GRAVITY PROBE B

PROCEDURE FOR

GMA OPERATION

(PTP) CONNECTING AND DISCONNECTING THE FLIGHT GMA TO THE ECU

Procedure No. P*0946 Rev. -*

1/24/10

Prepared by: *D. Meriwether*

Approvals:

Program Responsibility	Signature	Date
D. Meriwether Test Author		
C. Gray GMA REE		
R. Brumley Payload Technical Manager		
R. Pressberg GP-B Quality Assurance		

NOTES:

Level of QA required during performance of this procedure:
_X_ Stanford QA Representative
___ Government QA Representative

1) The Flight GMA has no valve state indicators.
2) The E-Mock GMA has valve state monitors, indicating an open or closed position. This configuration will allow a confirmation that the ECU EU / ECU3 Test Set correctly commands the valves intended.
3) The MSS 3.2.7 software was created and intended to be used with the previous GMA. The valve commands used in 3.2.7 operate different valves in the E-Mock GMA, as well as the Flight GMA.
4) There shall be Flight Hardware used during this test.

Revision Record:

Rev	Rev Date	ECO #	Summary Description

Acronyms and Abbreviations:

Acronym / Abbreviation	Meaning
ECU Monitor Mnemonics	
BE_XXXXX_XXXXXX	Binary Word Monitor
CE_XXXXX_XXXXXX	Current Monitor
DE_XXXXX_XXXXXX	Digital Word Monitor
TE_XXXXX_XXXXXX	Temperature Monitor
TE_XXXXX_X**GT**XXX	GRT TYPE Thermometer
TE_XXXXX_X**PT**XXX	PRT TYPE Thermometer
TE_XXXXX_X**ST**XXX	SDT TYPE Thermometer
TE_XXXXX_XXXXX**D**	Dewer located Thermometer
TE_XXXXX_XXXXX**P**	Probe located Thermometer
TE_XXXXX_XXXXX**Q**	Quartz Block located Thermometer
VE_XXXXX_XXXXXX	Voltage Monitor
AC	Alternate Current
Closed Loop	Hardware Controlled
Command	Software response indicating command sent
Current	Commanded Heater Amperage
DC	Direct Current
Open Loop	Software Controlled
Power	UV Lamp Power Supply readout
Pressure	GMA Pressure Sensor readout
Range	UV Lamp Power Hi Lo Range readout
Signal	UV Lamp Intensity readout
Temperature	Thermometer readout
Voltage	Commanded Heater Voltage

CCCA	Command & Control Computer Assembly
CSTOL	Colorado Spacecraft Test and Operations Language
ECU	Experimental Control Unit
EPS	Electrical Power Subsystem
FEU	Flight Equivalent Unit
FSW	Flight Software
FTP	file transfer protocol
GMA	Gas Management Assembly
GP-B	Gravity Probe B
ICD	Interface Control Document
MOC	Mission Operations Center

MSS	Mission Support Software
OASIS-CC	Operations and Science Instrument Support – Command and Control
ONR	Office of Naval Research
PDU	Power Distribution Unit
QA	Quality Assurance
RTC	Real-Time Commands
SPC	Stored Program Commands
TCP/IP	Transmission Control Protocol over Internet Protocol
Tlm	Telemetry
UPS	Uninteruptable Power System
VAC	Volts AC

Table of Contents

A Scope 5

B Old GMA Versus New GMA Software & Valve Translation Matrix: 5

C Requirements Verification 6

D Configuration Requirements 7

E Software Required 7

F Procedures Required 8

G Equipment Pretest Requirements 8

H Personnel Requirements 9

I Safety Requirements 9

J General Instructions 10

K References and Applicable Documents 10

L Operations: 11

A **Scope**

This procedure connects and disconnects the Flight GMA from the ECU.

B **Old GMA Versus New GMA Software & Valve Translation Matrix:**

GMA Valve Name	Ops State	MSS 3.2.7 Name	Cmd State	Telemetry Name	Results State
V1	Open	SV1	Open	SV1	Open
V1	Closed	SV1	Closed	SV1	Closed
V1 - alternate	Open	CV5	Open	SV1	Open
V1 - alternate	Closed	CV5	Closed	SV1	Closed
V2	Open	SV2	Open	SV2	Open
V2	Closed	SV2	Closed	SV2	Closed
V2 - alternate	Open	CV4	Open	SV2	Open
V2 - alternate	Closed	CV4	Closed	SV2	Closed
V3	Open	SV3	Open	SV3	Open
V3	Closed	SV3	Closed	SV3	Closed
V4	Open	SV4	Open	SV4	Open
V4	Closed	SV4	Closed	SV4	Closed
V5	Open	SV5	Open	SV5	Open
V5	Closed	SV5	Closed	SV5	Closed
V6	Open	SV6	Open	SV6	Open
V6	Closed	SV6	Closed	SV6	Closed
V7	Open	CV1	Open	CV1	Open
V7	Closed	CV1	Closed	CV1	Closed
V8	Open	SV7	Closed	SV19	Open
V8	Closed	SV10	Closed	SV19	Closed
V9	Open	SV8	Open	SV8	Open
V9	Closed	SV8	Closed	SV8	Closed
V10	Open	SV9	Open	SV9	Open
V10	Closed	SV9	Closed	SV9	Closed
V11	Open	SV7	Open	SV7	Open
V11	Closed	SV10	Open	SV7	Closed
V12	Open	CV1A	Open	CV1A	Open
V12	Closed	CV1A	Closed	CV1A	Closed
V13	Open	SV11	Open	SV11	Open
V13	Closed	SV11	Closed	SV11	Closed
V14	Open	SV12	Open	SV12	Open
V14	Closed	SV12	Closed	SV12	Closed
V15	Open	SV13	Open	SV13	Open
V15	Closed	SV16	Open	SV13	Closed

GMA Valve	Ops	MSS 3.2.7	Cmd	Telemetry	Results
Name	State	Name	State	Name	State
V16	Open	CV2A	Open	CV2A	Open
V16	Closed	CV2A	Closed	CV2A	Closed
V17	Open	SV14	Open	SV14	Open
V17	Closed	SV14	Closed	SV14	Closed
V18	Open	SV15	Open	SV15	Open
V18	Closed	SV15	Closed	SV15	Closed
V19	Open	CV2	Open	CV2	Open
V19	Closed	CV2	Closed	CV2	Closed
V20	Open	SV13	Closed	SV16	Open
V20	Closed	SV16	Closed	SV16	Closed
V21	Open	SV17	Open	SV17	Open
V21	Closed	SV17	Closed	SV17	Closed
V22	Open	SV18	Open	SV18	Open
V22	Closed	SV18	Closed	SV18	Closed
V23	Open	SV19	Open	SV10	Open
V23	Closed	SV23	Open	SV10	Closed
V24	Open	CV3A	Open	CV3A	Open
V24	Closed	CV3A	Closed	CV3A	Closed
V25	Open	SV20	Open	SV20	Open
V25	Closed	SV20	Closed	SV20	Closed
V26	Open	SV21	Open	SV23	Open
V26	Closed	SV21	Closed	SV23	Closed
V27	Open	CV3	Open	CV3	Open
V27	Closed	CV3	Closed	CV3	Closed
V28	Open	SV19	Closed	SV21	Open
V28	Closed	SV23	Closed	SV21	Closed
V29	Open	SV22	Open	SV22	Open
V29	Closed	SV22	Closed	SV22	Closed
V30	Open	SV24	Open	SV24	Open
V30	Closed	SV24	Closed	SV24	Closed

C **Requirements Verification**

C.1 Requirements Cross Reference

C.2 Expected Data for Verification per requirement

D **Configuration Requirements**

D.1 If using the ECU3 Test set, it shall be connected to the ECU EU via a 1553 data bus, a timing signal (10 Hz) and a 28.0 Volt power supply. Ref: Figure 1, ECU EU Test Set Interconnect diagram

D.2 If using the ECU Power Supply shall be the sole provider of Heater Power to ECU controlled GMA Heaters. Ref: Figure 1, ECU Test Set Interconnect diagram

D.3 The Aft ECU shall be attached via cables to the GMA. Ref: Drawing 5856124, Payload Cable Interconnect Diagram

Description	Part No.	Finite Lifetime Object	No. Req'd
Flight GMA	8A02681		1

D.4 Commercial test equipment

Manufacturer	Model	Serial Number
SUN Workstation (Test Set)	Ultra 2	941H2436

D.5 Mechanical/Electrical Special test equipment

Description	Part No.
Timing & Interrupt Test Supply	001

D.6 Tools

Description	No. Req'd
8 mm tape drive	1

D.7 Expendables

Description	Quantity
8 mm tape	1

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.

F **Procedures Required**

Procedure Name	Procedure No.
(PTP) Flight GMA ECU Connections	P0946

G **Equipment Pretest Requirements**

Equipment	Serial No.	Test Required	Proc. No.	Test Performed Date	By
ECU EU	8A01313-ECU GSE	Certification	gma_moog.prc	2/7/01	HDM
E-Mock GMA	1	Certification	S-Doc S0621	1/5/02	KB

H Personnel Requirements

H.1 As a general requirement, all operations involving flight equipment require at least two persons at all times.

H.2 The test leader for this procedure is Dave Meriwether <Cell *650-725-9332* >, or his appointed representative.

H.3 The GMA REE is Chris Gray <Cell *650-996-5070* >. The GMA REE is responsible for all GMA tests, and will therefore schedule appropriate times for the performance of this procedure.

H.4 The Test Director for all Gyro Spin Up activities conducted in FIST Ops is Rob Brumley <Cell *650-245-1746* >, or his appointed representative.

H.5 The Stanford Quality Assurance representative is Dorrene Ross <Beeper *650-317-7922, 1283969* > or her appointed representative.

H.6 The Office of Naval Research representative is Abe Sabbag < Sabbaga@onr.navy.mil> or his appointed representative.

H.7 The following personnel are qualified to perform this procedure using the FIST Ops test set:

H.7.1 Dave Meriwether <Cell 650-725-9332>

H.7.2 Thomas Wai <Phone 650-354-5644>

H.7.3 Styrmir Sigurjonsson <Pager 845-1625>

H.7.4 Rick Stephenson <Phone 724-3002>

I Safety Requirements

I.1 Standard safety practices to ensure safety of personnel and prevent damage to equipment shall be observed during performance of this test.

I.2 Read the CARD's[1] appropriate to ECU GMA Operations before running this test.

I.3 All connectors used will have connector savers attached. Protect all electrical connections and/or Connector Savers with ESD dust caps when the connectors are not mated.

I.4 Ensure that power is removed from cable assemblies before connecting and disconnecting cable connections.

I.5 Grounded wrist straps are to be worn prior to removal of connector caps or covers and during cable mating/demating operations.

I.6 Examine all mating connections before attempting to mate them. Remove any foreign particles. Look for any damaged pins or sockets. Do not force the coupling action if excessive resistance is encountered. Ensure that key ways are aligned.

[1] Constraints and Restrictions Document

J **General Instructions**

J.1 Test operators shall read this procedure in its entirety and resolve any apparent ambiguities prior to beginning this test.

J.2 This procedure operates the GMA system for the GP-B satellite. Knowledge of the GMA, caution in its operation and attention to displayed information must be exercised at all times during these operations or Hardware damaged may result.

J.3 This procedure shall be conducted on a formal basis to its latest approved and released Version.

J.4 Tests will be conducted under the environmental conditions existing in the Moog Inc.

J.5 This procedure operates Flight Hardware.

J.6 In order to expedite test operations, unless specifically noted, the sequence in which major sections or subsections are preformed may be altered at the discretion of the GMA REE or his representative.

J.7 Upon completion of the test, all data on the ECU3 Ops test set under the /opt/usr6/lab and sub-directories shall be transferred to the data archive on the Payload Server. Upon confirmation that the FIST Ops test set data has been successfully archived, the data in the /opt/usr6/lab/bridge, /snaps, /messages and /oasis_raw_data directories may be deleted.

K **References and Applicable Documents**

K.1 SCIT-01 System Design, Verification, Integration & Test Plans

K.2 SCSE 06 Command and Telemetry Handbook, App B sw_cmd 3.2.5

K.3 SCSE 16 SECTION 9, Flight Software Design Specification, External Interface Detailed Design, Version Fg

K.4 PLSE-12, Science Payload Specification, Version 4.3

K.5 MSS3.2.7_Report_Excel.xls; GMA Telemetry Monitor List

K.6 ECU Drawings

L **Operations:**

L.1 Flight GMA / ECU Connections

L.1.1 ECU Connections

CAUTION: ESD PRACTICES SHALL BE FOLLOWED AT ALL TIMES

L.1.1.1 Connect the cable end marked 2A117P5 to the ECU J5 connection

L.1.1.2 Connect the cable end marked 2A117P7 to the ECU J7 connection

L.1.1.3 Connect the cable end marked 2A117P4 to the ECU J4 connection

L.1.1.4 Connect the cable end marked 2A117P6 to the ECU J6 connection

L.1.2 GMA Connections

L.1.2.1 Connect the cable end marked 2A1126P3 to the GMA 2A126J3 connection

L.1.2.2 Connect the cable end marked 2A1126P4 to the GMA 2A126J4 connection

L.1.2.3 Connect the cable end marked 2A1126P1 to the GMA 2A126J1 connection

L.1.2.4 Connect the cable end marked 2A1126P2 to the GMA 2A126J2 connection

L.1.3 ECU Disconnection's

L.1.3.1 Disconnect the cable end marked 2A117P5 to the ECU J5 connection

L.1.3.2 Disconnect the cable end marked 2A117P7 to the ECU J7 connection

L.1.3.3 Disconnect the cable end marked 2A117P4 to the ECU J4 connection

L.1.3.4 Disconnect the cable end marked 2A117P6 to the ECU J6 connection

L.1.4 GMA Disconnection's

L.1.4.1 Disconnect the cable end marked 2A1126P3 to the GMA 2A126J3 connection

L.1.4.2 Disconnect the cable end marked 2A1126P4 to the GMA 2A126J4 connection

L.1.4.3 Disconnect the cable end marked 2A1126P1 to the GMA 2A126J1 connection

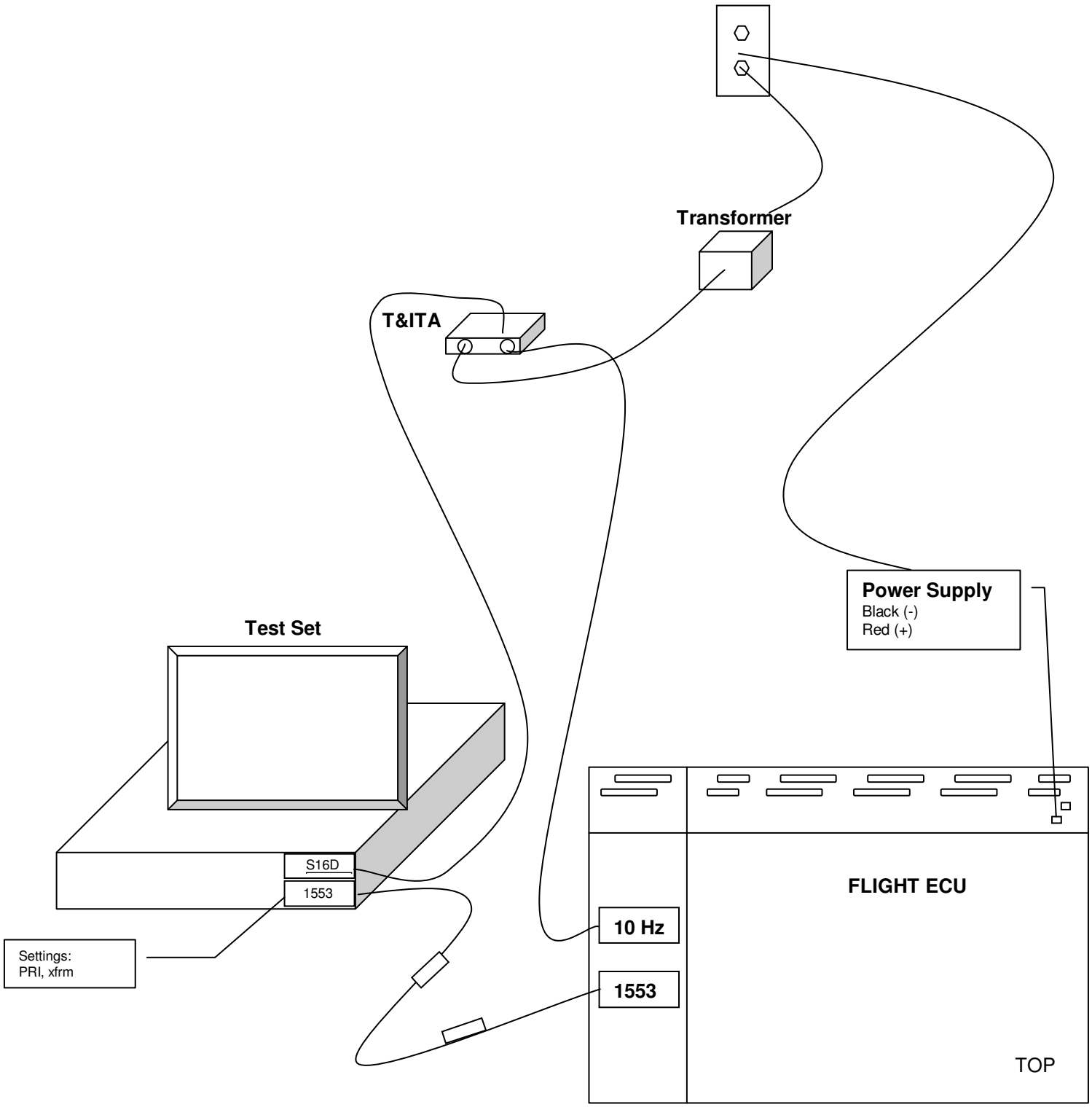
L.1.4.4 Disconnect the cable end marked 2A1126P2 to the GMA 2A126J2 connection

L.1.4.5 Update the Cable Connection Log

L.1.4.6 Operation completed:

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

Quality Engineer: _____
Date: _____
Time: _____


Transformer
T&ITA
Power Supply
Black (-)
Red (+)
Test Set
S16D
1553
Settings:
PRI, xfrm
FLIGHT ECU
10 Hz
1553
TOP