APPROVAL SHEET FOR SUSPENDED LOAD OPERATIONS

SLO-KSC 2007-006

TITLE: Installation or removal of payload using the Cargo Element Lifting Assembly (CELA) in the SSPF

DOCUMENT NUMBER/TITLE: OMI L5166 Cargo Element Lifting Assembly

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REQUIRED APPROVAL

CONTRACTOR	____ DESIGN	____ R & QA	✓ OPERATIONS	✓ SAFETY
NASA	____ DESIGN	____ R & QA	✓ OPERATIONS	✓ SAFETY

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NASA SUSPENDED LOAD OPERATION
ANALYSIS/APPROVAL

OPERATIONS

Install/remove payloads into or from the Canister, Trunnion Support Fixture (TSF), Element Rotation Stand (ERS), Payload Rotation Stand (PRS), Rotation Handling Fixture (RHF), and Cargo Element Work Stand (CEWS) in the Space Station Processing Facility (SSPF).

SUPPORTING DOCUMENTS - The associated operational procedure and System Assurance Analysis (SAA) are as follows:

- OMI L5166, Cargo Element Lifting Assembly (CELA)
- SAA21HASI-001, Cargo Element Lifting Assembly
- SAA21CRS1-001, 30 Ton Highbay Bridge Cranes - (SSPF)

GENERAL DESCRIPTION

Installation or removal of the payload into or from the Canister, TSF, ERS, PRS, RHF, or CEWS requires a maximum of two people under the suspended load depending on the number of keel trunnions (one person per keel trunnion) to guide each keel trunnion into the corresponding keel latch. One person may be required under the suspended load to perform static ground connections.

Removal or Installation of the payload from or into the Canister, TSF, ERS, PRS, RHF, or CEWS requires a maximum of three people under-the CELA counterbalance drive motors to guide the trunnion from or into the corresponding trunnion retention fitting.

RATIONALE/ANALYSIS - The suspended load tasks comply with the NASA Alternate Safety Standard as follows:

Alternate Standard Requirement #1a

During installation/removal of the payload into the canister or test stand, the technicians must be directly beneath the suspended load to guide the trunnions

into/out of the retention fittings. There is no alternate access to the trunnion retention fittings located beneath the CELA Counterbalance Drive Motors. This physical limitation precludes any design, operational, or procedural changes that would eliminate personnel exposure to a suspended load.

During installation/removal of the payload into the canister, the technician must go beneath the suspended payload to guide the keel trunnion into/out of the keel latch. There is no alternate access to the keel trunnion located underneath the payload, and the cover cannot be installed or removed while the payload is in the payload canister. This physical limitation precludes any design, operational, or procedural changes that would eliminate personnel exposure to a suspended load.

Alternate Standard Requirement #1b

The possible use of a secondary support system, to catch the load in the event of a crane failure, was analyzed. It was determined that the use of a secondary support system was not feasible because of the position of the payload over the Canister, TSF, ERS, PRS, RHF, or CEWS.

Alternate Standard Requirement #1c

The maximum number of personnel allowed under the suspended load while guiding the keel trunnion into or out of the keel latch is one person per keel trunnion. One person will be allowed under the suspended load to perform, static ground connections, if required. Three people are allowed under the CELA Counterbalance Drive Motors to guide the trunnions during installation or removal into or from the trunnion retention fittings Also, during contingency ingress to or egress from the canister, only man-loaded personnel may pass under the suspended CELA.

Alternate Standard Requirement #1d

Guiding the keel trunnions into the keel latches will be accomplished as quickly and safely as possible to minimize exposure time. It will take for either one or two persons (one person per keel trunnion) up to 60 minutes to guide the keel trunnions into the keel latches. Guiding the payload trunnions into or out of the retention fittings will take two persons (one per trunnion) and a task leader up to 60 minutes to ensure the payload is installed or removed properly. Ground connections will take up to 10 minutes for one person to perform the grounding operation.

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 & Mission Assurance Division Chief will be permitted. The NASA Safety & Mission Assurance Division Chief will maintain a list of approved suspended load operations.

Alternate Standard Requirement #4

OMI L5166 will be revised to permit only the approved personnel under the suspended load. The OMI will be 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 & Mission Assurance Division Chief.

Alternate Standard Requirement #6

The suspended load operations addressed in this analysis involve one of the 30 ton SSPF bridge cranes. The cranes are designed, tested, inspected, maintained, and operated in accordance with the Standard for Lifting Devices and Equipment, NASA-STD-8719.9.

The SSPF 30 ton crane hoists are equipped with two magnetic holding brakes, each capable of holding the load up to the crane's rated capacity. Each brake's ability to hold the rated load (30 tons) is verified annually. The cranes are designed to meet a 5 to 1 safety factor based on ultimate strength for the load bearing components. The 30 ton cranes are load tested annually at 100% of their rated capacities. Detailed preventive maintenance is performed monthly, quarterly, semiannually, and annually on the cranes to ensure proper operation. A detailed inspection of the lifting fixtures is performed annually. Nondestructive testing of the crane hooks is performed annually.

Alternate Standard Requirement #7

An SAA has been completed on the 30-ton bridge cranes in the SSPF. The SAA includes a Failure Modes and Effects Analysis/Critical Items List (FMEA/CIL) and a hazard analysis. No critical single failure points were identified during this analysis.

Alternate Standard Requirement #8

Visual inspections for cracks or other signs of damage or anomalies are performed on the hoist hooks, hoist beams, hoist cables, hoist rod assemblies, and hoist fittings, and crane functional checks are performed before each operation per NASA-STD-8719.9.

Alternate Standard Requirement #9

Trained and licensed crane operators shall remain at the hoist controls while personnel are under the load.

Alternate Standard Requirement #10

Appropriate safety control areas are established before initiating operations. Only the minimum number of people (manloaded in the procedure) will be permitted in this area.

Alternate Standard Requirement #11

A pretask briefing and a safety walkdown of the area will be 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 potential hazards. 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

The personnel beneath the suspended load will be in voice contact with the hoist operator and/or task leader. 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

Personnel working beneath the load shall be in continuous sight of the hoist operator and/or task leader.

Alternate Standard Requirement #14

The NASA Safety & Mission Assurance Division shall conduct periodic reviews to ensure the continued safety of suspended load procedures.

Alternate Standard Requirement #15

The NASA Safety & 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.

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