



HESSI SPACECRAFT HANDLING & LIFTING PROCEDURE

HSI_MIT_025D.DOC

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**WARNING: THIS PROCEDURE CONTAINS
HAZARDOUS OPERATIONS**

DOCUMENT REVISION RECORD

Rev.	Date	Description of Change
A	99/12/15	Initial Draft
B	00/03/12	Additions for Hydraset.
C	00/11/15	Cleanup and editing.
D	00/11/20	Addition of Procedure for Scissor-Lift XL19

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1.0 INTRODUCTION

This procedure describes the operations used to lift the HESSI Spacecraft to the vibration table in Building 144 at JPL using an overhead crane and a Hydraset. The procedure will describe both lifting equipment and lifting procedure.

2.0 EQUIPMENT REQUIREMENTS

The following equipment will be required to support this procedure.

- Overhead Crane
- Hydraset with preload weight
- Lifting Jig
- Shackles
- Mechanics Tool Box
- Grounding Strap Cable
- Scissor-Lift (for Z axis vibration only)

3.0 EQUIPMENT PRETESTING AND EXAMINATION

Hoisting equipment shall be either proof loaded or documentation provided showing that the equipment has a factor of safety of no less than 2.5. Each lifting line, including bolts and shackles shall be inspected before use. Slings shall show no evidence of damage, kinking or misuse. Unapproved devices shall not be used for lifting applications.

4.0 SAFETY

The Test Conductor will be responsible for safety while conducting mechanical handling operations outlined in this procedure. The Test Conductor will ensure compliance with all safety regulations or practices in effect during these operations. Areas in which lifting and handling operations are taking place will be cordoned off and non-essential personnel will be evacuated.

The Test Conductor or the Test Conductor's designee will give all instructions to the crane operator for crane movements. Only certified crane operators shall operate the crane.

This procedure contains lifting operations where personnel may be required to work near a suspended load. Personnel will not be allowed under the suspended load at any time.

Tools used over the upper titanium ring on the imager on the spacecraft will be tethered at all times.

5.0 SPACECRAFT LIFTING PROCEDURE

IMPORTANT: ESD straps must be worn at all times when touching the spacecraft.

5.1 Disconnect Vacuum Pump

- Disconnect the vacuum pump in accordance with the Vacuum Disconnecting Procedure.

IMPORTANT: The spacecraft can not be disconnected from the vacuum pump for more than 15 hours.

5.2 Attach Hydraset to the crane

- Secure the Hydraset to the crane with a shackle.
- Attach the Hydraset control lines to the *up* and *down* levers. Make sure that the control line labeled “up” is attached to the up lever.
- Remove the lock-pin holding the Hydraset to its stand and lift the Hydraset out of the stand.
- Attach the preload weight to the lower eye-bolt on the Hydraset with a shackle.
- Leave both Hydraset control levers in the down position. Lift the Hydraset with the crane slowly until the ram of the Hydraset is extended roughly 4”. Unclip the lever lock from the control levers.
- Lift the weight from its stand.
- Pull out the cables from the control cable housings as needed. Tension must be kept on the cable winders or the cable will birds-nest. Assign one person to each control cable.
- Secure the lifting jig to the shackle beneath the preload weight using an approved stainless steel shackle.

NOTE FOR THE Z AXIS VIBRATION ONLY: It will be necessary for the person performing the next steps to be raised off the ground with a scissor lift. Carry out steps in the “Procedure for Scissor-Lift XL19” in Appendix A so as to be moved into position to perform steps 5.3 and 5.4.

5.3 Attach the Three Lifting Fixture Legs to the Imager

- Attach legs using M6 x 30mm A286 bolts provided. The bolts go through the lower holes on the legs, through the conical brass washers and into the holes between the struts on the imager middle ring. The bolts should be finger-tightened only.
- Secure legs to the upper titanium ring using the t-handle pins through the leg standoff fixtures.

5.4 Attach Lifting Fixture to Spacecraft

- Raise the lifting jig and position it directly over the spacecraft.
- Record the weight shown on the Hydraset gauge: _____ lbs
- Lower the crane in “inch mode” until the holes in the lifting jig line up with the holes in the legs bolted to the imager.
- Secure the lifting jig to the legs using the t-handle pins tethered to the lifting jig.
- Tighten the three M6 bolts to 11 Nm
- The Test Conductor shall inspect and approve all lifting hardware prior to lifting.

BEGINNING OF HAZARDOUS OPERATIONS

5.5 Lift the Spacecraft to the Vibration Table (pre-Test)

- The Test Conductor shall provide a verbal description of the spacecraft transport route to all personnel prior to lift.
- Raise the crane until the hydraset reading is roughly 384 pounds (this puts a 100 lb. pull on the spacecraft).
- Remove all 24 bolts holding the red ring to the spacecraft dolly. Remove the washers as well.
- Have four people stand on each side of the spacecraft to ensure that it does not hit the dolly while being raised.
- Lift the spacecraft using the Hydraset by pulling repeatedly on the control line attached to the up lever. . The lift rate is 0.005”/stroke.
- Once the spacecraft is completely off the red ring, lift it slowly using the crane in inch mode.
- Record weight of spacecraft noting current configuration. Subtract the weight of the lifting bars and hardware (4.8 lbs). Net weight _____ lbs.
- Move the spacecraft to the vibration table slowly while at least two people keep the spacecraft from swinging. Be sure that the spacecraft is high enough to clear any obstacles.

5.6 Place Spacecraft on the Vibration Table

- Rotate the spacecraft so that the negative X side of the spacecraft is facing the west wall on building 144.
- Lower the spacecraft in inch mode until it is ½ - ¼” above the locating stud-bolts that hold the force sensors in place.
- With four people guiding the spacecraft, slowly lower the spacecraft down onto the stud-bolts with the Hydraset.
- Once the spacecraft has been lowered onto the bolts ½”, lower the spacecraft using the crane in inch mode until the spacecraft is about ¼” above the vibration table.
- Lower the spacecraft slowly the rest of the way using the Hydraset.
- Remove each of the stud-bolts and replace them with ¼-28 UNF x 1.5” grade 8 SHCS and washers.

- Finger tighten each bolt.

5.7 Remove Lifting Jig and Legs

- Lower the lifting jig with the Hydraset until the loadcell reads the value recorded in step 5.4.

NOTE FOR THE Z AXIS VIBRATION ONLY: It will be necessary for the person performing the next four steps to be raised off the ground with a scissor lift. Carry out the steps in the “Procedure for Scissor-Lift XL19” in Appendix A to be in a position to continue.

- Remove the t-handle pins from the lifting jig.
- Loosen but do not remove the M6 bolts holding the lifting legs to the imager.
- Slowly raise the crane in inch mode until the lifting jig is clear of the spacecraft.
- Remove M6 bolts, beveled washers, and the t-handle pins from the legs standoff fixtures and carefully remove legs.
- Move the Crane over the Spin Balance pit.
- Perform the vibration test.

5.8 Rotate the Spacecraft (Between X and Y Axis Tests)

- Repeat Sections 5.3 and 5.4.
- Raise the crane and hydraset until the loadcell output is roughly 384 pounds.
- Remove all 24 bolts holding the red ring to the vibration fixture.
- Have four people stand on each side of the spacecraft to ensure that it does swing or rotate while being raised.
- Lift the spacecraft using the Hydraset by pulling repeatedly on the control line attached to the up lever. The lift rate is 0.005”/stroke.
- Once the spacecraft is completely off the vibration fixture, lift it slowly using the crane in inch mode a few inches.

5.9 Place Spacecraft on the Vibration Table

- Rotate the spacecraft so that the negative Y side of the spacecraft is facing the west wall on building 144.
- Lower the spacecraft in inch mode until it is ½ - ¼” above the locating stud-bolts that hold the force sensors in place.
- With four people guiding the spacecraft, slowly lower the spacecraft down onto the stud-bolts with the Hydraset.
- Once the spacecraft has been lowered onto the bolts ½”, lower the spacecraft using the crane in inch mode until the spacecraft is about ¼” above the vibration table.
- Lower the spacecraft slowly the rest of the way using the Hydraset.
- Remove each of the stud-bolts and replace them with ¼-28 UNF x 1.5” grade 8 SHCS and washers.
- Finger tighten each bolt.

5.10 Remove Spacecraft from the Vibration Table

- Repeat steps 5.3 and 5.4.
- Raise the crane and hydraset until the loadcell output is roughly 384 pounds.
- Remove all 24 bolts holding the red ring to the vibration fixture.
- Have four people stand on each side of the spacecraft to ensure that it does not swing or rotate while being raised.
- Lift the spacecraft using the Hydraset by pulling repeatedly on the control line attached to the up lever. The lift rate is 0.005"/stroke.
- Once the spacecraft is completely off the vibration fixture, lift it slowly using the crane in inch mode a few inches.
- Move the spacecraft back to the dolly.
- Lower the spacecraft in inch mode until it is 1/4" above the spacecraft dolly.
- Insert four 1/4-28 bolts in four quadrants and start the threads into the dolly to act as guides.
- With four people guiding the spacecraft, slowly lower the spacecraft down onto the dolly with the Hydraset.
- Tighten each bolt to 30 in-lbs..

END HAZARDOUS OPERATIONS

END OF PROCEDURE

Completed Date/Time: _____

Test Conductor: _____

APPENDIX A.

The following procedure is intended for use of the SCISSOR-LIFT XL19 at JPL. The purpose of the Scissor-Lift is to raise a person sufficiently high and close to the spacecraft to be able to attach/detach the lifting bars and attach/remove the hoist.

PROCEDURE FOR SCISSOR-LIFT XL19

1. CONNECT GROUND CABLE TO THE TOP OF BASKET AND GROUND OTHER END TO FLOOR.
2. WITH TECHS INSIDE, MOVE SCISSOR-LIFT WITHIN 2 FEET OF SPACECRAFT ON ONE SIDE.
3. RAISE BASKET TO NECESSARY HEIGHT FOR ACCESS TO WORKING AREA OF SPACECRAFT.
4. TECHNICIAN IN BASKET WILL CRANK HIMSELF OUT TO REACH WORK AREA OF SPACECRAFT.
5. TECHNICIAN WILL CLIP HIS WRIST STRAP TO GROUND EXTENSION BEFORE TOUCHING SPACECRAFT.
6. AFTER COMPLETING THE NECESSARY TASK, THE TECHNICIAN WILL CRANK HIMSELF BACK TO SCISSOR-LIFT.
7. LIFT WILL BE RE-POSITIONED TO ANOTHER SIDE AND REPEAT STEPS 2 THROUGH 6.
8. WHEN TASK IS COMPLETED, LIFT WILL BACK AWAY, LOWER TO FLOOR, DISENGAGE GROUND CABLE , ALLOW TECHNICIAN TO EXIT AND THEN DRIVE BACK INTO AIRLOCK AND PARK.