STANFORD UNIVERSITY
W.W. HANSEN EXPERIMENTAL PHYSICS LABORATORY
GRAVITY PROBE B, RELATIVITY GYROSCOPE EXPERIMENT
STANFORD, CALIFORNIA 94305-4085

# (PTP) ECU TEMPORARY INSTALLATION

## GP-B PAYLOAD VERIFICATION TEST II OPERATIONS ORDER

**P0835**
6 June, 2001

| | | |
|---|---|---|
| PREPARED | H. Yengoyan/L. Yamanishi | Date |
| APPROVED | K. Pearce, Systems Test Engr. | Date |
| APPROVED | W. Bencze, Test Director | Date |
| APPROVED | D. Ross, Quality Assurance | Date |
| APPROVED | R. Brumley, Payload Technical Mgr. | Date |

## REVISION RECORD

| REVISION | ECO | PAGES | DATE |
|---|---|---|---|
| | | | |
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## 1. SCOPE

This procedure provides authority to temporarily install the Experiment Control Unit (ECU) Assembly onto the neck of the Science Mission Dewar and the installation of required flight cables to be used during Payload Verification II Phase B.

This procedure also installs the flight cables from the Forward ECU to various connection points in the payload, per connection drawing 8A02105.

**NOTE**

**Flight hardware; protect parts and assemblies to prevent magnetic contamination and physical damage.**

## 2. REFERENCE DOCUMENTS

### 2.1. Procedures

P0852 - Magnetometer temporary installation procedure.

### 2.2. Drawings

8A00631 – FWD Payload Electronics Install Drawing (GP-B), Rev. A

5856126 – Bracket, Front, FWD Elec. Mounting (GP-B), Rev. A

5856127 – Bracket, Rear, FWD Elec. Mounting (GP-B), Rev. A

8A00504- ECU To Spacecraft Interface Wiring Diag, Rev NC

8A02105- Payload Cable Interconnect & Installation, Rev NC

8A00469- ECU (W300,301,302) UV Lamp/Switch Cable Assy, Rev A

8A01959- ECU (W303) Final Filters Cable Assy, Rev A

8A00533- ECU (W303A) FEE P12A To Top Hat I2 Cable Assy, Rev A

8A01546- ECU (W309) P8 To EV 1&2 and LV1 Cable Assy, Rev D

8A01416- ECU (W309A) EV 1&2 Extension Cable Assy, Rev A

8A01547- ECU ((W310) P9 To EV 3&4 and LV2 Cable Assy, Rev D

8A01417-ECU (W310A) EV 3&4 Extension Cable Assy, Rev A

8A00543-ECU (W311) A Aft To Fwd Cable Assy, Rev B

8A00548-ECU (W312) B Aft To Fwd Cable Assy, Rev B

8A01548-ECU (W314) Magnetometer 1&3 Cable Assy, Rev A

8A01549-ECU (W315) Magnetometer 2&4 Cable Assy, Rev A

8A01550-ECU (W316) Support Ring & Vacuum Gauge Cable Assy, Rev A

8A01268-ECU (W350) J9 to J802 & FEE J805A Cable Assy, Rev A

8A01418-ECU (W351) J10 To J805 & FEE J802A Cable Assy, Rev A

**2.2 DRAWINGS (Cont'd)**

8A01315-ECU (W352) Dewar J801 Cable Assy, Rev A

8A01291-ECU (W354) J7 To Top Hat I7 Cable Assy, Rev B

8A01289-ECU (W355) J5 To Top Hat I5 Cable Assy, Rev B

8A00532-ECU (W356) J1 To Top Hat I1 Cable Assy, Rev B

8A01318-ECU (W357) J3 To Top Hat I3, SRE A&B J4 Cable Assy, Rev A

8A01290-ECU (W358) J6 To Top Hat I6 Cable Assy, Rev B

8A01962-ECU (W608) P9 Pressure Sensor Cable Assy, Rev A

**2.3. FIGURES**

Not applicable

**2.4. SUPPORTING DOCUMENTATION**

GP-B Magnetic Control Plan, LMMS-5835031

GP-B (FIST) Preliminary Hazards Analysis, LMMS-F314446

GP-B (FIST) Safety Plan, LMMS- F314447

FIST Emergency Procedures SU/GP-B P0141

# 3. GENERAL REQUIREMENTS

## 3.1 Quality Assurance

Integration shall be conducted on a formal basis to approved and released procedures. Safety, ONR and the QA program office shall be notified 24 hours before the start of this procedure. A Quality Assurance Representative, designated by D. Ross shall be present during the 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 that 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.

## 3.2 Red-line Authority

Authority to red-line (make minor changes during execution) this procedure is given solely to the Test Director or his designate and shall be approved by the QA Representative. Additionally, approval by the Payload Technical Manager shall be required, if in the judgment of the Test Director or QA Representative, experiment functionality may be affected.

## 3.3 Personnel

The following personnel are qualified to perform this procedure:

- Haig Yengoyan
- Tom Welsh
- Mike Taber
- Dave Murray
- Bob Farley
- Lou Yamanishi
- Larry Catanzano
- Bud Swihart
- John Thatcher
- Dave Meriwether
- Bill Bencze
- Terry McGinnis
- Jim Lockhart

See section 3.1 for details on which Quality Assurance personnel are required to be notified and/or witness this procedure.

## 3.4 Safety

**In case of any injuries obtain medical treatment at:**

Stanford University **Call 9-911**

## 4. CONFIGURATION REQUIREMENTS:

**4.1** SMD mounted vertically in the SMD test stand with the work platforms and scaffolding attached. The forward electrical mounting brackets are already installed on the neck of the SMD.

## 5. HARDWARE REQUIREMENTS

The Dewar, ECU and accompanying build hardware are very delicate. Be sure to handle them with care so that they do not become damaged.

**NOTE**
**Take all necessary precautions not to let anything physically damage the ECU and Science Mission Dewar or particulate onto its surfaces.**

### 5.1 Hardware Required:

| | |
|---|---|
| Qt. 1 | 8A00841-101 ECU Assembly |
| Qt. 8 | NAS1351N3-12 or equivalent, 10-32 SHCS, A-286, 3/4" long |
| Qt. 8 | NAS620C10 or equivalent, #10 Flat Washer, CRES |
| Qt. 1 | Torque wrench 10-120 in-lbs. |
| Qt. 1 | Torque wrench 2.5-25 in-lbs |
| Qt. 1 | Mili Ohm meter |
| Qt. AR | Hand tools (Allen wrenches, screw drivers, etc.) |

## 6. VERIFICATION REQUIREMENTS

No requirements are being verified during this procedure.

## 7. OPERATIONS:

Operator _____

Date Initiated_____

Time Initiated_____

## 8. NOTIFICATION

### 8.1 Safety Notification

Safety shall be notified 24 hours in advance prior to the start of any work performed. Record who was contacted, the date, and time below.

Contact: _____
Date and Time: _____

### 8.2 Quality Assurance Notification

The Test Director is to notify the Quality Engineer 24 hours in advance prior to the start of any work performed. Record who was contacted, the date, and time below.

Contact: _____
Date and Time: _____

### 8.3 ONR Notification

Quality Engineer to notify ONR 24 hours in advance prior to the start of any work performed. Record who was contacted, the date, and time below.

Contact: _____
Date and Time: _____

## 9. INSTALLING THE ECU UNIT

### 9.1 Mounting the ECU Unit

**CAUTION**

**The ECU Unit is ESD Sensitive. Use grounding wrist straps for ESD protection when handling the unit or installing associated hardware.**

9.1.1 Locate the set of brackets on the Dewar neck that will hold the ECU Unit. Refer to sheet 3 of the 8A00631 drawing for the location. Wipe off the brackets and ECU mounting tabs with isopropyl alcohol.

9.1.2 Verify the orientation of the ECU unit onto the Dewar brackets. The ECU unit must have the J1, J3, J5, and J6 connectors pointing up toward the sunshade.

9.1.3 Lift the ECU unit onto the Dewar brackets oriented in the correct position and hold it against the brackets.

9.1.4 While one person is holding the ECU in place, the other person will attach the 8 each 10-32 x .75" long socket head cap screws and 8 each #10 flat washers. Make sure to place the rolled edge of the washer against the ECU so that the mounting tabs will not be marred. Tighten the screws hand tight.

9.1.5 Verify that there is one flat washer under each socket head cap screw.

9.1.6 After all the fasteners are installed on the ECU, torque the eight 10-32 screws per Note 3 of the 8A00631 drawing to 35 to 45 inch-pounds.

Torque Wrench Asset Number _____
Calibration Due Date _____
Final Torque Value _____

9.1.7 Product Assurance to witness torque.

QA Witness _____

9.1.8 Verify that all screws were torqued and the ECU unit is correctly oriented.

9.1.9 After the ECU unit is installed, measure the electrical resistance between the ECU unit and the 5856126 & 5856127 mounting brackets per Note 4 of the 8A00631 drawing. The resistance is to be less than 0.0025 Ohms. Record the data below.

Ohm Meter Asset Number _____
Calibration Due Date _____
ECU unit to mounting bracket_____ Ω

9.1.10 Product Assurance to witness measurement.

QA Witness _____

**10. PROCEDURE COMPLETED**

The results obtained in the performance of this procedure are acceptable:

Test Engineer _____ Date _____

Payload Test Dir. _____ Date _____

Discrepancies if any (see attached d-log)

The information obtained under this assembly and test procedure is as represented and the documentation is complete and correct:

Integration Manager _____ Date _____

QA Manager _____ Date _____

## 11. FLIGHT CABLE INSTALLATION

**Note 1:** Routing and tie-down of flight cables shall be determined at time of assembly. Cables may be secured with tie-wraps to dewar structure, scaffolding, test stand cable mount blocks as appropriate.

**Note 2:** Every effort should be made to protect the flight cables and route them away from foot traffic or areas where equipment may be moved.

**Note 3:** Prior to installation, the cables may be sheathed in anti-static plastic sleeving as required as an additional abrasion and contamination control precaution.

**11.1** Verify GSE power, HLD's and TLM to Aft ECU per Aft ECU Wiring Diagram 8A00504.

11.1.1 Product Assurance to verify
QA Verification _____

**11.2** Install ECU Aft to Fwd Cables PN 8A0543-101 (W311) and PN 8A00548 -101 (W312)

11.2.1 W311 Cable - Mate 2A117P1 to Aft ECU J1. Mate 1A06P11 & 1A06P12 To Fwd ECU J11 & J12 respectively.

11.2.2 W312 Cable – Mate 2A117P2 to Aft ECU J2. Mate 1A06P13 & 1A06P14 To Fwd ECU J13 & J14 respectively.

11.2.3 Torque backshell fasteners to 3.5 – 4.5 inch pounds.

Torque Wrench Asset Number _____
Calibration Due Date _____
Final Torque Value _____

11.2.4 Product Assurance to witness torque.

QA Witness _____

**11.3** Install Fwd ECU to Top Hat I1 cable PN 8A0532-101 (W356) and Fwd ECU to Top Hat I3 cable PN 8A01318-101 (W357).

11.3.1 W356 Cable – Mate P1 to Fwd ECU J1 and PI1 to Top Hat feedthru I1.

11.3.2 W357 Cable – Mate P3 to Fwd ECU J3 and P13 to Top Hat feedthru I3 (1A08P4 & 1A09P4 not connected at this time)

11.3.3 Torque backshell fasteners to Fwd ECU to 3.5 – 4.5 inch pounds.

Torque Wrench Asset Number _____
Calibration Due Date _____
Final Torque Value _____

11.3.4 Product Assurance to witness torque.

QA Witness _____

11.3.5 After test completion, demate W356 PI1 and W357 PI3 form Top Hat feedthrus I1 & I3 and mate GSE cable connectors per engineering instructions.

**11.4** Install Aft ECU to FEE base plate cable PN 8A01959-101 (W303) and FEE base plate to Top Hat I2 cable PN 8A00533-101 (W303A).

11.4.1 Mate W303 connector 5A01P12A to W303A J12A.
Perform continuity checks per W303 & W303A wiring diagrams.

11.4.2 Product Assurance to verify continuity.

QA Verification _____

11.4.3 W303 cable – Mate 2A117P30 & 2A117P31 to corresponding Aft ECU Box connectors J30 & J31.

11.4.4 W303A cable – Mate PI2 to Top Hat feedthru I2.

11.4.5 Torque backshells to Aft ECU J30 & J31 to 3.5 – 4.5 inch pounds.

Torque Wrench Asset Number _____
Calibration Due Date _____
Final Torque Value _____

11.4.6 Product Assurance to witness torque

QA to Witness _____

11.4.7 After test completion, demate W303A P12 from Top Hat feedthru I2 and mate GSE cable per engineering instruction.

**11.5** Install Fwd ECU J5 to Top Hat feedthru I5 cable PN 8A01289-101 (W355)

11.5.1 Mate W355 connector P5 to Fwd ECU J5
Mate W355 connector P15 to Top Hat feedthru I5.

11.5.2 Torque backshell fasteners to Fwd ECU J5 to 3.5 – 4.5 inch pounds

Torque Wrench Asset Number _____
Calibration Due Date _____
Final Torque Value _____

11.5.3 Product Assurance to witness torque.

QA to Witness _____

11.5.4 After test completion, demate W355 PI5 from Top Hat feedthru I6 and mate GSE cable per engineering instructions.

**11.6** Install Fwd ECU J6 to Top Hat feedthru I6 cable 8A01290 (W358)

11.6.1 Mate W358 connector P6 to Fwd ECU J6
Mate W358 connector PI6 to Top Hat feedthru I6

11.6.2 Torque backshell fasteners to Fwd ECU J6 to 3.5 – 4.5 inch pounds.

Torque Wrench Asset Number _____
Calibration Due Date _____
Final Torque Value _____

11.6.3 Product Assurance to witness torque

QA witness _____

11.6.4 Demate PI6 after test and mate GSE cable to Top Hat I6 per engineering Instructions.

**11.7** Install Fwd ECU J7 to Top Hat feedthru I7 cable PN 8A01291-101 (W354)

11.7.1 Mate W354 connector P7 to Fwd ECU J7.
Mate W354 connector PI7 to Top Hat feedthru I7.

11.3.2 Torque backshell fasteners to Fwd ECU J7 to 3.5 – 4.5 inch pounds.

Torque Wrench Asset Number _____
Calibration Due Date _____
Final Torque Value _____

11.7.3 Product Assurance to witness torque

QA witness _____

11.7.4 Demate PI7 after test and mate GSE cable to Top Hat I7 per engineering Instructions.

**11.8** Install Fwd ECU J10 to SD Temp Sensor J805 cable PN 8A01418-101 (W351)

11.8.1 Mate W351 connector P10 to Fwd ECU J10
Mate W351 connector P805 to SD Temperature Sensor J805

11.8.2 Torque backshell fasteners to Fwd ECU J7 to 3.5 – 4.5 inch pounds.

Torque Wrench Asset Number _____
Calibration Due Date _____
Final Torque Value _____

11.8.3 Product Assurance to witness torque

QA witness _____

11.8.4 Demate W351 P10 after test and mate GSE cable to Temp Sensor J805 per engineering instructions.

**11.9** Install Aft ECU J10 to Magnetometer 1 & 3 cable PN 8A01548-101 (W314) (See P0852)

11.9.1 Mate W314 connector 2A117P10 to Aft ECU J10
Route and tie down cables with tie wraps to tie blocks provided on magnetometer test table.
Mate W314 connector 4A00P1 to Mag 1 and 4A02P1 to Mag 3.
*Remove mounting screw and retainer bracket from Mag 1 & 2 backshells before mating.*

11.9.2 Torque backshell fasteners to Aft ECU J10 to 3.5 – 4.5 inch pounds.

Torque Wrench Asset Number _____
Calibration Due Date _____
Final Torque Value _____

11.9.3 Product Assurance to witness torque

QA witness _____

**11.10** Install Aft ECU J11 to Magnetometer 2 & 4 cable PN 8A01549-101 (W315) (See P0852)

11.10.1 Mate W315 connector 2A117P11 to Aft ECU J11
Route and tie down cables with tie wraps to tie blocks provided on magnetometer test table.

Mate W314 connector 4A01P1 to Mag 2 and 4A03P1 to Mag 4.
*Remove mounting screw and retainer bracket from Mag 2 & 4 backshells before mating.*

11.10.2 Torque backshell fasteners to Aft ECU J11 to 3.5 – 4.5 inch pounds.

Torque Wrench Asset Number _____
Calibration Due Date _____
Final Torque Value _____

11.10.3 Product Assurance to witness torque

QA witness _____

**11.11** Install Fwd ECU J8 to Top Plate J801 cable PN 8A01315-101 (W352)

11.11.1 Mate W352 connector P8 to Fwd ECU J8.
Mate W352 connector P801 to Top Plate J801.

11.11.2 Torque backshell fasteners to Fwd ECU J8 to 3.5 – 4.5 inch pounds.

Torque Wrench Asset Number _____
Calibration Due Date _____
Final Torque Value _____

11.11.3 Product Assurance to witness torque

QA witness _____

11.11.4 After test completion, demate P801 and mate GSE cable per engineering instructions.

**11.12** Install Fwd ECU J9 to Top Plate J802 cable PN 8A01268-101 (W350).

11.12.1 Mate W350 connector P9 to Fwd ECU J9
Mate W350 connector P802 to Top Plate J802

11.12.2 Torque backshell fasteners to Fwd ECU J8 to 3.5 – 4.5 inch pounds.

Torque Wrench Asset Number _____
Calibration Due Date _____
Final Torque Value _____

11.12.3 Product Assurance to witness torque

QA witness _____

11.12.4 After test completion demate W350 P9 from Top Plate and mate GSE cable per engineering instructions.

**11.13** Install Aft ECU J3 to FEE base plate cable PN 8A01550-101 (W316) and FEE J9B to Plumbing Pallet J9A PN 8A01962-101 (W608).

11.13.1 Mate W608 J9B to W316 P9B.
Perform continuity checks per W608 & W316 wiring diagrams.

11.13.2 Product Assurance to verify continuity.

QA verify _____

11.13.3 Mate W316 2A117P3 to Aft ECU J3. W316 P9D & P814 not connected at this time.
Mate W608 P9A to Plumbing Pallet P9.

11.13.4 Torque backshell fasteners to Aft ECU J3 to 3.5 – 4.5 inch pounds.

Torque Wrench Asset Number _____
Calibration Due Date _____
Final Torque Value _____

11.13.5 Product Assurance to witness torque

QA witness _____

11.13.6 After test completion, demate W608 P9A from Top Plate and mate GSE cable per engineering instructions.

**11.14** Demate GSE cables and remate flight cables to Dewar and Probe Per P540 (K6.1).

**11.15** Install Aft ECU J8 to LV1 & FEE J2 cable PN 8A01546-101 (W309) and FEE J2 to EV1 & EV2 cable PN 8A01416-101 (W309A).

11.15.1 Mate W309 5A01P2 to W309A J2. Install arming plug PN 8A00542-101 P19 and perform continuity checks per W309 and W309A wiring diagrams.

11.15.2 Product Assurance to verify continuity.

QA Verification _____

11.15.3 Mate W309 P8 to Aft ECU J8, W309 P1 to LV1 J1 mtr drive, W309 P3 to LV1 htr J3, W309A P1 to EV1 mtr drive, W309A P3 to EV1 htr J3, W309A P4 to EV2 J4 mtr drive and W309A P5 to EV2 J5 htr.

11.15.4 Torque backshell fastenters to Aft ECU J8, LV1 J1 & J3, EV1 J1 & J3 and EV2 J4 & J5.

Torque Wrench Asset Number _____
Calibration Due Date _____
Final Torque Value _____

11.15.5 Product Assurance to witness torque

QA to Witness _____

**11.16** Install Aft ECU J9 to LV2 & FEE J3 cable PN 8A01547-101 (W310) and FEE J3 to EV3 & EV4 cable PN 8A01417-101 (W310A).

11.16.1 Mate W310 5A01P3 to W310A J3. Install arming plug PN 8A00542-102 P20 and perform continuity checks per W310 and W310A wiring diagrams.

11.16.2 Product Assurance to verify continuity.

QA Verification _____

11.16.3 Mate W310 P9 to Aft ECU J9, W310 P1 to LV2 mtr drive P1, W310 J1 to LV2 htr J2, W310A P1 to EV3 mtr drive, W310A P2 to EV3 htr, W310A P4 to EV4 mtr drive and W310A P5 to EV4 htr.

11.16.4 Torque backshell fastenters to Aft ECU J8, LV1 J1 & J2, EV1 J1 & J3 and EV2 J4 & J5

Torque Wrench Asset Number _____
Calibration Due Date _____
Final Torque Value _____

11.16.5 Product Assurance to witness torque

QA to Witness _____

**11.17** Install fiber optic cables PN 8A00469-101 (W300), 8A00469-102 (W301) 8A00469-103 (W302)

11.17.1 Carefully clean fiber optic wire ends per engineering direction prior to mating of connectors.

11.17.2 Mate W300 L1 thru L4 to corresponding Top Hat feedthru connectors UVPM-1 thru 4 located at 204 degrees. Mate F1 thru F4 to corresponding Aft ECU box connectors. Torque F1 thru F4 finger tight.

11.17.3 Mate W301 L1 thru L4 to corresponding Top Hat feedthru connectors UV34-1 thru 4 located at 216 degrees. Mate F5 thru F8 to corresponding Aft ECU box connectors. Torque F5 thru F8 finger tight.

11.17.4 Mate W302 L1 thru L4 to corresponding Top Hat feedthru connectors UV12-1 thru 4 located at 312 degrees. Mate F9 thru F12 to corresponding Aft ECU box connectors. Torque F9 thru F12 finger tight.

**11.18** Remove flight cables after completion of tests and package for shipment to LMMS Bldg. 205.

## 12. PROCEDURE COMPLETED

The results obtained in the performance of this procedure are acceptable:

Test Engineer _____ Date _____

Payload Test Dir. _____ Date _____

Discrepancies if any:

The information obtained under this assembly and test procedure is as represented and the documentation is complete and correct:

Integration Manager _____ Date _____

QA Manager _____ Date _____