

APPROVAL SHEET FOR SUSPENDED LOAD OPERATIONS

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**NASA SUSPENDED LOAD OPERATION
ANALYSIS/APPROVAL**

OPERATION: Global Geospace Science (GGS) WIND lifting operations in the Building AO and Payload Hazardous Servicing Facility (PHSF) High Bays.

SUPPORTING DOCUMENTS: The associated System Assurance Analyses (SAA) and GGS WIND Test Procedures (TP) are:

SAA 29AO13-002 10-ton Bridge Cranes - Building AO
SAA 01HS11-005 East 50-ton Bridge Crane PHSF
TP-20044966 Shipping Container Loading/Unloading
TP-20044967 Laboratory Handling and Shipping

GENERAL DESCRIPTION: The following GGS WIND operations require personnel to be directly under the load (Laboratory):

Lower Laboratory onto dolly in AO - 2 mechanical technicians
Lower Laboratory onto Laboratory Integration Fixture (Aronson) in AO - 2 mechanical technicians
Lower Laboratory onto dolly in AO - 2 mechanical technicians
Lower Laboratory onto shipping container base in AO - 2 mechanical technicians
Lower Laboratory onto dolly in PHSF High Bay - 2 mechanical technicians
Lift Laboratory off dolly in PHSF High Bay - 4 mechanical technicians
Lower Laboratory onto static balance fixture in PHSF High Bay - 4 mechanical technicians
Lift Laboratory off of static balance fixture in PHSF High Bay - 4 mechanical technicians
Mate Laboratory to Delta third stage in PHSF High Bay - 4 MDA personnel

These operations require two-to- four mechanical technicians to work below the Laboratory when suspended from the facility crane in the Building AO High Bay and in the PHSF High Bay. These Laboratory lifting operations will be performed using GGS WIND test procedures TP-20044966 and TP-20044967. The test procedures will include warnings and precautions to minimize the exposure of personnel to suspended loads. When possible, separation and mating during crane operations will be between two GSE items (i.e. non-flight interface).

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

Alternate Standard Requirement 1a - The Laboratory mating/separation ring is smaller in diameter than the outer diameter of the Laboratory. It is necessary to position four personnel beneath the Laboratory to ensure proper mating and proper separation to prevent damaging the flight separation surface or to position two personnel beneath the Laboratory to ensure proper alignment of the GSE interfaces.

Alternate Standard Requirement 1b - The use of secondary support structures to "catch" the Laboratory in the event of a failure was analyzed. A secondary support system is not feasible for the GGS WIND Laboratory because the separation interface represents the only primary structure support interface for the Laboratory.

Alternate Standard Requirement 1c - The test procedures will limit the number of personnel beneath the suspended Laboratory to four when lifting or mating the Laboratory at the flight separation interface and two when mating at a GSE interface.

Alternate Standard Requirement 1d - GGS WIND mechanical technicians 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. TP-20044966 and TP-20044967 will control the operations.

Alternate Standard Requirement 4 - Operational requirements will be included in TP-20044966 and TP-20044967. These test procedures will be on-site during GGS WIND operations for inspection.

Alternate Standard Requirement 6 - The Building AO 10-ton bridge cranes and the PHSF High Bay 50-ton bridge cranes 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 Laboratory lift fixture was designed with an ultimate factor of safety of five times its rated load and proof tested to twice its rated load annually. The lift fixture was designed to handle the worst case Laboratory weight.

When lifting the Laboratory the cranes will be connected to a KSC supplied hydraset, a crane scale, the Laboratory lift fixture, and the Laboratory. Maximum weight of the Laboratory will be approximately 2750 pounds.

Operation of the cranes will be limited to trained and certified crane operators per KMI 6340.4, 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 in close proximity of the Laboratory shipping container base, Laboratory dolly, static balance fixture, or third stage PAF.

Alternate Standard Requirement 7 - System Assurance Analyses (SAA) have been performed on the Building AO and PHSF facility cranes that will be used to lift the GGS WIND Laboratory. Each SAA includes a Failure Modes and Effects Analysis/Critical Items List (FMEA/CIL) and a hazard analysis.

The SAA (SAA01HS11-005) for the 50-ton Bridge Cranes in the PHSF, identifies no Category 1 Mechanical or Electrical Critical Items.

The SAA for the 10-ton Bridge Crane at Building AO identifies one Category 1 Mechanical Critical Item for the 10-ton crane. 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 KSC supplied hydraset will be used for the initial one inch of travel during separation and the final one inch of travel during mating.

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

Alternate Standard Requirement 8 - Pre-operational inspections will be performed. The Laboratory lift fixture has been proof tested and tagged and will be visually inspected prior to each Laboratory 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 - GGS WIND test procedures TP-20044966 and TP-20044967 establish appropriate hazard control areas and prohibit non-essential personnel.

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.

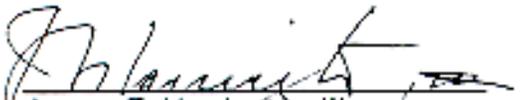
Alternate Standard Requirement 13 - The test conductor, the crane operator, and the crane power cut-off switch operator will be in visual contact with the personnel beneath the suspended load throughout the operation.

APPROVAL:

Date: 8/1/94

CONCURRENCE:

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8/23/94