

APPROVAL SHEET FOR SUSPENDED LOAD OPERATIONS

KSC-XSC 1995-007

TITLE NEAR SPACECRAFT HANDLING

DOCUMENT NUMBER/TITLE 7352-9092 NEAR MECHANICAL HANDLING PROCEDURE

PREPARED BY THEODORE HARTKA / JHU/APL / NEAR MECHANICAL ENG.

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REQUIRED APPROVAL

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 NASA DESIGN R & CA OPERATIONS SAFETY

TYPE OR PRINT NAME	SIGNATURE	ORGN.	DATE
T. HARTKA	<i>[Signature]</i>	JHU/APL	11/30/95
T. ROCHE	<i>[Signature]</i>	JHU/APL	11/30/95
T. COXHILL	<i>[Signature]</i>	JHU/APL	11/30/95
D. SKELLY	<i>[Signature]</i>	NASA/KSC	12/1/95
M. RUETHER	<i>[Signature]</i>	NASA/KSC	12/2/95
W. FLETCHER	<i>[Signature]</i>	NASA/KSC	12/2/95
M. COLONY	<i>[Signature]</i>	RT-500-2A	12/4/95
D.L. FRANK	<i>[Signature]</i>	RT-500	12/4/95
B. B. JENSEN	<i>[Signature]</i>	RT	12/4/95
Jose A. Caraballo	<i>[Signature]</i>	RT-500-2	12/4/95

CONTRACTOR DIRECTOR OF SAFETY

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NASA SUSPENDED LOAD OPERATION ANALYSIS/APPROVAL

OPERATION: Near Earth Asteroid Rendezvous (NEAR) lifting operations in the Building AE and SAEF 2 High Bays.

SUPPORTING DOCUMENTS: The associated System Assurance Analyses (SAA) and NEAR Procedures are:

SAA 29AE32-001 5-ton Bridge Crane - Building AE
SAA 01FS0420-001 20-ton Bridge Crane SAEF 2
7352-9092 NEAR Mechanical Handling Procedure

GENERAL DESCRIPTION: The following NEAR operations require two personnel to be directly under the load (spacecraft):

Installation/Removal of the spacecraft onto handling dolly in AE.
Installation/Removal of the spacecraft onto Test Payload Attach Fitting (PAF) in SAEF 2.
Installation/Removal of the spacecraft onto the spin balance machine in SAEF 2.

These operations require two personnel to work below the spacecraft when suspended from the facility crane in the Building AE High Bay and in the SAEF 2 High Bay. These lift operations will be performed using NEAR Procedure 7352-9092. The test procedures will include warnings and precautions to minimize the exposure of personnel to suspended loads.

RATIONALE/ANALYSIS: The NEAR suspended load operations comply with the NASA Alternate Safety Standard for Suspended Load Operations because:

Alternate Standard Requirement 1a: The spacecraft mating/separation ring is smaller in diameter than the outer diameter of the spacecraft. It is necessary to position two personnel beneath the spacecraft to ensure proper mating separation to prevent damaging the flight separation surface.

Alternate Standard Requirement 1b: A secondary support system is not feasible for the spacecraft because the separation interface represents the only primary structure interface for the spacecraft.

Alternate Standard Requirement 1c: The handling procedure will limit the number of personnel beneath the suspended load to no more than two.

Alternate Standard Requirement 1d: The NEAR spacecraft personnel will accomplish the mating and separation tasks as quickly and safely as possible to minimize exposure. Each operation is expected to expose personnel to a suspended load for less than five minutes. 7352-9092 will control these operations.

Alternate Standard Requirement 4: Operational requirements will be included in 7352-9092. This procedure will be on site during NEAR operations for inspection.

Alternate Standard Requirement 6: The building AE 5 ton bridge crane and the SAEF 2 20 ton bridge crane are tested, inspected, maintained, and operated in accordance with the NASA Safety Standard for Lifting Devices and Equipment, NSS/GO-1740.9.

The cranes are load tested at 100 percent rated capacity annually and have a monthly, quarterly, semiannual and annual preventative maintenance program to ensure proper operation. The cranes are load tested to 125 percent rated capacity when new or following a major repair or modification.

The spacecraft lift bars and fixture were designed with an ultimate factor of safety of five times rated load and proof tested to a factor of 2.5 times rated load annually. The lift fixtures were designed to handle the worst case spacecraft weight.

When lifting the spacecraft, the cranes will be connected to a hydraset, crane scale, lift fixtures, and spacecraft. Maximum weight of the spacecraft is approximately 1825 pounds.

Operation of the cranes will be limited to trained and certified crane operators per KMI6430.4, Examination and Licensing of KSC Facility Crane Operators.

An individual will be stationed at the crane main circuit breaker during hoisting to immediately remove power, thus setting the brakes, should a failure occur with the crane controls.

The crane will be operated in a slow-speed mode when the spacecraft is in close proximity to its initial or final resting position.

Alternate Standard Requirement 7: System Assurance Analyses (SAA) have been performed on the Building AE and SAEF 2 cranes that will be used to lift the spacecraft. Each SAA includes a Failure Modes and Effects Analysis/Critical Items list (FMEA/CTL) and a hazard analysis.

The SAA (01FS0420-001) for the 20 ton Bridge Crane in SAEF 2 identifies no Category 1 Mechanical or Electrical Critical Items.

The SAA (29AE32-001) for the 5 ton Bridge Crane in Building AE identifies one Category 1 Mechanical Critical item. The Critical Item is the Hoist Gear Reducer, which if it disengages, will result in dropping the load.

There is no history of failure with the Critical Item in the critical failure mode. The CIL Sheet for the Critical Item identifies design, test, and inspection rationale for accepting the risk associated with the Critical Item. The CIL has been submitted and approved by KSC senior management.

A hydraset will be used for the initial 3 or 4 inches of travel during separation and the final 3 or 4 inches of travel during mating.

Pre-operational checks of the crane control system will be performed prior to each lift of the spacecraft.

Alternate Standard Requirement 8: Pre-operational inspections will be performed. The spacecraft lift fixtures have been proof tested, dye penetrant inspected, tagged and will be visually inspected prior to each spacecraft lift.

Alternate Standard Requirement 9: Trained and certified crane operators shall operate the crane controls at all times when personnel are beneath suspended loads.

Alternate Standard Requirement 10: NEAR procedure 7352-9092 establishes appropriate hazard control areas before initiating operations. Only the minimal number of personnel (manloaded in procedure) will be permitted in this area.

Alternate Standard Requirement 11: A pre-task briefing and a safety walk down of the hazard control area will be performed immediately prior to each operation to ensure personnel are ready to support.

Alternate Standard Requirement 12: Personnel beneath the suspended load will be in voice contact with the crane operator and test conductor throughout the operation. At any time during the operation anyone can call a safety hold. The crane operator will have full visual contact with the load throughout the operation.

Alternate Standard Requirement 13: The test conductor, the crane operator, and the crane power cut-off switch operator will be in visual contact with the personnel beneath the suspended load

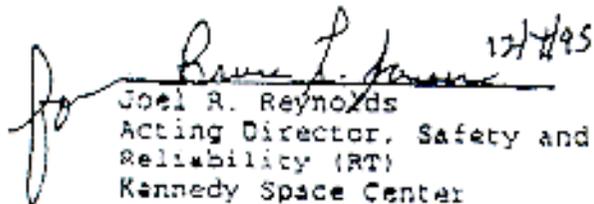
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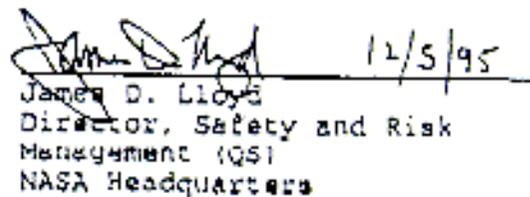
APPROVAL:

DATE:

CONCURRENCE:

DATE:

 12/1/95
Joel R. Reynolds
Acting Director, Safety and
Reliability (RT)
Kennedy Space Center

 12/5/95
James D. Lloyd
Director, Safety and Risk
Management (QS)
NASA Headquarters