APPROVAL SHEET FOR SUSPENDED LOAD OPERATIONS

SLO-KSC- 1997-001

TITLE Transfer Modified Blue Plate To Mock Up Engine

DOCUMENT NUMBER/TITLE SS29-248

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REQUIRED APPROVAL

CONTRACTOR ____ DESIGN ____ R & QA ____ OPERATIONS ____ SAFETY

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NASA SUSPENDED LOAD OPERATION
ANALYSIS/APPROVAL

OPERATION: Transfer modified blue plate to mock up engine.

SUPPORTING DOCUMENTS: The associated System Assurance Analysis (SAA) and test procedure are as follows:

- TPS SS29-248 - Transfer Modified Blue Plate to Mock Up Engine
- SAA 09FY121-002 - System Assurance Analysis of the 10-Ton Bridge Cranes at the VAB/Low Bay Areas K&L Checkout Cells 1, 2 and 4

GENERAL DESCRIPTION: Permit two (2) technicians to be directly under the suspended mock up engine during installation/removal of six (6) gimbal bolts and transfer of GSE mock up adapter plate (blue plate) to handler.

The mock up engine will be lifted off the engine handler, the GSE blue plate will be removed, the modified blue plate will be attached to the engine and the engine will be lowered back on to the handler.

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

Alternate Standard Requirement 1a: The operations can not be conducted without personnel working beneath the load during operations involving the connection and disconnection of the mock up adapter plate to the handler.

There are no procedural or operational means to completely eliminate the hazard of exposing personnel to a suspended load. In addition, it is not feasible to redesign the lifting/handling equipment to eliminate the requirement for personnel to work under a suspended load during these operations.

Alternate Standard Requirement 1b: The possible use of a secondary support system to catch the load in the event of a crane failure has been reviewed and determined not to be feasible.

Alternate Standard Requirement 1c: The maximum number of personnel permitted beneath the load at any one time is two (2).

Alternate Standard Requirement 1d: The two (2) technicians will perform their task as quickly and safely as possible to minimize exposure. The suspended load operation is estimated to take approximately 10 minutes.

Alternate Standard Requirement 4: TPS SS29-248 has been written to permit only the minimum number of personnel under the suspended load.

Alternate Standard Requirement 6: The suspended load operations covered by this report are performed using one of the VAB 10-Ton bridge cranes. The cranes are designed, tested, inspected, maintained and operated in accordance with the NASA Safety Standard for Lifting Devices and Equipment, NSS/GO-1740.9.

The mock up engine with associated GSE is estimated to weigh approximately 8500 pounds.

The cranes are 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 daily before use and load holding/brake capability is tested annually.

The VAB 10-Ton bridge cranes are equipped with mechanical and magnetic braking systems with overspeed braking, each capable of stopping and holding the load at the crane's rated capacity. The mechanical load brake controls the lowering speed of the hoist motor. If the speed of the load begins to exceed that of the motor, the brake begins to set, slowing the rate of descent. The magnetic load brake provides braking torque to the hoist motor pinion shaft. Whenever the hoist motor is energized the solenoid in the magnetic load brake is also energized causing the magnetic load brake to release. Therefore whenever power is removed from the hoist motor, the magnetic brake will set.

Operation of the crane will be by trained and certified operators per KMI 6340.4, Examination and Licensing of KSC Facility Crane Operators.

Alternate Standard Requirement 7: SAA09FY121-002 has been completed on the VAB 10-Ton bridge cranes. The SAA includes a Failure Modes and Effects Analysis/Critical Item List (FMEA/CIL) and a Hazard Analysis (see supporting documents).

The SAA for the VAB 10-Ton bridge cranes identifies one single failure point (SFP) in the hoist gear drive when the system is hoisting or lowering. The identified failure mode is disengagement of the drive gear as a result of structural failure of the teeth, shafts or keys which will allow the load to drop. There is no history of failure with the SFP in the critical failure mode. The use of high quality components and a comprehensive maintenance, inspection and test program including preoperational checks ensure the crane operates properly. The gears and shafts are designed in

accordance with American Gear Manufacturers Association (AGMA) and Crane Manufacturers Association of America (CMAA) standards and all load bearing parts are designed so that the static stress, calculated for rated load, does not exceed 20 percent of the average ultimate material strength.

Alternate Standard Requirement 8: Visual inspections for cracks or other signs of damage or anomalies are performed on the crane and associated lifting equipment and crane functional checks are performed in accordance with NSS/GO-1740.9.

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

Alternate Standard Requirement 10: Appropriate safety control areas are established before initiating operations. Only the minimum number of personnel will be permitted in this area.

Alternate Standard Requirement 11: A pretask briefing and a safety walkdown 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 hazards involved.

Alternate Standard Requirement 12: Personnel beneath the suspended load will be in voice contact with the crane operator/signal person throughout the operation. At any time during the operation anyone can call a safety hold if they see a discrepancy.

Alternate Standard Requirement 13: The crane operator/signal person are positioned during the operation in full view of the load block, lifting fixtures and attach points. Personnel working beneath the load shall remain in continuous sight of the crane operator/signal person.

Approval: Date: 1/15/97

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