GRAVITY PROBE B

PROCEDURE FOR

PAYLOAD VERIFICATION

(PTP) UV CABLE TO AFT ECU DEMATE/MATE

To be performed at Vandenberg Air Force Base building 1610

P1075 Rev A

THIS DOCUMENT CONTAINS NON HAZARDOUS OPERATIONS

11 December 2003

Prepared by: *B. Clarke*

Approvals:

Program Responsibility	Signature	Date
B. Clarke Charge Control REE		
R. Brumley Payload Technical Manager		
B. Bencze Payload Electronics Manager		
D. Ross GP-B Quality Assurance		

NOTES:

Level of QA required during performance of this procedure:

____Stanford QA Representative

____Government QA Representative

All redlines must be approved by QA

Revision Record:

Rev	Rev Date	ECO #	Summary Description
-	11/26/2003	N/A	Original revision.
A	12/12/2003	1463	1. Added alcohol usage warning prior to steps L.1.9 and L.1.15 per K-EC-0001.9, Kennedy Space Center Safety and Mission Assurance Off-Site Safety Requirements Document for VAFB, CA. 2. Update Table D.5 – Expendables with correct quantities per P1075 as run 12/8/2003 (OP# 2166). 3. Update Table L.1.1 with correct fiber labeling per P1075 as run 12/8/2003 (OP# 2166). 4. Update steps L.1.5, L.1.6 and L.1.17 to include an alternate description of the fiber optic SMA connector. Add the term “floating round knurled nut”.

Acronyms and Abbreviations:

Acronym / Abbreviation	**Meaning**
ECU	Experiment control unit
ESD	Electrostatic discharge
ONR	Office of Naval Research
QA	Quality assurance
SMA	Standard military adapter
UV	Ultra violet

Table of Contents

A Scope

This procedure details the demating and/or mating of the flight UV cables to the AFT ECU.

B Requirements Verification

No requirements are verified using this procedure.

C Configuration Requirements

C.1 The UV fiber optic connection at the AFT ECU must be accessible.

C.2 The stain relief on the UV cables near the AFT ECU must be such that the mate/demate may be performed without exceeding the minimum bend radius for the fiber optics and without over stressing the connector. The minimum bend radius for this cable is 6".

D Hardware Required

D.1 Flight hardware required

Description	No. Req'd
GP-B spacecraft and payload	1
Fiber optic cables, P/N 8A00649-103, Rev A – S/N W300, W301, W302	3

D.2 Commercial test equipment

Manufacturer	Model	Serial Number	Calibr. Exp. Date
N/A			

D.3 Mechanical/Electrical Special test equipment

Description	Part No.	Rev. no.	Serial No.	Certification Date
N/A				

D.4 Tools

Description	No. Req'd
5X optical visor	1
Fiber optic inspection microscope	1
Stainless steel tweezers	1
Pick	1
Scalpel	1
5/16" open end wrench	1
Small locking pliers	1

D.5 Expendables

Description	Quantity
Reagent grade isopropyl alcohol	N/A, on hand
Filtered compressed air	N/A, on hand
Lint free wipes and swabs	N/A, on hand
Kapton tape (or suitable low residue cleanroom tape)	N/A, on hand
Clean latex gloves	N/A, on hand
Small clean nylon bag (demating only)	12
Clean plastic cap (pin) (demating only)	12
Clean plastic cap (socket) (demating only)	12
Clean Delrin alignment sleeve (mating only)	12

E Software Required

E.1 Flight Software

Flight Software Name	Version No.
N/A	

E.2 CSTOL Scripts

CSTOL Script Name	Version No.
N/A	

E.3 SPC Scripts

SPC Script Name	Version No.
N/A	

E.4 Test Support Software

Test Software Name	Version No.
N/A	

F Procedures Required

Procedure Name	Procedure No.
GP-B Maintenance and Testing at All Facilities	P0875
PROBE C CABLE CONNECTOR INTERFACE	LMMS drawing 1C34103, Rev D

G Equipment Pretest Requirements

Equipment	Serial No.	Test Required	Proc. No.	Test Performed	
				Date	By
N/A					

H Personnel Requirements

H.1 Test Lead

The Test Lead has overall responsibility for the implementation of this procedure. The Test Lead will perform Pre-Test and Post-Test Briefings in accordance with P0875 "GP-B Maintenance and Testing at all Facilities" Checklists will be used as directed by P0875.

H.2 Other Personnel

All personnel participating in this procedure shall work under the direction of the Test Lead who shall determine whether the person is qualified.

A qualified POD operator shall operate the spacecraft POD if needed.

The QA program office shall be notified prior to the start of this procedure. A Quality Assurance Representative shall review any discrepancy noted during this procedure, and approve its disposition.

Quality Assurance shall be notified at least 24 hours prior to the start of this procedure.

I Safety Requirements

I.1 General

Extreme care must be taken to avoid accidentally bumping the space vehicle or damaging the connectors. Connector savers or equivalent adapters shall be used to protect the connector pins from damage during any measurements. A properly grounded ESD wrist strap must be worn while mating to or de-mating electrical connections from Probe connectors.

All mate/demates involving flight connectors shall be logged.

I.2 Fiber Optics

The fiber optic cables are very fragile. Use care when mating and demating fiber optic connectors as not to break the optical fiber or scratch the polished optical surface at the end of the connectors. All fiber optic connectors must be rinsed with alcohol (isopropyl or ethyl), dried with filtered air and inspected using a 5X optical visor and/or a fiber optic inspection microscope prior to mating to ensure there is no contamination on the optical surfaces.

I.3 UV Lamps

Ozone is produced when running the UV lamps in an oxygen environment. The amount of ozone that can be produced by these UV lamps is potentially a mild hazard to both hardware and personnel. In order to mitigate ozone production, the UV section of the ECU should be purged with dry filtered nitrogen gas while the UV lamps are powered on.

J General Instructions

J.1 Redline Authority

Authority to redline this procedure is given solely to the Test Lead with mandatory concurrence form the QA representative. QA concurrence is required before final review/buyoff (on last page) of the completion of the activity described in this procedure.

J.2 Test Anomaly or Discrepancy

Any nonconformance or test anomaly will be recorded in a D-log or as a Discrepancy Report per Quality Plan P0108. Do not alter or break test configuration if a test failure occurs; notify quality assurance.

Upon completion of this procedure, the QA Program Engineer will certify 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.

J.3 Test Exit and Re-test Authority

Only the following persons have the authority to exit/terminate this test or perform a retest:

Test Lead

QA

K References and Applicable Documents

P0108 Quality Plan

P0875 GP-B Maintenance and Testing at all Facilities

Test started. Date:

Time:

L OPERATIONS

L.1 ECU FIBER OPTIC DEMATE/MATE

SECTION STARTED _____ AT _____
DATE TIME

SIGNED: _____ PRINT NAME: _____
TEST LEAD

SIGNED: _____ PRINT NAME: _____
QA REPRESENTATIVE

L.1.1 A single run of this procedure may be used for either mating or demating the UV fiber optics to the AFT ECU. This run of the procedure performs a (circle one)

DEMATE MATE

Complete the appropriate section below.

DEMATE

L.1.2 Use gloved hands when handling the fiber optic connectors in order to keep the optical surfaces oil and particle free.

L.1.3 Before demating, verify the fiber optic cable assignment at the AFT ECU interface is per Table L.1.1. Columns ECU and CABLE/FIBER should agree.

L.1.4 This interface uses style 906 stainless steel fiber optic SMA connectors. The pins are on the cable end and the sockets are mounted through the ECU bulkhead.

L.1.5 If the connectors have been staked, carefully remove enough staking material using a pick or scalpel such that the 5/16" floating hex nut or floating round knurled nut can rotate freely about the pin once it is broken free of the staking material on the ¼" - 40 threaded bulkhead connector.

QUALITY_____

L.1.6 To remove the connector, loosen and unscrew the floating hex nut or floating round knurled nut while pulling straight out on the pin. When loosening and unscrewing the floating hex nut or floating round knurled nut it is important to minimize the rotation of the pin with respect to the socket in order limit the scratching of the optical surfaces within the connector.

QUALITY_____

L.1.7 Cover the socket with a clean plastic cap.

L.1.8 For the cables corresponding to a gyro (see Table L.1.1) there is a Delrin alignment sleeve that may come out with the pin. If it comes out with the pin, carefully remove it from the pin using the stainless steel tweezers and save in a clean nylon bag.

QUALITY_____

WARNING:
Alcohols are flammable and vapor/air mixtures may be explosive. Exposure hazards include skin and eye contact and inhalation. Ingestion can be toxic.

L.1.9 Using the fiber optic inspection microscope, examine the optical surface in the pin and note the condition in table L.1.2. If there appears to be particulate contamination present it may be washed with isopropyl alcohol, dried with a lint free wipe and filtered air then re-inspected.

QUALITY_____

L.1.10 Cover the pin with a clean plastic cap and bag the connector with a small nylon bag held on with Kapton or other clean room approved tape.

QUALITY_____

L.1.11 After all the connectors have been demated, inspected and covered they may be stowed by ganging the cables together, wrapping in styrene padding or other suitable shock resistant material and lashing loosely to the spacecraft frame using Kapton tape or other clean room approved tape. Strain relief is at the discretion of the test lead.

QUALITY_____

MATE

L.1.12 Use gloved hands when handling the fiber optic connectors in order to keep the optical surfaces oil and particle free.

L.1.13 This interface uses style 906 stainless steel fiber optic SMA connectors. The pins are on the cable end and the sockets are mounted through the ECU bulkhead.

L.1.14 Remove the plastic caps from the ECU bulkhead (sockets) and the cable (pins).

WARNING:
Alcohols are flammable and vapor/air mixtures may be explosive. Exposure hazards include skin and eye contact and inhalation. Ingestion can be toxic.

L.1.15 Inspect the optical surface in the pins using the fiber optic inspection microscope and note the condition in table L.1.2. If there appears to be particulate contamination present it may be washed with isopropyl alcohol, dried with a lint free wipe and filtered air then re-inspected.

QUALITY_____

L.1.16 Inspect the socket using the 5x optical visor and note the condition in table L.1.3. Chase the ¼" - 40 threads of the socket using a stainless steel nut with the proper threads to make certain any residue of staking compound from a previous mate will not impede connector mating. Note there are mating connectors on the back side of the sockets (inside the ECU) only for the connections with a UV switch assigned to them. If there appears to be particulate contamination present it may be washed with isopropyl alcohol and dried with filtered air then re-inspected.

QUALITY_____

L.1.17 Mate the pins to the sockets per table L.1.1. On all connections that have a UV switch assigned to them, place the Delrin alignment sleeve on the pin prior to inserting in the socket. Push the pin straight in while tightening the 5/16" nut or floating round knurled nut until the pin is seated hand tight. Care should be taken to minimize the rotation of the pin relative to the socket during this process in order to minimize scratching of the optical surfaces within the connector. Acceptable seating is indicated by lack of radial movement (less than 1mm) of the pin under moderate force (~6-8 oz.) applied in the radial direction near the back of the pin.

QUALITY_____

SECTION COMPLETED _____ AT _____
DATE TIME

SIGNED: _____ PRINT NAME: _____
TEST LEAD

SIGNED: _____ PRINT NAME: _____
QA REPRESENTATIVE

TABLE L.1.1 – UV FIBER OPTIC CABLE ASSIGNMENTS

Per P0888 Rev – as run 4/9/02 (OP#1885) and 5/14/02 (OP# 1891)
Redline changes to the original assignments per P0888 Rev- are reflected below in the ECU F9 and ECU F11 cable assignments. Changes are due to fiber breakage on original assembly and documented in the as run procedures listed above and in Lockheed DR# R74662.

Drawing(s) affected by redlines:
LMMS drawing 1C34103, Rev D - PROBE C CABLE CONNECTOR INTERFACE

UV Switch	ECU	CABLE/FIBER-FIBER	TOP HAT	GYRO	FIXTURE
N/A	ECU F1	W300/L1-F1P1	PMI	N/A	N/A
N/A	ECU F2	W300/L2-F2P1	PMII	N/A	N/A
N/A	ECU F3	W300/L3-F3P1	PMIII	N/A	N/A
1a	ECU F4	W300/L4-F4P1	PMIIII	1	A
3a	ECU F5	W301/L1-F5P1	UV34I	3	A
3b	ECU F6	W301/L2-F6P1	UV34II	3	B
4a	ECU F7	W301/L3-F7P1	UV34III	4	A
4b	ECU F8	W301/L4-F8P1	UV34IIII	4	B
N/A	ECU F9	W302/L3-F11P1	UV12I	N/A	N/A
1b	ECU F10	W302/L2-F10P1	UV12II	1	B
2b	ECU F11	W302/L1-F9P1	UV12III	2	B
2a	ECU F12	W302/L4-F12P1	UV12IIII	2	A

TABLE L.1.2 – UV FIBER OPTIC CABLE INSPECTION

CABLE/FIBER	CONDITION
W300/L1	
W300/L2	
W300/L3	
W300/L4	
W301/L1	
W301/L2	
W301/L3	
W301/L4	
W302/L3	
W302/L2	
W302/L1	
W302/L4	

TABLE L.1.3 – ECU UV FIBER OPTIC CONNECTION (SOCKETS) INSPECTION

ECU SOCKET	CONDITION
ECU F1	
ECU F2	
ECU F3	
ECU F4	
ECU F5	
ECU F6	
ECU F7	
ECU F8	
ECU F9	
ECU F10	
ECU F11	
ECU F12	

L.2 PROCEDURE COMPLETION

L.2.3 At test completion, the following any raw data files collected during the implementation of this procedure shall be archived on the Payload Server:

Server path: _____

L.2.4 The original 'As-Built' hard copy of this document shall be kept as part of:

_____

SECTION COMPLETED _____ AT _____
DATE TIME

SIGNED: _____ PRINT NAME: _____
TEST LEAD

SIGNED:_____ PRINT NAME: _____
QA REPRESENTATIVE

Test completed.

Completed by: _____
Witnessed by: _____
Date: _____
Time: _____

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

Test Engineer(s)

SIGNED: _____PRINT:_____ DATE:_____

SIGNED: _____PRINT:_____ DATE:_____

SIGNED: _____PRINT:_____ DATE:_____

Test Lead

SIGNED: _____PRINT:_____ DATE:_____

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

Payload Test Director

SIGNED: _____PRINT:_____ DATE:_____

QA Representative

SIGNED: _____PRINT:_____ DATE:_____

Program QA Engineer

SIGNED: _____PRINT:_____ DATE:_____

Appendix 1 – Pre-Procedure Checklist

DATE	CHECKLIST ITEM	COMPLETED	REMARKS
	1. Verify the test procedure being used is the latest revision.		
	2. Verify all critical items in the test are identified and discussed with the test team.		
	3. Verify all required materials and tools are available in the test area.		
	4. Verify all hazardous materials involved in the test are identified to the test team.		
	5. Verify all hazardous steps to be performed are identified to the test team.		
	6. Verify each team member knows their individual responsibilities.		
	7. CONFIRM THAT EACH TEST TEAM MEMBER CLEARLY UNDERSTANDS THAT HE/SHE HAS THE AUTHORITY TO STOP THE TEST IF AN ITEM IN THE PROCEDURE IS NOT CLEAR.		
	8. Confirm that each test team member clearly understands that he/she must stop the test if there is any anomaly or suspected anomaly.		
	9. NOTIFY MANAGEMENT OF ALL DISCREPANCY REPORTS OR D-LOG ITEMS IDENTIFIED DURING PROCEDURE PERFORMANCE. IN THE EVENT AN INCIDENT OR MAJOR DISCREPANCY OCCURS DURING PROCEDURE PERFORMANCE MANAGEMENT WILL BE NOTIFIED IMMEDIATELY.		
	10. Confirm that each test team member understands that there will be a post-test team meeting.		
	Team Lead Signature: _____		

Appendix 2 – Post-Procedure Checklist

DATE	CHECKLIST ITEM	COMPLETED	REMARKS
	1. Verify all steps in the procedure were successfully completed.		
	2. Verify all anomalies discovered during testing are properly documented.		
	3. Ensure management has been notified of all major or minor discrepancies.		
	4. Ensure that all steps that were not required to be performed are properly identified.		
	5. If applicable sign-off test completion.		
	6. Verify all RAV valve operations have been entered in log book		
	7. Verify the as-run copy of procedure has been filed in the appropriate binder		
	Team Lead Signature: _____		

Appendix 3– Contingency Responses

	Condition	Circumstance	Response
1	Power Failure	Any time	Wait for power restoration and restore valve status
2	Burst disk rupture (MT/GT)	Any time	Evacuate room
3	Oxygen depletion alarm	Any time	Evacuate room