attach points.

Alternate Standard Requirement #1b: The possibility of a secondary support system, to catch the load in the event of a crane failure, was analyzed. Stands, capable of supporting the strongback in the event of a crane failure, would require a redesign of the orbiter payload bay support structure and OPF access platforms. In addition, installation and removal of stands would potentially be a suspended load operation. These stands would also reduce access and hinder ingress/egress from the payload bay door area. Redesign of the orbiter payload bay support structure and OPF access platforms is not feasible.

Alternate Standard Requirement #1c: The maximum number of personnel allowed under the suspended strongback is three, two technicians (1 ea. at the fwd and 1 ea. at the aft lower hingeline attach points) and the Orbiter Move

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Director (OMD). The OMD will direct the overall operation, monitor the attach points and needs to be in close proximity to the two technicians.

Alternate Standard Requirement #1d: The operation will be accomplished as quickly and safely as possible to minimize exposure time. It will take three personnel approximately 15 minutes to install or remove the lower hingeline portion of the strongback. This operation will be performed four times to completely install or remove the strongbacks from the orbiter since there are four lightweight strongbacks required to operate the payload bay doors.

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 Center NASA Safety Assurance Director will be permitted. A list of approved suspended load operations will be maintained by the Center NASA Safety Assurance Directorate.

Alternate Standard Requirement #4: OMI V9023.001 is written to allow only the required personnel under the suspended load. The OMI 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 Center NASA Safety Assurance Director.

Alternate Standard Requirement #6: Suspended load operations involved with installation or removal of the lightweight payload door strongback involve one of the OPF 30 ton bridge cranes. The cranes are designed, tested, inspected, maintained, and operated in accordance with the NASA Safety for Lifting Devices and Equipment, NSS/GO-1740.9.

The OPF (Bays 1 & 2) 30 ton crane hoists are equipped with a gear reducer and mechanical load brake enclosed in one unit, an electrical drive motor, a motor brake at the south end of the drum, and a solenoid-actuated band brake at the north end of the drum. The OPF (Bay 3) 30 ton crane hoists are equipped with two electrical holding brakes at each end of the drum. All brakes are capable of holding the load up to their respective crane's rated capacity. Each brake's ability to hold the rated load (30 tons) is verified annually. The cranes are

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designed to meet a 5 to 1 safety factor based on ultimate strength for the hoist load bearing components.

A single 30 ton crane is utilized for this task. The weight of the suspended load (strongback) is approximately 600 pounds.

The lightweight strongback is designed to meet a 5 to 1 safety factor based on ultimate strength.

The 30 ton cranes are load tested annually at 100% of their rated capacity. Detailed preventive maintenance is performed monthly, quarterly, semiannually, and annually on the cranes to ensure proper operation. Nondestructive testing of the crane hooks is performed annually.

Alternate Standard Requirement #7: System Assurance Analyses (SAA) have been completed on the 30 ton bridge cranes in the OFF. The SAAs include a Failure Modes And Effects Analysis / Critical Items List (FMEA/CIL) and a hazard analysis (see Supporting documents). SAAs for the 30 ton bridge cranes in OPF's (Bays 1,2,and 3) identify no single failure points.

Alternate Standard Requirement #8: Visual inspection for damage or anomalies are performed on the crane, strongback & fittings, and crane functional checks are performed before each operation per NSS/GO-1740.9.

Alternate Standard Requirement #9: Trained and licensed crane operators shall remain at the crane 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: A pretask briefing and a safety walkdown of the area are conducted prior to the lift to ensure that all systems and personnel are ready to support. All participants are instructed on their specific tasks and warned of any hazards involved. Following any crew change, the new personnel are instructed by the task leader on their specific tasks and warned of any hazards involved.

Alternate Standard Requirement #12: Personnel beneath the suspended load will be in radio, visual, or voice contact with the crane ground controller and/or task leader. Upon loss of communication, the operation shall stop

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immediately, personnel shall clear the hazardous area, and the load shall be safed. Operations shall not continue until communications are restored.

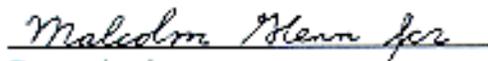
Alternate Standard Requirement #13: Personnel working beneath the load shall remain in continuous sight of the crane ground controller and/or task leader.

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

Alternate Standard Requirement #15: The Center NASA Safety Assurance Directorate 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: 2/26/99



Bruce L. Jansen
Acting Director, Safety Assurance
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