

# APPROVAL SHEET FOR SUSPENDED LOAD OPERATIONS

BLO-KBC-1997-005

TITLE TDRS H, I, J (HSG01) Lifting and Mating Operations

DOCUMENT NUMBER/TITLE LP80409-404-322 Mechanical Operations

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**REQUIRED APPROVAL**

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## 1.0 OPERATION

Tracking and Data Relay Satellite (TDRS) H, I, J (HS601) spacecraft (S/C) lifting and mating operations (see Figure 1).

## 2.0 SUPPORTING DOCUMENTS

### 2.1 Applicable Documents

LP80409-H04-322	Mechanical Operations
HS601G59297 (CDRL LS-FA-01)	TDRS H, I, J Launch Site Safety Plan
PP80409-H00-002 (CDRL LS-FA-02)	TDRS H, I, J (HS601) Missile System Prelaunch Safety Package (MSPSP)
SAA 01HS11-005	50-Ton Bridge Crane PHSF
SAA 01FS0420-001	20-Ton Bridge Crane SAEF 2

### 2.2 Reference Documents

KHB 1710.2C, Annex G 27 February 1997	KSC Safety Practices Handbook
NSS/GO-1740.9	NASA Safety Standard for Lifting Devices and Equipment

## 3.0 GENERAL DESCRIPTION

The following S/C operations require four Hughes Space and Communications Company (HSC) personnel, for the purpose of physical guidance, to be directly under the flight hardware, lifting fixture and hydraset during the last stage of a mate (within 1 inch), and the beginning of a lift (first 1 inch).

- Case 1 - S/C lifting from the HSC transport/shipping container.
- Case 2 - S/C mating to and lifting from the HSC mechanical ground support equipment (MGSE) support stand (fueling stand).
- Case 3 - S/C mating to the Lockheed Martin Atlas Type D, Payload Adapter (PLA). Please note that this operation is controlled by Lockheed Martin and is included for reference only. This operation will be covered by a Lockheed Martin specific SLOA/A to KSC.

## 4.0 RATIONALE/ANALYSIS

The S/C suspended load operations comply with the NASA Alternate Safety Standard for Suspended Load Operations because:

**Alternate Standard Requirement 1a:** The S/C mating/separation ring is smaller in diameter than the outer diameter of the S/C. It is necessary to position HSC personnel beneath the S/C to ensure proper mating, de-mating and lifting in order to prevent damaging the flight mating/separation ring surface.

**Alternate Standard Requirement 1b:** A secondary support system is not feasible because the S/C mating/separation ring represents the only primary structure interface for the S/C.

**Alternate Standard Requirement 1c:** The HSC S/C Mechanical Operations procedure (LP80409-H04-322) limits the number of personnel beneath the suspended load to no more than four.

**Alternate Standard Requirement 1d:** HSC personnel will accomplish the mating, demating and lifting operations as quickly and safely as possible to minimize exposure. Specific procedures listed in section 2.0 will control these operations. HSC personnel are only under the load during the last 1 inch prior to mate and for the first 1 inch during lifting.

**Alternate Standard Requirement 4:** Existing HSC TDRS H, I, J (HS601) launch operations procedures are complete and will be used (see Section 2.0).

**Alternate Standard Requirement 6:** The suspended load operations covered by this report are performed at the PHSF using the 50-ton bridge crane or at SAEF 2 using the 20-ton bridge crane. The 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% rated capacity annually and there is preventative maintenance program to ensure proper operation. The cranes are load tested to 125% rated capacity when new or following a major repair or modification.

The HSC MGSE lift fixture was designed with an ultimate factor of safety of 5.0 times the rated load and proof tested to a factor of 2.0 times the rated load annually. The lift fixture was designed to handle a substantially greater rated load than the maximum expected S/C weight.

When lifting the S/C, the S/C will be connected to the crane with a HSC hydraset and lift fixture. The hydraset will be used for the initial 1 inch of travel during lifting and the final 1 inch of travel during mating. Maximum weight of the S/C is approximately 7000 lbs.

Only HSC crane operators trained and certified by KSC will be allowed to operate the KSC PHSF crane.

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 S/C is in close proximity to MGSE.

**Alternate Standard Requirement 7:** System Assurance Analyses (SAA) have been performed on the PHSF 50-ton bridge crane and the SAEF 2 20-ton bridge crane. Each SAA includes a Failure Modes and Effects Analysis/Critical Items list (FMEA/CIL) and a hazards analysis.

The SAA (01HS11-005) for the PHSF 50-ton bridge crane and the SAA (01FS0420-001) identify no Category 1 mechanical or electrical critical items.

**Alternate Standard Requirement 8:** Pre-operational inspections of the lifting equipment as well as crane functional checks will be performed prior to use. The HSC MGSE lift fixtures have been proof tested, dye penetrant inspected, tagged and will be visually inspected prior to each S/C lift.

**Alternate Standard Requirement 9:** Only HSC crane operators trained and certified by KSC will be allowed to operate the crane when personnel are beneath suspended loads.

**Alternate Standard Requirement 10:** Section 2.0 procedures establish appropriate control areas before initiating operations. Only the minimum number of essential personnel (manloaded in procedure) will be permitted in this area.

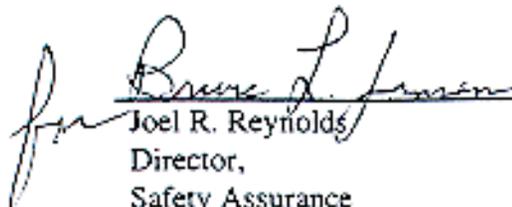
**Alternate Standard Requirement 11:** A pre-task briefing and a safety walk down of the control area will be performed immediately prior to each operation to ensure personnel are ready to support.

**Alternate Standard Requirement 12:** HSC personnel beneath the suspended load will be in voice contact with the HSC crane operator and the HSC mechanical integration supervisor throughout the operation. At any time during the operation anyone can call a safety hold. The HSC crane operator will have full visual contact with the load throughout the operation.

**Alternate Standard Requirement 13:** The HSC mechanical integration supervisor, the HSC crane operator and the HSC crane power cut-off switch operator will be in visual contact with the HSC personnel beneath the suspended load throughout the operation.

Approval:

Date:

  
Joel R. Reynolds  
Director,  
Safety Assurance  
Kennedy Space Center

10/6/97

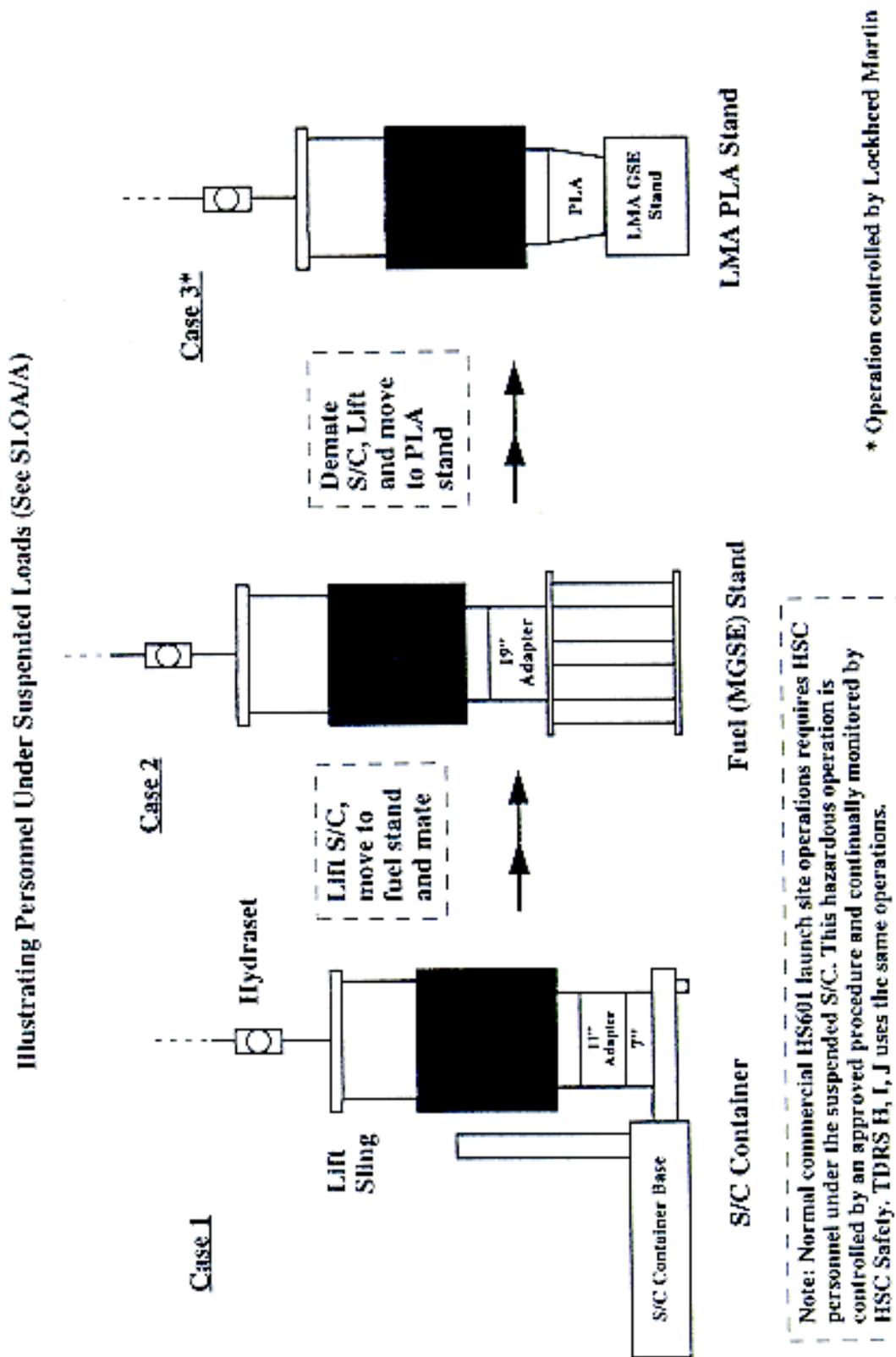


Figure 1 S/C Mating and Lifting Suspended Load Operations