

NASA SUSPENDED LOAD OPERATION INTERIM ANALYSIS/APPROVAL

1. OPERATION *MATING OF THE GEOTAIL SPACECRAFT TO THE SPIN BALANCE MACHINE AND THE SPACECRAFT GSE DOLLY AT ESA 60A*

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3. CONTRACTOR	4. CONTRACT NO.	5. VEHICLE/GSE/EFFECTIVITY FACILITY	
7. DOCUMENT <i>GP1098F</i> <i>NSS/GD 1740.9</i>	8. TITLE <i>KSC GROUND SAFETY PLAN VOL.1</i> <i>NASA STANDARD for LIFTING DEVICES & EQUIP.</i>		9. ITEM NO. <i>SECTION 2.3</i> <i>3.7.19</i>

10. REQUIREMENT

KSC SAFETY POLICY DOES NOT ALLOW PERSONNEL TO WORK UNDER SUSPENDED LOADS. THE REQUIREMENTS ARE:
GP1098F - "A LOAD WILL NOT BE LIFTED, SUSPENDED OR TRANSPORTED OVER PERSONNEL"
NSS/GD-1740.9 - "LOADS SHALL NOT BE MOVED OVER PEOPLE UNLESS SPECIFICALLY AUTHORIZED IN A TECHNICAL OPERATING PROCEDURE"

11. DESCRIPTION *TO MATE THE SPACECRAFT (S/C) TO THE SPIN BALANCE MACHINE OR THE S/C GSE DOLLY REQUIRES FOUR TECHNICIANS WORKING BENEATH THE S/C SUSPENDED ON THE FACILITY CRANE. THE MATING SURFACE IS SMALLER IN DIAMETER THAN THE OVERALL DIAMETER OF THE S/C.*

12. DETAILED RATIONALE

THE PERSONNEL WORKING BELOW THE SUSPENDED LOAD ARE REQUIRED TO ATTACH THE MATING HARDWARE.

13. REMARKS

STRICT ADHERENCE TO THE SAFETY REQUIREMENTS DEFINED IN GEOTAIL PROCEDURES, GTL-TOP-004 AND GTL-TOP-1005 WILL MINIMIZE THE EXPOSURE OF PERSONNEL WORKING UNDER THE SUSPENDED SPACECRAFT.

14. REQUIRED APPROVAL

CONTRACTOR

NASA

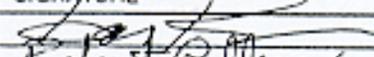
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15. TYPE OR PRINT NAME

SIGNATURE

ORGN.

DATE

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NASA SUSPENDED LOAD OPERATION
ANALYSIS/APPROVAL

OPERATION: Mating of GEOTAIL Spacecraft (S/C) to the Spin Balance Machine and the S/C GSE Dolly located at ESA 60A

SUPPORTING DOCUMENTS: The associated operational procedure/System Assurance Analysis (SAA) are as follows:

- o SAA 29EA32-001 5-Ton Bridge Cranes - S&A Building
- o SAA 29EA32-002 10-Ton Bridge Crane - DBL
- o GTL-TOP-T004, "Inter-Facility Transportation"
- o GTL-TOP-M005, "Spin Balance Test Procedure"

GENERAL DESCRIPTION: This operation requires four technicians to be working below the S/C when suspended from the facility crane. This work will be performed according to GEOTAIL Procedures GTL-TOP-T004 and GTL-TOP-M005, and will minimize the time for working under the suspended spacecraft.

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

Alternate Standard Requirement #1a - Because the mating ring (surface) of the S/C is smaller in diameter than the overall diameter of the S/C, personnel are required to be beneath the suspended load to attach the Morman Clamp when mating the S/C to either the spin balance machine or the S/C dolly.

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 that the use of a secondary support system was not feasible because the only attach points on the S/C were installed only for the primary support system. A secondary support system would prevent access to the area of critical work.

Alternate Standard Requirement #1c - The maximum number of personnel permitted under the load at any time is four.

Alternate Standard Requirement #1d - Technicians will accomplish the required tasks as quickly and safely as possible to minimize time exposure. This will be done in accordance with GTL-TOP-T004 and GTL-TOP-M005. (Technicians will be under the load for approximately 5 minutes.)

Alternate Standard Requirement #4 - Procedures are available on-site for inspection.

Alternate Standard Requirement #6 - The DBL 10-ton and the S&A 5-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 annually at 100 percent of rated capacity, and have a monthly, quarterly, semiannual and annual preventative maintenance program to ensure proper operation.

As applicable, the cranes are load tested at 125% rated load when new and when extensively repaired, modified or altered.

The spacecraft lifting fixture is designed for an ultimate factor of safety of five times the design limit load and proof loaded to twice the design limit load. The spacecraft lifting fixture was designed based on a worst case load of lifting the heaviest spacecraft configuration.

When performing the mate operation, the cranes (5-ton or 10-ton) are connected to the spacecraft lifting fixture and hydraset. The maximum load lifted is 2507 pounds.

Alternate Standard Requirement #7 - System Assurance Analyses (SAA's) have been completed on each crane (SAA 29EA32-001 5-ton bridge cranes - S&A Building and SAA 29EA322-002 10-ton bridge crane - DBL). Each SAA includes a Failure Modes and Effects Analysis/Critical Items List (FMEA/CIL) and a hazard analysis. Copies of the SAA's are on file at MDSSC Safety-KSC, NASA Safety-KSC, and NASA Safety-HQ for review.

The SAA's identify three single point failures (SPF) for the 10-ton crane and three single point failures for the 5-ton crane. Failure of these SPF's would cause the load to drop.

There is no history of failure with the SFP's in the critical failure mode. The use of high quality, reliable components and comprehensive maintenance, inspection, and test program, including pre-operational checks ensure that the crane systems operate properly. If a failure were to occur, the crane control pendant is equipped with an emergency stop button to stop the operations.

The following controls will be incorporated to minimize the probability of hazard occurrence:

Operation of the crane is only by trained and certified operators per KMI 6340.4, Examination and Licensing of KSC Facility Crane Operators;

An individual will be stationed at the main circuit breaker during hoisting to immediately remove power; thus, setting the brake should a failure occur in the crane speed control system;

The crane will be operated only in slow speed when the spacecraft is in close proximity of the spin machine or dolly;

Use of a hydraset shall be required when lifting payload/flight hardware with hazardous materials present; and

Pre-operational checks of the crane control system shall be accomplished prior to each use for flight hardware hoisting.

The associated SAA CIL Sheets (pages 8-14 for the 10-ton crane and pages 8-14 for the 5-ton crane) identify all the rationale for accepting the SPF risk, including design information, failure history, and the operational controls in effect to minimize the risks (maintenance, inspection, test, etc.).

Alternate Standard Requirement #8 - The S/C lifting fixture has been proof loaded and tagged.

Alternate Standard Requirement #9 - Trained and licensed crane operators shall remain at the crane controls while personnel are under the load.

Alternate Standard Requirement #10 - Appropriate safety zones are established before initiating operations. Only the minimum number of people will be permitted in this area.

Alternate Standard Requirement #11 - A pre-task briefing and a safety walk-down of the area are conducted prior to the lift to ensure that all systems and personnel are ready to support.

Alternate Standard Requirement #12 - Personnel beneath the suspended load will be in voice contact with crane controller, and/or signal person.

Alternate Standard Requirement #13 - Personnel will be stationed at the crane cutoff switch in full view of the operation to stop the crane if a failure is observed.

APPROVAL:

DATE:

CONCURRENCE:

DATE:

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