

## APPROVAL SHEET FOR SUSPENDED LOAD OPERATIONS

SLO-KSC-2005-002

TITLE De-installation / Installation of PP on TACP

DOCUMENT NUMBER/TITLE JTP-351036 Measurement Dimension of TACP-L - ECLSS/TOS#1 RACK

JTP-351037 Measurement Dimension of TACP-M - ECLSS/TOS#2 RACK

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DATE Sep 2005

**REQUIRED APPROVAL**

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## NASA SUSPENDED LOAD OPERATION ANALYSIS/APPROVAL (SLOAA)

### OPERATION:

#### De-installation of PP or TACP:

1. To set up the Lifting GSE (AP lifting Device Kit)-----This operation is not work under a suspended load.
2. To position the Lifting GSE over ECLSS/TCS#1 Rack or #2 Rack.
3. To attach the Lifting wire for PP to the Pump Package (PP) frame.  
or  
To attach the wire of Lifting GSE to the TAC Package (TACP) frame
4. To lift the PP or TACP up from the ECLSS/TCS#1 Rack or #2 Rack.
5. To lift the PP or TACP up and move to the floor. -----This operation is not work under a suspended load.

#### Installation of PP or TACP:

1. To set up the Lifting GSE ---This operation is not work under a suspended load.
2. To position the Lifting GSE over PP or TACP.
3. To attach the Lifting wire for PP to the PP frame.  
or  
To attach the wire of Lifting GSE to the TACP frame
4. To position the PP or TACP on ECLSS/TCS#1 Rack or #2 Rack.
5. To lift the PP or TACP down to the ECLSS/TCS#1 Rack or #2 Rack.

### SUPPORTING DOCUMENTS:

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

1. JS10-129 AP Lifting Device Kit Stress Analysis Report
2. JS14-217 Lifting wire for PP Inspection Report
3. JTP 351036 Measurement Dimension of TACP-L - ECLSS/TCS#1 RACK
4. JTP 351037 Measurement Dimension of TACP-M - ECLSS/TCS#2 RACK
5. SAA21CRS1-002, System Assurance Analysis of the 5-ton Bridge Cranes located in the Intermediate Bay at SSPF.
- 6, SAA21CRS1-001, 30 Ton High bay Bridge Cranes-Space Station Processing Facility (SSPF)

### GENERAL DESCRIPTION:

1. When positioning the Lifting GSE, 2 workers will work under the Lifting GSE.
2. When attaching the Lifting Wire for PP to the PP frame or the wire of Lifting GSE to the TACP, 2 workers will work under the Lifting GSE.
3. When detaching/installing and lifting up/down the PP or TACP from/to ECLSS/TCS#1 Rack or #2 Rack, 3 workers will work under the Lifting GSE.
4. Installation is the reverse of De-installation.

**RATIONALE/ANALYSIS:**

The suspended load tasks comply with the NASA Alternate Safety Standard for Suspended Load Operations as follows,

**Alternate Standard Requirement #1a:**

These operations cannot be conducted without placing personnel or hands under the Lifting GSE during PP or TACP removal/install operations. The Lifting GSE operations at SSPF have been evaluated for alternate methods to complete this task, and it has been determined that there are no design, procedural, or operational means to eliminate personnel exposure to a suspended load, without exposing flight hardware to unacceptable damage.

**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 use of a secondary support system was not feasible, because there is no open space to set up a secondary support system for the reason that the operation area is limited, and because of the vertical and horizontal movement of suspended PP or TACP, and positioning of the PP or TACP and ECLSS/TCS Rack under the Lifting GSE.

**Alternate Standard Requirement #1c:**

1. The maximum number of personnel allowed under the Lifting GSE during positioning the Lifting GSE over the ECLSS/TCS#1 Rack or #2 Rack or PP or TACP are 2 workers: #1 for supporting the structure of the Lifting GSE, and #2 for supporting the turnbuckles.
2. The maximum number of personnel allowed under the Lifting GSE during attaching 2 wires to the PP frame or 4 wires to the TACP frame is 2 workers: #1 for supporting the Lifting GSE, and #2 is for attaching the slings.
3. The maximum number of personnel allowed under the lifting GSE during detaching/installing and lifting up/down the PP or TACP is 3 workers: #1 for turnbuckles operation, #2 for loosening the Drive Nut, and #3 for watching the QD interface.

**Alternate Standard Requirement #1d:**

1. Positioning the Lifting GSE over the ECLSS/TCS#1 Rack or #2 Rack or PP or TACP will be accomplished as quickly and safely as possible to minimize exposure time. It will take up to 30 minutes under the suspended Lifting GSE.
2. Attaching 2 slings to the PP frame or 4 slings to the TACP will be accomplished as quickly and safely as possible to minimize exposure time. It will take up to 30 minutes under the suspended Lifting GSE.
3. Detaching/installing and lifting up/down the PP or the TACP will be accomplished as quickly and safely as possible to minimize exposure time. It will take up to 45 minutes under the suspended Lifting GSE.

**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. The NASA Safety and Mission Assurance Division will maintain a list of approved suspended load operations.

**Alternate Standard Requirement #4:** The work authorizing documents are written to allow only required personnel under the suspended load. The work authorizing documents are 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 suspended load operations addressed in this analysis involve the 5 ton and 30 ton SSPF bridge cranes. The cranes are designed, tested, inspected, maintained, and operated in accordance with the NASA 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.

These cranes are designed to meet a 5 to 1 safety factor based on ultimate strength for the hoist load bearing components. The 5-ton and 30 ton cranes are load tested annually at 100% of their rated capacities. Detailed preventive maintenance is performed monthly, quarterly, semiannually, and annually on these cranes to ensure proper operation. Nondestructive testing of the crane hooks is performed annually.

The lifting GSE utilized for the each operation is described in page 1.

The maximum weight of the lifting GSE is 45 lbs and the payload may weigh as much as 86 lbs (PP: 84.7 lbs, The lifting wire for PP: 0 44lbs) The total load is 131 lbs.

The lifting GSE is rated at 110.5 lbs and designed to meet 5 to 1 safety factor based on ultimate strength.

The lifting wire for PP is rated at 88 lbs and designed to meet 5 to 1 safety factor based on ultimate strength.

**Alternate Standard Requirement #7:** An SAA has been completed on the 5-ton and 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 (see supporting documents). 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 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 person 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.

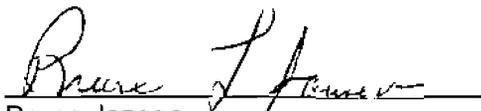
**Alternate Standard Requirement #13:** Personnel working beneath the load shall be in continuous sight of the hoist operator and/or task leader.

**Alternate Standard Requirement #14:** The NASA Safety 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:

CATE:

 9/13/05

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