GRAVITY PROBE B

PROCEDURE FOR PAYLOAD VERIFICATION

AS3 REMOVAL PROCEDURE

P0504 REV A

May 14, 2001

		Signatures:	Date:
Prepared:	Rob Bernier AS3 Setup, and Alignment Leader		
Approved:	Ted Acworth AS3 Science Test Leader		
Approved:	M. Taber Payload Systems Test Manager		
Approved:	D. Ross QA Inspector		
Approved:	Harv Moskowitz LMSSC		
Approved:	Rob Brumley, Payload Technical Manager		

NOTES:
Authority to redline this document (make minor changes during execution of this procedure): Edward Acworth, Rob Bernier
Level of QA required during performance of this procedure:
__√__Stanford QA Representative
___Government QA Representative All redlines must be approved by QC

Revision Record

Rev	Date:	ECO #	Summary Description	Date
-	8/25/99		Wrote Original Procedure	8/10/99
A	10 May 01	1265	Incorporated redlines, conformed to new Pdoc format, improved procedure flow	5/8/01

A Scope

A.1 This Procedure covers removing AS3 from the Fist Ops Lab and all Post Calibrations required to verify the calibration of AS3.

This Procedure ☐Does☒Does not provide formal verification of GP-B requirements.
This Procedure ☐Does☒Does not include constraints and restrictions for the Payload.

B Safety Requirements

B.1 Harv Moskowitz is required before step R (AS3 Lifting Procedure in Fist Ops Lab) during the installation and removal procedures to monitor safety

B.2 Hardware Safety

B.2.1 Don't Jar the Probe with anything

C Personnel

C.1 QA Notification

C.1.1 The ONR representative and SU QA shall be notified 24 hours prior to the start of this procedure. Upon completion of this procedure, the QE Manager will certify his/her concurrence that the effort was performed and accomplished in accordance with the prescribed instruction by signing and dating in the designated place(s) in this document.

C.2 Red-line Authority

C.2.1 Authority to red-line (make minor changes during execution) this procedure is given solely to the AS3 Test Engineers or his designate and shall be approved by the QA Representatiove. Additionally, approval by the Payload Technical Manager shall be required, if in the judgement of the AS3 Test Engineers or QA Representative, experiment functionality may be affected.

C.2.2 Redlines can be initiated by Rob Bernier or Ted Acworth and must be approved by QA.

C.3 Any nonconformance or test anomaly should be reported by a Discrepancy Report. Refer to the Quality Plan, P0108, for guidance. Do not alter or break test configuration if a test failure occurs; notify quality assurance.

C.4 Test Personnel

C.4.1 Personnel Responsibilities

C.4.1.1 Qualified AS3 Operators Personnel

C.4.1.1.1 Robert Bernier

C.4.1.1.2 Ted Acworth

C.4.1.2 Crane Operation

C.4.1.2.1 Mike Taber

Mike Taber is required at the beginning of the test to operate the crane and observe the star module lifting, positioning and mounting operations onto the SMD flange. Mike Taber will also be required at test end during star module removal.

C.4.2 Only the following persons have the authority to exit/terminate this test or perform a retest: Rob Bernier or Ted Acworth.

D **Requirements**

D.1 Electrostatic Discharge Requirements:

D.1.1 Electrical mating and demating of AS3 hardware connectors

D.1.2 Grounding straps will be used when mating, or demating connectors on the probe.

D.1.3 Place cable connector A only into socket A, etc.

D.1.4 Strain relieve all cables

D.1.5 Connection and disconnection shall be performed only by Ted Acworth or Rob Bernier, and only when the equipment involved is in a powered-down state (unless otherwise noted)

D.1.6 Connectors shall be inspected for contamination and for bent, damaged, or recessed pins prior to mating.

D.2 Lifting Operations Requirements

D.2.1 The lifting operation should be QC'd by the Payload Systems Test Manager (Mike Taber) who will direct the lifting of AS3 over the SMD

D.2.2 Harv Moskowitz's presence will be necessary during lifting for safety assurance

D.2.3 Personnel should not be present beneath the AS3 star module during lifting operations

D.2.4 When pushing the control rack make sure that it doesn't topple over.

D.2.5 When maneuvering the AS3 star module be careful not to allow the accelerations to exceed 2 G to avoid shock

D.3 Required Equipment

D.3.1 Hardware Required

D.3.2 Cabling list between AS3 star module and control rack station. (clockwise from accessory cable)

Accessory A
Accessory B
Video coax 1
Video coax 2
Video coax 3
Video coax 4
Motor 1
Motor 2
Motor 3
Motor 4
Motor 5
Quad Cells

Vacuum hose for AS3 vacuum bell
Vacuum pressure sensor 1
Vacuum pressure sensor 2
Thermistor coax 1
Thermistor coax 2
Thermistor coax 3
Thermistor coax 4
Jitter A
Jitter B
Jitter C
Laser power
N_2 hose for window #4 purge, 20 foot length, 3/8 inch diameter
Vacuum hose for Window #4/AS3 window vacuum volume

D.3.3 Cabling list between AS3 control rack and TRE-GSE control rack

Quantity 9 of 20 foot coax with male BNC connectors on both ends

D.3.4 Equipment requiring formal periodic calibration

Manufacturer	Model	Serial Number	Calibr. Exp. Date
Newport Optical Power Meter	1830-C	1604	11 May 02
Newport Optical Power Meter Detector Head (quantity 2)	818-SL	7761 and 7844	11 May 02
Fluke multimeter "GPB SMD"	85	66500192	16 Nov 01
Torque wrench for tightening flange mount bolts	DA175M and DA130M	STU-0031 and STU-0030	OK to use FIST OPS wrench
Torque wrench (FIST OPS property in bonded storage)		000191	28 Nov 01

D.3.5 Special AS3 test equipment

Description	Part No.	Rev. no.	Serial No.
AS3 star module	25567	A	none
500 bomb cart for AS3 star module	none	none	none
AS3 mounted to bomb cart using three legs setup for on-cart optical transmissibility tests (tabs for holding condenser lens under the AS3 star module	none	none	none
AS3 star module mounting flange		none	none
Torque wrench for tightening flange mount bolts	DA175M	none	STU-0031
Torque wrench for tightening flange mount bolts	DA130M	none	STU-0030
10.75 inch Diameter Mylar sheet for the bottom of the AS3 mounting flange			
N_2 cylinder with valve	none	none	none
AS3 control rack including AS3-PC computer and other instruments	none	none	none
AS3 control station including: 5x video monitors and 2 switch boxes AS3-HR1510 computer, computer monitor, keyboard and mouse AS3-PC computer monitor, keyboard, mouse, and trackball	none	none	none
AS3 vacuum pumping cart:			

Vacuum pump for AS3 vacuum bell	none	none	none
220V power cord	none	none	none
20 feet of QF 50 vacuum hose	none	none	none
Vacuum pump for Window #4/AS3 window vacuum volume (available in FIST OPS)	none	none	none
30 feet of 3/8 inch diameter vacuum hose with QF 10 fittings	none	none	none
Mechanical toolbox	none	none	none
¼ inch socket adapter to 5/32 Allen. Note, due to limitation on space, max 1.100 in long.	none	none	none
Allen wrench, 5/32 (in)	none	none	none
6 inch Caliper	none	none	none
Electrical toolbox	none	none	none
Optics toolbox	none	none	none
AS3 Payload Verification test notebook	none	none	none

D.3.6 Tools

Description	No. Req'd
AS3 Mechanical Toolbox inventoried	1
AS3 Electrical Toolbox inventoried	1
AS3 Optics Toolbox inventoried	1

Toolbox content lists are contained in a separate document titled "AS3 tools list."

D.3.7 Computers and software:

Computer	**Name**	**Model**	**Software Vendor**	**Software Name**	**Version No**
WinTel	AS3-PC	Industrial PC 133 MHz NT	National Instruments and other	Lab View and other	5.0.1
WinTel	AS3-HR1510	Adsys	Various support software		

D.3.8 Expendables

Description	**Quantity**
Optics cleaning supplies	1 bag
JAZ® disks	4
Blank CD-R disks	20
Video camera and media	1
Still Camera and media	1

D.4 Instrument Pretest Requirements

(Documented in this procedure)

D.5 Configuration Requirements

D.5.1 (Documented in Procedure)

D.6 Optional Non Flight Requirement

D.6.1 Na

D.7 Verification / Success Criteria.

D.7.1 This procedure will be considered a success if at the end of the procedure AS3 is mounted to the probe, all of it's cables are connected, and it is ready for the P0501 the Alignment procedure.

D.8 Constraints and Restrictions:

D.8.1 Be extra careful of the vacuum connections to the Top Hat assembly. They are extra sensitive due to the Probe being sub atmospheric, leaving the possibility of air entering the well a heightened risk.

E References and Applicable Documents

E.1 Drawings, N/A

E.2 Supporting Documentation

E.2.1 Payload Test Verification NoteBook.

E.3 Additional Procedures:

E.3.1 P501 AS3 Alignment; P501 Alignment; P555 Telescope Telemetry and optical Power setup procedure; P502 Artificial Star 3 Transmissibility and acquisition range tests of telescope; p503; P504

F Intermediate Shutting down AS3 Motor Control box:

F.1 Storing AS3 Motor Position Procedure

F.1.1 Run Before Reboot

F.2 Backup and Power Down Procedure

F.2.1 Mirror AS3-P Drive C to Drive D

F.2.2 If Mirroring is not available, copy AS3 Files to D drive

F.2.3 Leave AS3 PC running!

F.2.4 Shut down Jitter Amplifier

F.2.5 Shut down Camera Power

F.2.6 Shut down monitors.

F.2.7 Shut Down Motor Power

F.2.8 Shut down Optical Power System.

F.2.9 Shut down Jitter Power Supply.

F.2.10 Leave AS3 PC running!

F.3 Signed: _____ Date: _____

G **Readying AS3 for lifting**

G.1 Disconnect all cables from the Star Module

G.2 Close vacuum port MDC valve on AS3

G.3 Turn off the Vacuum pump

G.4 Shut down the vacuum to the window #4 cavity

G.5 Open the valve to the window # 4 cavity

G.6 Pressurize the window number 4 cavity with 2 (psi.) Helium.

G.7 Break the Q50 vacuum port and cap the end with a vacuum plug

G.8 Disconnect the small vacuum hose from the window number 4 cavity

G.9 Pressurize the Helium to 2 (psi)

G.10 Signed: _____ Date: _____

H **Unbolting AS3 Star Module**

H.1 Connect crane hook to AS3 through the AS3 5/8 in and ¾ in shackles.

H.2 Ready the bomb cart, tools, and camera's required for removal of AS3

H.3 Unbolt the Flange from the sunshade flange mounting position:

H.4 Using the torque wrench: SN:

H.4.1 Note the loosening torque on each screw, using a Star Pattern reduce the torque on the screws to where they all are finger tight.

H.4.2 From 1:00 on the cover, in a clockwise order. Screw torque's (in-lb):

Screw 1_____; , Screw 2_____; , Screw 3_____; , Screw 4_____;

Screw 5_____;, Screw 6_____; , Screw 7_____; , Screw 8_____;

Screw 9_____; Screw 10_____; , Screw11_____; , Screw12_____; ,

Screw13_____; , Screw14_____; , Screw15_____; , Screw16_____; ,

H.5 Remove the screws from the holes noting the position each came from and keeping track of them in order.

H.6 Take up slack in the crane allowing AS3 to carry most of it's load from the top.

H.7 Raise the pressure of the Helium up to 30 (psi.)

H.8 Raise AS3 up 1 mm from the flange

H.9 Allow the Helium to vent from the cavity

H.10 Prepare the test window for placement on the flange, remove it from it's clean bag

H.11 Raise AS3 up 25 mm

H.12 Inspect top surface of window flange for tape residue.

H.13 Insert Lockheed window cover pin 8a02288gse-101 into top of cross flange.

H.14 Raise AS3 up 200 mm

H.15 Signed: _____ Date: _____

I **Retraction of AS3**

I.1 Place AS3-s mylar cover on the bottom of AS3 taping in place

I.2 Raise AS3 clear of any obstructions and haul it over to the waiting bomb cart

I.3 Lower AS3 down to eye level,

I.4 Attach AS3's legs Lower AS3 onto the bomb cart and place the bolts on the cart

I.5 Performed by _____ Date: _____

J **Install the protecting cover on the Probe**

J.1 Shoot video and stills of the probe flange, Window Number 4 and reticle to verify no contamination present in the system.

J.1.1 Video Start Time: _____ End Time: _____

J.1.2 Digital Camera Download Number _____ Frame number _____

J.1.2.1 Filename _____

J.1.3 Still Camera Roll number, _____ Frame number _____

J.2 Place the cover down on top flange noting the same orientation as it was removed

J.3 Place the screws finger tight in the same order that they were removed.

J.4 Tighten down the screws to 30 (in-lb's) torque

J.4.1 From 1:00 on the cover, in a clockwise order. Screw torque's (in-lb):

Screw 1_____; , Screw 2_____; , Screw 3_____; , Screw 4_____;

Screw 5_____;, Screw 6_____; , Screw 7_____; , Screw 8_____;

Screw 9_____; Screw 10_____; , Screw11_____; , Screw12_____; ,

J.5 Screw13_____; , Screw14_____; , Screw15_____; , Screw16_____; ,

J.6 Signed: _____ Date: _____

K **Fist Ops Floor Test's**

K.1 Hook up AS3 in the FIST Operations floor, and run the following Tests

K.2 AS3 cabling setup

K.2.1 Using a Grounding Strap for connecting all AS3 Cables to the AS3-Star Module resting on the FIST Ops Floor.

K.2.2 Connect up all cables to AS3-Star Module.

K.2.2.1 Except Jitter Control and Amplifier

K.2.3 Strain relieve the cables.

K.2.4 Go over all the cables, check them out, verify that they are all connected in the correct position.

K.2.5 Signed: _____ Date: _____

K.3 Power on Procedure

K.3.1 Power on the AS3 motor Control Box

K.3.2 Turn on Camera's,

K.3.3 Turn on Quad Cell Power

K.3.4 Power On Optical power

K.3.5 Turn on Vacuum and Temperature Gages

K.3.6 Check out Verify that the Vacuum, Temperature and other items are operational.

K.4 Post Telescope Focus Test

K.4.1 Align AS3 beam normal to telescope reticle

K.4.1.1 Run Labview "Align To Reticle_F.vi" Version F

K.4.1.1.1 Data file name: _____

K.4.1.1.2 Run "SnagIt.exe" to capture the screen window

K.4.1.1.2.1file name: _____

K.4.2 Collimate 150 mm beam Run it Three Times

K.4.2.1 Run Labview "Focus Automatic_F.vi" Version F with "150 mm Beam Sliding Aperture" setting of method selection switch

K.4.2.1.1 Data file name: _____

K.4.2.1.2 Data file name: _____

K.4.2.1.3 Data file name: _____

K.4.2.1.4 Run "SnagIt.exe" to capture the screen window

K.4.2.2 file name: _____

K.4.2.3 (optional) 6“ cube corner collimation test

K.4.2.4 Knife edge collimation test

K.4.2.4.1 Do Both Sides colinear, and Then Separate both sides

K.4.2.5 File Names: _____

K.4.2.6 File Names: _____

K.4.2.7 File Names: _____

K.5 AS3 Vacuum operation

K.5.1 Setup AS3 Vacuum pump next to Star Module

K.5.2 Connect Q50 vacuum hose from AS3 to the vacuum pump

K.5.3 Connect the Vacuum sensor cable to AS3’s sensor

K.5.4 Power on the vacuum pump

K.5.5 Put some Lead bricks on the hose to damp out the vibration

K.5.6 After 5 minutes note the vacuum on the flange space gage.

K.5.6.1 Vacuum gage reading: _____(psi)

K.5.6.2 Electronic Vacuum gage reading: _____(milliTorr)

K.5.6.3 Verify that there is no leaks

Signed: _____ Date _____

Discrepancies if any:

K.5.7 Reset limits on the 150 mm retroreflector

K.6 **Occlusion Test**, verify reticle central position, to occlusion angle based on centered beam setup.

K.6.1 Null To Reticle

K.6.2 Centered on Reticle Position Setup File Name:

Filename:_____

K.6.3 Place a piece of graph paper under AS3, on the bomb cart platform. Trace the outline of the AS3 optical beam.

K.6.4 + Azimuth (Point of beginning Occlusion between AS3 beam and internal interference)

Filename:_____

K.6.5 - Azimuth (Point of beginning Occlusion between AS3 beam and internal interference)

Filename:_____

K.6.6 + Elevation (Point of beginning Occlusion between AS3 beam and internal interference)

Filename:_____

K.6.7 - Elevation (Point of beginning Occlusion between AS3 beam and internal interference)

Filename:_____

K.6.8 Compute Angles from Reticle to first occlusion Position:

+Azimuth Angle: _____
-Azimuth Angle: _____
+Elevation Angle: _____
+-Elevation Angle: _____

K.6.9 Verify that the Max angle of +- 125 arcmin is never exceeded

Date:_____

Name:_____

K.7 Align to Wedge Spot A

L **Offline calibrate the AS3 optical transmissibility**

L.1 AS3 star module should be assembled on the AS3 bomb cart, with three special attachment feet with support tabs Pointing radially inward setup to hold the transmissibility testing focusing lens.

L.2 Measure the AS3 optical transmissibility

L.2.1 Retract the 1cm cc, 6" cc, and sliding aperture

L.2.2 Drive the AS3 beam to AS3 center orientation

L.2.3 Set to max AS3 optical power

L.2.4 Place the transmissibility testing condenser lens, and the second power meter head in the beam path under the star module. (fill about 75% of the optical power meter detector head sensor area with focused AS3 light.

L.2.5 Place the aperture cutout sheet on the condenser lens (to neck down the beam to the telescope entrance profile)

L.2.6 Set AS3 optical power to first test value = 2 mW.

L.2.7 Record the optical power meter readings from both detectors.

L.2.7.1 Detector 1 (at fiber source inside AS3) power = _____ W

L.2.7.2 Detector 2 (at AS3 exit beam) power = _____ W

L.2.8 Drive the AS3 beam to telescope reticle orientation

L.2.8.1 Record the optical power meter readings from both detectors.

L.2.8.1.1 Detector 1 (at fiber source inside AS3) power = _____ W

L.2.8.1.2 Detector 2 (at AS3 exit beam) power = _____ W

L.2.9 Drive the AS3 beam to telescope boresight orientation

L.2.9.1 Record the optical power meter readings from both detectors.

L.2.9.1.1 Detector 1 (at fiber source inside AS3) power = _____ W

L.2.9.1.2 Detector 2 (at AS3 exit beam) power = _____ W

L.2.10 If desired, Set AS3 optical power to a second test value and repeat test

L.2.11 See AS3 Payload Ver I Test Notebook page 65 for data reduction method..

M **Shutting down AS3 Procedure:**

M.1 Storing AS3 Motor Position Procedure

M.1.1 Run Before Reboot

M.2 Backup and Power Down Procedure

M.2.1 Mirror AS3-P Drive C to Drive D

M.2.2 If Mirroring is not available, copy AS3 Files to D drive

M.2.3 Software Power Down AS3-PC

M.2.4 Hardware Power down AS3-PC

M.2.5 Shut down AS3 UPS

M.2.6 Power down all systems on AS3.

M.2.7 Disconnect AS3 critical power

M.2.8 Disconnect AS3 support power

M.3 Signed: _____ Date: _____

N **Removal of Cable from around the area of the probe**

N.1 Break down AS3-wiring and remove AS3 rack tower

N.2 Remove AS3 table

O **Discrepancies if any:**

P **Procedure Completion.**

Completed by: _____
Witnessed by: _____

DATE: _____
Time: _____

Quality Manager _____ Date _____
Payload Test Director _____ Date _____