

APPROVAL SHEET FOR SUSPENDED LOAD OPERATIONS

SLO-KSC

TITLE Install/remove the H70-0743 Orbiter Ferry Flight sling on the H70-0597 proof load fixture at the four sling attach points at VAB and SLF.

DOCUMENT NUMBER/TITLE SLO-KSC-2011-001

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CHECK APPROPRIATE BOX:

Single Occurrence Operation Multiple Occurrence Operation Revision to Existing SLOAA

IF REVISION TO EXISTING SLOAA, SUMMARIZE CHANGES / RATIONALE:

REQUIRED APPROVAL

CONTRACTOR _____ DESIGN _____ R & QA OPERATIONS SAFETY

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OPERATION: Install/remove the H70-0743 Orbiter Ferry Flight sling on the H70-0597 proof load fixture at the four sling attach points at VAB and SLF.

SUPPORTING DOCUMENTS:

1. VAB Operation: Type B TPS: H70-0743-03-003-018
2. SLF Operation: Solumina WAD: WR-OHE-001
3. SAA09FT01-004, Systems Assurance Analysis of the Link Belt 250-Ton Truck Crane HC-268
4. SAAFL000000-001, Systems Assurance Analysis of the 300-Ton Mobile Crane at KSC
5. SAA00004, Systems Assurance Analysis of the Tadano 130-Ton Mobile Crane at KSC
6. SAA09FY120-001, Systems Assurance Analysis of the 325-Ton Bridge Cranes at the VAB
7. SAA09FY12-005, Systems Assurance Analysis of the 250-Ton Bridge Cranes at the VAB

GENERAL DESCRIPTION: This operation involves a demonstration test to install/remove the H70-0743 Orbiter Ferry Flight sling on the H70-0597 proof load fixture at the four sling attach points. This operation will be performed in VAB High Bay 2 utilizing the VAB 325-ton and VAB 250-ton overhead cranes and at the SLF utilizing the Link Belt 250-ton mobile crane (aft end) and either the Tadano 130-ton mobile crane or P&H 300-ton mobile crane (forward end). The operation of attaching the H70-043 Orbiter Ferry Flight sling to the H70-0597 proof load fixture at four points requires a minimum number of personnel under the load to perform the following tasks:

1. Install/remove the H70-0743 Orbiter Ferry Flight sling on the H70-0597 proof load fixture at the four sling attach points (2 forward, 2 aft) (2 personnel each attach point - 4 hours).

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

Alternate Standard Requirement #1a: H70-0743 Orbiter Ferry Flight sling attachment to the H70-0597 proof load fixture 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



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cumbersome to prevent the sling 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 is eight as stated in the General Description. These personnel are also identified with safety vests 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: For the VAB operation a Type B TPS: H70-0743-03-003-018 will be used and for the SLF operation Solumina WAD WR-OHE-001 will be used. Both are written to allow only required personnel under the suspended load. Required authorizing paperwork is available on site for inspection during the operation.

Alternate Standard Requirement #5: Any 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 mobile cranes and overhead cranes are designed, tested, inspected, maintained and operated in accordance with the NASA Safety Standard for Lifting Devices and Equipment, NASA-STD 8719.9. The H70-0743 Orbiter Ferry Flight lifting sling is designed with a safety factor of 5 against ultimate strength and a safety factor of 3 against yield.

The cranes' lifting mechanisms are equipped with dual means of braking.

The live wire rope for the mobile cranes meet a design safety factor of 3.5 based on ultimate strength (per ASME-B30.5). The overhead crane meets design safety factors required per ASME-B30.2.



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Alternate Standard Requirement #6 continued:

The cranes are load tested annually at 100 percent of the crane's rated capacity. Detailed crane preventive maintenance is performed monthly, semi-annual and annually including monthly wire rope inspection and annual crane hook nondestructive testing.

VAB High Bay 2 Operation: When performing this test to install/remove the H70-0743 Orbiter Ferry Flight sling on the H70-0597 proof load fixture at the four sling attach points the VAB 250-ton Overhead Crane #1 (250-ton main hook or 25-ton aux hook) and the VAB 325-ton Overhead Crane #1 (325-ton main hook or 50-ton aux hook) will be used. The two cranes will be connected to the H70-0743 sling, one on each end. H70-0743 sling forward load is 14,326 lbs and aft sling load is 25,060 lbs.

SLF Operation: When performing this test to install/remove the H70-0743 Orbiter Ferry Flight sling on the H70-0597 proof load fixture at the four sling attach points the 250-ton mobile crane will be connected to the aft end of the H70-0743 sling. Rated capacity of the 250-ton mobile crane in this configuration (counter weight AB+B, rear lift, 170 foot of boom, 80 foot radius) is 39,475 lbs. (75% capacity per load chart) and the aft crane load is 25,060 lbs. The 300-ton mobile crane or 130-ton mobile crane will be used for the forward end lift. Rated capacity of the 300-ton mobile crane in this configuration (rear lift, 120 foot of boom, 40 foot radius) is 192,400 lbs. (75% capacity per load chart) and the forward crane load is 14,326 lbs. Rated capacity of the 130-ton mobile crane in this configuration (counter weight 30,864 lbs, rear lift, 120 foot of boom, 40 foot radius) is 29,970 lbs. (75% capacity per load chart) and the forward crane load is 14,326 lbs.

Alternate Standard Requirement #7: A System Assurance Analysis (SAA) has been completed on all cranes that may be used in operations covered in this SLOAA. The SAA included a Failure Modes and Effects Analysis/Critical Items List (FMEA/CIL) and a hazard analysis (see Supporting Documents).

There is no history of failure with the SFPs in the critical failure mode. The use of high quality, reliable components, and a comprehensive maintenance, inspection and test program (including per-operational checks) ensures that the crane systems operate properly.

Alternate Standard Requirement #8: Visual inspections for cracks or other sign of damage or anomalies are performed on the hoist hooks and lifting sling assembly along with crane functional checks prior to each operation per NASA-STD 8719.9.



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Alternate Standard Requirement #9: The crane operators and mechanical technicians are all trained and have current certifications. Operators will 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: Personnel are briefed just prior to performing the task about the hazard involving the suspended load. A pre-task briefing and a safety walk down 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.

Alternate Standard Requirement #12: Personnel beneath the suspended load will be in radio, visual, or voice contact with the crane 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. Operation shall not continue until communications are restored.

Alternate Standard Requirement #13: Ground controllers and operators are properly positioned during all phases of the lifting operation in full view of the load block, lifting fixture attach points. 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 operation, a list of cranes/hoists used for suspended load operations and copies of the associated FMEA/CIL and hazard analyses to NASA Headquarters.

APPROVAL:

DATE:

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Mark Gordon

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