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Gravity Probe B Relativity Mission

GRAVITY PROBE-B
STANDARD OPERATING PROCEDURE

GP-B MAINTENANCE AND TESTING AT ALL FACILITIES

P0875 REV-

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Scope:

This procedure is part of the corrective action to DR 410. As a result of this event Gravity Probe-B management has determined that tighter test controls must be implemented. Controls are implemented in the following areas:

- Performance of Maintenance
- Test Procedure performance
- Use of Gas Cylinders
- Electrical/Mechanical connections

Purpose:

The purpose of this Standard Operating Procedure is to provide standardized instructions to be followed when the Gravity Probe – B test team performs testing and testing related activities. This procedure also incorporates the use of both Pre-test and Post-test team briefings.

Applicability:

This procedure applies to all personnel involved in test procedure performance. The requirements outlined in this procedure are mandatory.

Responsibilities:

Test Team Leads (Responsible Engineers)

- Test Team Leads will review the test procedure prior to performing a Pre-Test meeting with the test team. The purpose of this review will be to identify and resolve any potential problem area that could have a negative impact on test procedure performance. The Team Lead should review the entire procedure with the thought in mind, "what could go wrong and how can it be prevented"?

- Pre/Post Test Meetings

  - Prior to actual start of the test, the Test Team Lead will conduct a Pre-Test meeting with the entire test team and will complete the Pre-Test Checklist. (Attachment #1).

  - At the completion of the test, the Test Lead will conduct a Post-Test meeting with the entire test team and will complete the Post-Test Checklist (Attachment #2).

Quality Engineer/Inspector

- Prior to the start of the test the Quality Engineer/Inspector will review the test procedure to ensure that adequate Q-Buys are in place.

- The Quality Engineer/Inspector will maintain the as-run copy of the test procedure at all times during testing.

- The Quality Engineer/Inspector has the authority to add Q-Buys to the procedure as required for QA inspection/test enhancement.

- The Quality Engineer/Inspector will be responsible for approving all procedure redlines identified during testing.

- At the completion of the test the Quality representative will ensure that the completed Pre and Post Test briefing checklists are maintained with the completed procedure.

Gas Cylinder Handling and Use

- A gas cylinder identification program has been put into use by Gravity Probe-B program. This program includes the following items:

  - Each time a new gas cylinder is put into use, the serial number of the cylinder will be recorded in the procedure.

  - Prior to each use gas cylinders will be tested using a gas analyzer to ensure the type of gas in the cylinder matches the identification label on the shoulder of the cylinder.

  - Once the type of gas in the cylinder has been verified, the cylinder will be tagged with a program unique tag. A brown tag will be used to identify nitrogen, a yellow tag for compressed air, and a blue tag will be used to identify helium.

  - Prior to connecting any gas line to the cylinder, the external mainfolding will be purged (outlet valve turned on and off) to remove any possible contamination prior to connecting the line.

- A warning will be placed in the procedure prior to any step that requires the connection of a gas cylinder. The warning will read as follows:

WARNING

LIQUID HELIUM USED IN THE GRAVITY PROBE-B PROGRAM REPRESENTS A HAZARDOUS MATERIAL FOR THE PERSONNEL INVOLVED IN TESTING AND CRYO SYSTEM OPERATIONS. EXTREME CARE SHOULD BE USED WHEN WORKING AROUND OR WITH HELIUM (LIQUID OR GASEOUS).

- The gas line will be inspected and cleaned (if required) prior to connecting the line to the regulator.

- Consumption of the gases used will be monitored. The gas regulators used on all cylinders will be monitored to ensure the gas used does not drop below 200psi. This should serve to reduce the amount of contamination that could possibly enter the cryo system.

- A training program for the use of gases will be established for the Gravity Probe-B Program. This program will include the uses of helium (liquid or gaseous), nitrogen and any other type of gas that could be used on the program.

Connector Mate/Demate

- Extreme care should be used when handling connectors of all types.

- Dust caps will be used on all connectors when the connector is not mated.

- Prior to the mate of all flight connectors, the connector will be inspected using 4x magnification. This inspection will check for foreign objects as well as bent pins or any other anomaly that may be present.

- All Mate/Demates will be appropriately annotated in the Mate/Demate Log and will be verified by Quality.

- Connectors will not be mated/demated with power applied unless specific instructions to do so are required by the procedure.

- Mechanical connectors will be checked to ensure the threads are clean prior to connection. In all cases both the male and female ends of the connector will be inspected for cleanliness.

- A connector mate and demate training program will be established for the Gravity Probe-B program.

Summary

Incorporation of the items in this Standard Operating Procedure should serve to improve all testing activities conducted by the Gravity Probe-B Program. All test team members are encouraged to review all operating procedures and where possible make recommendations for improvements.

ATTACHMENT #1 PRE-TEST CHECKLIST

DATE	PROCEDURE #	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 PRE-STAGED AND 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. **NOTE**: **DURING A HAZARDOUS OPERATION THE TEST WILL ONLY BE STOPPED WHEN IT IS SAFE TO DO SO**.		
		8. CONFIRM THAT EACH TEST TEAM MEMBER CLEARLY UNDERSTANDS THAT HE/SHE HAS THE AUTHORITY TO STOP THE TEST IF THERE IS ANY ANOMALY OR SUSPECTED ANOMALY **NOTE: DURING A HAZARDOUS OPERATION THE TEST WILL ONLY BE STOPPED WHEN IT IS SAFE TO DO SO**		
		9. NOTIFY MANAGEMENT OF ALL DISCREPANCY REPORTS OR D-LOG ITEMS IDENTIFIED DURING THE PROCEDURE. IN THE EVENT AN INCIDENT 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:		

ATTACHMENT #2 **POST-TEST CHECKLIST**

DATE	PROCEDURE #	CHECKLIST ITEM	COMPLETED	REMARKS
		1- VERIFY ALL STEPS IN THE PROCEDURE WERE SUCCESSFULLY COMPLETED.		
		2- VERIFY ALL MINOR/MAJOR DISCREPANCIES DISCOVERED DURING TESTING ARE PROPERLY DOCUMENTED.		
		3- ENSURE MANAGEMENT HAS BEEN NOTIFIED OF ALL MINOR/MAJOR DISCREPANCIES.		
		4- ENSURE THAT ALL STEPS THAT WERE NOT REQUIRED TO BE PERFORMED ARE PROPERLY IDENTIFIED.		
		5- IF APPLICABLE SIGN-OFF TEST COMPLETION.		
		TEAM LEAD SIGNATURE		