

APPROVAL SHEET FOR SUSPENDED LOAD OPERATIONS

SLO-KSC- 2005-003

TITLE MATE DEMATE AND LIFT OF NEW HORIZONS SPACECRAFT

DOCUMENT NUMBER/TITLE _____

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REQUIRED APPROVAL

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NASA SUSPENDED LOAD OPERATION ANALYSIS APPROVAL

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OPERATION: Mate, de-mate and lift of the New Horizons spacecraft and its lifting fixture to and from the dummy PAFs on the PHSF spin table and work stand.

SUPPORTING DOCUMENTS: The associated System Assurance Analyses (SAA) and test procedures are as follows:

SAA 01HS11-005 – 50-ton Bridge Crane PHSF

JHU/APL 7399-9328, New Horizons Mechanical Handling CCAFS/KSC/NASA

GENERAL DESCRIPTION: Personnel are required to work under a suspended load to guide the New Horizons spacecraft off the dummy PAFs during the first few inches of the lift following removal of the clamp band that attaches the spacecraft flight PAF to the dummy PAE on the spin table or work stand. Also, a suspended load exists when personnel are required to guide the spacecraft as it is lowered the last few inches for mating of the spacecraft flight PAF to the dummy PAF on the spin table or work stand. The spacecraft is suspended from a four-point lifting fixture that is attached to the PHSF crane. The frame of the lifting fixture is 103" long and 80" wide. The envelope of the spacecraft is approximately 84" long by 126" wide. The spacecraft weighs approximately 478 kg fueled and the lifting fixture weighs 199 kg.

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

Alternate Standard Requirement #1a: The spacecraft mating collar is smaller in diameter than the outer diameter of the spacecraft and the outer dimensions of the lifting fixture frame. It is necessary to position personnel beneath the spacecraft and its lifting fixture to guide the spacecraft during the initial phase of lifting from the dummy PAF on the spin table and during the final phase of lowering the spacecraft onto the dummy PAF on the work stand in order to ensure proper mating and prevent damage to the flight separation interface.

Alternate Standard Requirement #1b: The possible use of a secondary support system was analyzed and determined not feasible because the separation interface represents the only primary structure support for the spacecraft.

Alternate Standard Requirement #1c: The test procedures limit the number of personnel beneath the suspended load to two.

Alternate Standard Requirement #1d: Personnel will perform the spacecraft mate to and demate from the dummy PAF as quickly and safely as possible to minimize exposure. The suspended load operation is estimated to take approximately 15 minutes.

Alternate Standard Requirement #2: Suspended load operations **are** reviewed **and** approved on a case-by-case basis and **only** apply to the operations described herein for the New Horizons spacecraft.

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: The operational procedures identified of personnel hazard associated with **suspended** loads during lifting operations. The procedures will be available on site for inspection during the operation.

Alternate Standard Requirement #5: **A** new suspended load operation not covered by this SLOA, 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 covered by this report are performed at the PHSF using the 50-ton bridge crane. The cranes are designed, tested, inspected, maintained and operated **in** accordance with **NASA-STD-8719.9**, **NASA** Safety Standard for Lifting Devices and Equipment,

The crane is load tested annually at 100% of rated capacity, **and** there is a preventive maintenance program to ensure proper operation. **All** aspects of the crane controls **are** verified before each use **and** load holding/brake capability is tested annually. The spacecraft lift fixture has a rated load of 1700 lbs, and the proof load factor was 2. A dye penetrant test in accordance with **MIL-STD-6866**, Type **2**, Method **A**, Level **1** was performed on the frame. The pear **ring** was subjected to magnetic **particle** inspection in accordance with **NASA-STD-8719.9**, **NASA** Safety Standard for Lifting Devices and Equipment. The lift fixture will be certified and tagged with current proof tags during the period of use.

Alternate Standard Requirement #7: **An SAA** was completed on the PHSF 50-ton crane. The **SAA** includes a Failure Modes **and** Effects Analysis/Critical Items List (**FMEA/CIL**) **and** a Hazard Analysis. The **SAA-01HS11-005** identifies no Category 1 Mechanical or Electrical Critical Items. **The** total weight of the suspended load is significantly **less** than the crane's rated load.

Alternate Standard Requirement #8: Visual inspection of the lifting equipment as well as crane functional checks will be performed prior to each use.

Alternate Standard Requirement #9: Operation of the crane will be by trained **and** certified operators per KMI 6730.3, Examination and Licensing of KSC Special and Heavy Equipment or Facility Cranes /Hoists Operators. **An** individual will be stationed at the crane's dead man switch during hoisting to **immediately remove** power, thus setting the brakes, should a failure occur with the crane controls. Both of these individuals shall remain at the crane/dead **man** switch controls at all times that **the** crane is operated including those times **while** personnel are under the suspended load.

Alternate Standard Requirement #10: Safety controlled areas are established before initiating the lift operation. Only a minimum number of personnel will be **permitted** in this area.

Alternate Standard Requirement #11: A **pretask 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**.

Alternate Standard Requirement #12: Personnel beneath the **suspended** load will be in voice contact with the crane operator and **task** leader throughout the operation. **At** any time during the operation, anyone can call a safety hold if they see **a discrepancy**. The crane operator **will** have **full visual** contact with the load throughout the operation.

Alternate Standard Requirement #13: The task leader and crane operator **will** be in **visual** contact with personnel beneath the suspended **load** throughout the operation,

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** shall **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/CILs and hazard analyses to **NASA** Headquarters.

Approval:

Date:


Bruce Jansen

Chief, ISS/Payload Processing Safety and Mission Assurance Division
Kennedy Space Center