Stanford University

Gravity Probe B Program
P0594 A

GRAVITY PROBE B

PROCEDURE FOR

SCIENCE MISSION DEWAR

(PTP) SMD LIFT AND ROTATE 90°

P0594 Rev. A

October 18, 1999

ECO 1174-
June 22,2000

Approvals:

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REVISION	ECO NO.	PAGES	DATE
Original	-	All	October 18,1999
A	1174	6,7, 8, 9, 10, 11 Delete Unnecessary load cells, 3ea.	June 21, 2000

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7 SCOPE:

7.1 This procedure describes the steps necessary to lift and rotate the SMD, thus allowing either the X or Y axis to be vertical when the payload is horizontal.

8 REFERENCE DOCUMENTS:

8.1 Procedures

8.1.1 P0677, Disconnect Guard Tank Vent Lines from Gas Module.
8.1.2 P0675, Disconnect Main Tank Vent Lines from Gas Module.
8.1.3 P0613, Evacuate Well with Probe Installed in SMD.

8.2 LMMS Drawing No. 5834078 Pillow block, Positioning Ring, Assy Stand
8.3 LMMS P4880294 Space Vehicle Mass Properties Report - 31 AUG 99
8.4 GP-B magnetic Control Plan, LMSC-5835031
8.5 GP-B (FIST) Preliminary Hazards Analysis, LMSC-F314446

9 SAFETY

9.1 General

9.1.1 Personal injury and hardware damage can result during normal positioning, assembly and disassembly of lifting hardware.

9.1.2 Undesired events associated with this procedure include, but are not limited to, (1) Personnel who are positioning hardware getting their hands and feet caught between moving objects. (2) Suspended hardware is dropped. (3) Personnel and other objects get struck by moving objects.

9.1.3 The GP-B (FIST) Safety Plan and the GP-B (FIST) Preliminary Hazards Analysis should be reviewed for pertinent information regarding this procedure.

9.2 Lifting Procedures

9.2.1 The following equipment should be available and used per the direction of Safety.

9.2.1.1 Hard hats

9.2.2 Only trained and qualified crane operators shall control crane movements.

9.2.3 Movements shall be verbally rehearsed.

9.2.4 Spotters should be trained and briefed on the specifics prior to any load movement.

9.2.5 Personnel should be constantly aware of their surroundings to preclude any pinching of extremities between moving and non-moving hardware.

9.2.6 Only standard rigging techniques and hardware should be used. All hardware will be visually inspected prior to use.

9.2.7 Safety hoist ring bolts shall be tightened to the torque value indicated on the safety hoist ring. Safety hoist rings should not be modified.

9.2.8 The hoist operator shall inspect crane and fill out Crane/Hoist Inspection Tag prior to use.

9.2.9 The hoist operator shall be responsible for the safety of all lifting operations.

9.3 Injuries

9.3.1 Stanford University **CALL 9-911 -** Notify Mike Taber (650) 599-8033

9.3.2 LMMS **CALL 117-** Notify Mike Taber (650) 599-8033

4 QUALITY ASSURANCE

4.1 Integration shall be conducted on a formal basis to approved and released procedures. The QA office shall be notified of the start of this procedure. A Quality Assurance Rep. designated by D. Ross shall be present during this procedure and shall review any discrepancies noted and approve their disposition.

Upon completion of this procedure, the QA Program Engineer, D. Ross or her designate, nominally R. Leese, will certify her concurrence the effort was performed and accomplished in accordance with the prescribed instructions by signing and dating in the Designated place(s) in this document. Discrepancies will be recorded in a D-log or as a DR per Quality Plan P0108.

4.2 Authority to red-line (make minor changes to during execution) this procedure is given solely to the PTD or his designate and shall be approved by the QA Rep. Additionally, approval by the Hardware Manager shall be required, if in the judgement of the PTD or QA Rep. experiment functionality may be affected.

7 TEST PERSONNEL

Notify 24 hours in advance:

Safety Contact:_____ Date: _____ Time:_____

QA Contact:_____ Date: _____ Time:_____

ONR Contact:_____ Date: _____ Time:_____

5.1 Personnel Qualifications:

The test director is the designated signee for the “witnessed by” signoffs located at the end of this procedure. The person in charge of the operation is to sign the “completed by) signoff.

5.2 Qualification of Personnel:

The Test Director must have a detailed understanding of all procedures and

facility operations and experience in all of the SMD operations.

The Test Engineers must have SMD Cryogenics operations experience and an understanding of the operations and procedures used for the servicing/maintenance of the Dewar.

At present (June 2000) these personnel are qualified for this procedure:

Test Director	Mike Taber Dave Murray
Test Engineer	Tom Welsh Chris Gray Chris Boyle
Quality Engineer	Dorrene Ross Russ Leese

5.3 Critical operation Review

At the start of this procedure and before any test procedures have been initiated an operations review meeting will be held with all personnel in attendance who have been assigned or who could (on as a replacement basis) be assigned to this operation. This meeting will cover the following:

7.1.1 Manning assignments for all operations.
7.1.2 Verbal walk through of all operations.
7.1.3 Open discussion to cover all concerns and suggestions of test personnel.

8 CONFIGURATION REQUIREMENTS:

7.1 SMD and probe have no limitations as to their freedom of movement to rotate 90°.

6.2 Hardware Required:

NAME	PART NUMBER	CAPACITY	CALIBRATION DATE	REQUIRED
Hydra-set	C	10000 lbs.	7/2/00	3 ea.
Lifting fixture	8A02023GSE-A-101	10000 lbs.	None Required	1 ea.
Load cell	U42-10K-C1P1	10000 lbs.		1 ea.
Lifting cable	8A02058GSE-101	3500 lbs	No cal.	3 ea.
Torque wrench		500 ft. lbs.		1 ea.

Item	Weight lbs
Dewar total, Dry	1770.36
Probe C	448.98
Liquid Helium (50%)	330.00
TRE (2)	21.00
SRE (4)	120.00
PMS	25.00
ECU (FWD)	6.00
Lifting Ring	1280.00
Lifting Ring Hardware	267.58
Total	**4268.56**

Add to this number 300 lbs. In order to maintain positive pressure between the lifting Ring and the Pillow Block Assy.

NOTE: Lifting hardware is weighed in the "Operations Section" of this procedure. It will weigh approximately 1000 lbs. This is not included in the above total as it will be considered a tare weight.

7 Operations

Operations Number:_____
Date Initiated:_____
Time Initiated:_____

7.1 Verify Configuration

7.1.1 Well vent operator and VW-3 closed and manifold capped as per P0613, section 6.

7.1.2 Guard tank vent cap installed on GTVA per P0677.

Log Number:_____
Completion Date:_____

7.3 SV-9 closed and Main tank vent cap installed on MT vent line (short) per P0675.

Log Number:
Completion Date:

7.1.3 All electrical cables removed, except for 5 Dewar cables.

7.1.4 **Verify** all other plumbing lines and, electrical cables are removed.

7.1.5 **Verify** all loose objects are removed.

7.1.6 Physically restraint both GT and MT vent lines.

7.1.7 All decking and scaffold removed and stowed per Eng. Instruction.

7.1.8 All appropriate flooring and supports removed and stowed per Eng. Instruction.

7.1.9 Remove/verify removed both north and south turnbuckle struts.

7.2 **SET UP LIFTING HARDWARE:** (See Fig. 1)

7.2.1 Mark SMD lifting ring 90° clockwise or counterclockwise, as required, from current location at the "West" pillow block assy.
7.2.2 Specify which direction of rotation:_____ .
7.2.3 Torque Safety hoist rings (3 ea.) located on lifting ring to 60 ft. lbs.
7.2.4 Record torque:_____ft. lbs. Time:_____
7.2.5 Crane checkout complete and current. By:_____
Date:_____Time:_____
7.2.6 Safety brief for all personnel involved with this procedure.
7.2.7 Attach 10K load cell to crane. Wait for warm up period and zero load cell.
7.2.8 Attach Hydraset to load cell. Record weight:_____lbs.
QA: _____
7.2.9 Attach lifting fixture to load cell.
7.2.10 Raise lifting fixture off the floor approximately 6 inches.
7.2.11 All personnel should raise and lower the lifting fixture a few times with the Hydraset to get a feel for the controls.
7.2.12 Lower lifting fixture to the floor and repeat steps 7.2.9 through 7.2.11 with remaining Hydrasets.
7.2.13 Lower lifting fixture to floor and remove it and the Hydraset from the load cell.
7.2.14 Attach lifting fixture to load cell.
7.2.15 Raise lifting fixture off the floor and remove it's wheels.
7.2.16 Record load cell:_____ lbs. QA: _____ .
7.2.17 Install all three cables to the most outboard positions of the lifting fixture per fig.1.
7.2.18 Attach tag line to lifting fixture.
7.2.19 Raise lifting fixture and attach three Hydrasets.
7.2.20 Record 10K load cell:_____lbs. QA:_____ .
7.2.21 Raise crane to allow Hydrasets to clear obstacles and move crane to the east until centered over the SMD.
7.2.22 With one spotter for each Hydraset slowly lower the lifting fixture until the Hydrasets are able to be connected to the Safety hoist rings.
7.2.23 Begin data collection in table 1.

CAUTION:
The load cell read must be constantly monitored for any sudden changes that would affect this lifting operation.

7.2.24 Zero 10K load.
7.2.25 Attach Hydrasets to hoist rings and use crane to remove slack.
7.2.26 While holding down on Hydraset down lever, use the crane to

lower the Hydrasets to their center of travel and measure for all legs to be of the same length.

7.3 LIFT PAYLOAD AND ROTATE 90°

7.3.1 Check crane and legs for vertical alignment with SMD.
7.3.2 Simultaneously raise Hydrasets until 4568 lbs is read on the 10K load cell. Try to maintain equal weight on each of the three lower load cells. (approximately 1520 lbs.)
7.3.3 In both pillow block sets remove the outer two 1inch bolts.

CAUTION:
When removing the last 1 inch bolt from the pillow block set the SMD will be hanging from the crane and free of the test stand. Movement is possible, keep all tools and body parts clear of any potential pinch areas.

7.3.4 Alternating between the pillow block sets loosen the remaining 1 inch bolts incrementally while monitoring the load cells and clearance between the lifting ring and the pillow block spacers. Neither should move during the removal of the remaining bolts.
7.3.5 Use the Hydrasets to compensate for any movement.
7.3.6 Remove the last two 1 inch bolts being careful not to drop the backing plate and spacer blocks.
7.3.7 10K load cell reading: _____ QA:_____ .
7.3.8 Simultaneously remove the upper spacer blocks from each side.
7.3.9 **If necessary:** With 1 spotter watching the bottom of the SMD, use the crane to lower the SMD until clear of the pillow block sets.
7.3.10 Slowly rotate the payload 90° in the desired direction, and align with marks from 8.1.
7.3.11 Reinstall the upper spacer blocks.
7.3.12 Using the Hydrasets, raise the SMD until the lifting ring is in full contact with the pillow blocks and check alignment.
7.3.13 Attach lifting ring to pillow blocks using previously removed spacer blocks, backing plate and 1 inch bolts.
7.3.14 Torque 1 inch bolts to between 308 and 458 ft. lbs.
Record torque: _____ ft lbs.
Date:_____ Time: _____ QA:_____ .
7.3.15 Unload and disconnect the three Hydrasets from the lifting ring safety hoist rings.
7.3.16 Raise lifting fixture and move to west end of building.
7.3.17 Remove Hydrasets and lifting cables from lifting fixture. Stow Hydrasets into their stands.
7.3.18 Install wheels onto lifting fixture and lower to ground. Remove lifting fixture from load cell.
7.3.19 Remove load cell from crane and stow crane.

8 PROCEDURE COMPLETE

Completed by:

Witnessed by :

QA:

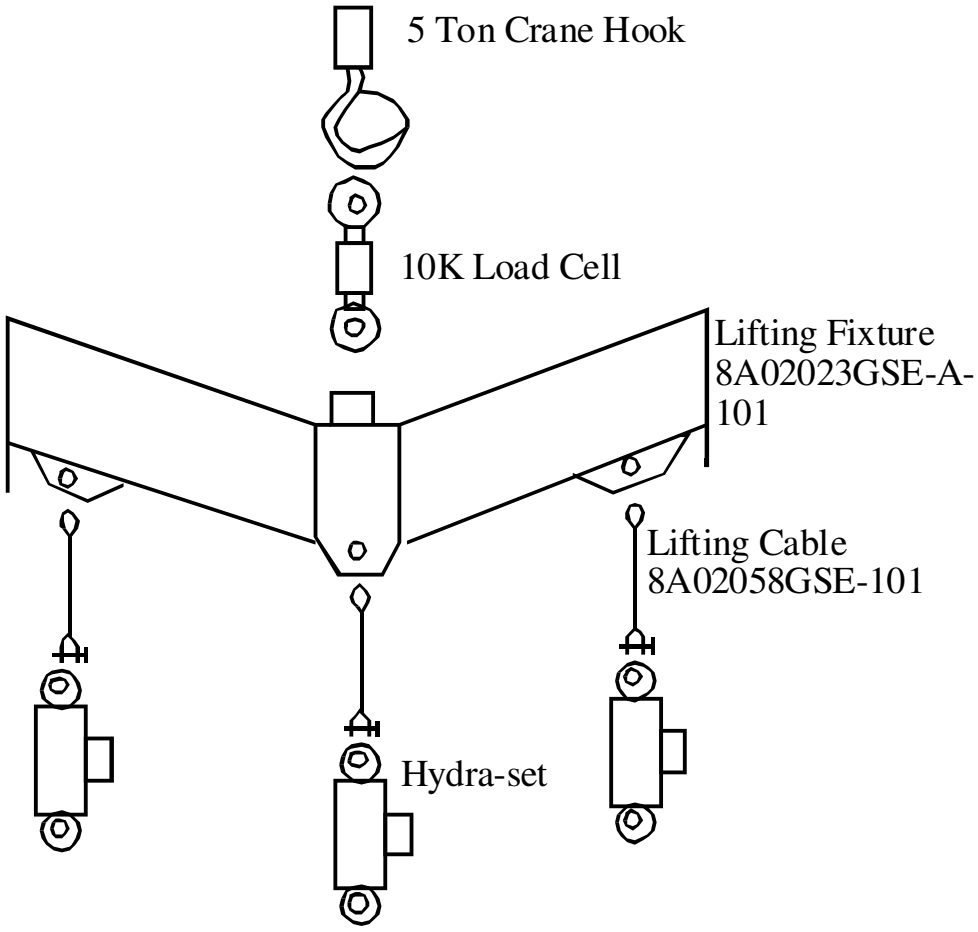
Date:

Time:

Data table 1

TIME DATE	10K LOAD CELL	COMMENTS

Figure 1


5 Ton Crane Hook
10K Load Cell
Lifting Fixture
8A02023GSE-A-
101
Lifting Cable
8A02058GSE-101
Hydra-set