National Aeronautics and Space Administration
Goddard Space Flight Center
Greenbelt, MD 20771

Cm#: FAST-PROC-046

September 30, 1993

Procedure

for the

Thermal Vacuum Bakeout

of the

FAST AURORAL SNAPSHOT EXPLORER

Cable Harness

Procedure No.

7544-155-93

SPACE SIMULATION TEST ENGINEERING SECTION
CODE 754.4

Thermal Vacuum Bakeout of the FAST AURORAL SNAPSHOT EXPLORER Cable Harness

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FAST Mission Manager

1.0 GENERAL

1.1 Test Objectives:

The objective of this test is to reduce potential molecular contamination due to outgassing.

1.2 Test Facility:

Thermal Vacuum Chamber 281. Facility 281 is a cryo pump equipped 3' x 4' thermal vacuum chamber. It is located in Building 7 at the Goddard Space Flight Center.

1.3 Auxiliary Test Equipment:

10 MHz Quartz Crystal Microbalance
Cold finger

1.4 Test Configuration:

The harness will be placed on the chamber payload table.

1.5 Test Team Personnel:

Thermal Vacuum Test Engineer:	Jamie Dunn/754.4
Thermal Vacuum Test Technicians:	Sebastian Costa/NSI Don Deibler/NSI George Smith/NSI George Stitt/754.4
Contamination Engineer:	Mike Rodriguez/724.4, MDA
Quality Assurance:	Teresa James/PARAU
FAST Mission Manager:	Tim Gehringer/740.4

1.9 Schedule:

The test is scheduled to start on September 29, 1993. It should last approximately 10 days.

1.8 Reference Numbers:

TAR No.: 1208
J.O. No.: 754-864-02-01-69
Folio No.: 4516

1.10 Applicable Documents:

1.10.1 Operations Procedure for Facility 281
NSI-26-01-179-2

1.10.2 FAST Subsystems Bakeout Plan
FAST-MGMT-014 September 27, 1993

2.0 TEST PROGRAM

2.1 General:

The harness shall be baked at +90°C with the QCM at -20°C until the frequency is ≤ 400 Hz/hr and the frequency is ≤ 15 Hz/hr/hr for five consecutive hours. Once the bakeout criteria is met, the harness will be lowered to +55°C for certification. When the QCM frequency is ≤ 200 Hz/hr, the harness will be considered certified, and the cold finger started.

2.2 Contamination:

2.2.1 Monitors:

The contamination rates and levels for the test will be monitored by the following devices:

2.2.1.1 QCM:

One 10 MHz Quartz Crystal Microbalance will be used to meet contamination criteria. All criteria will be met with the QCM at -20°C.

2.2.1.2 Cold finger:

The 22 square inch cylindrical device is permanently installed in the chamber. After the payload has met contamination criteria, this will be flooded with LN_2 and held at that temperature for at least eight hours. Contaminants still around in the chamber interior will condense on its surface. When the chamber is opened at the end of the test, the cold finger is washed with alcohol. The wash and its residue are analyzed for its contents.

2.2.2 Criteria:

2.2.2.1 QCM:

The QCM criteria for the bakeout phase is a frequency ≤ 400 Hz/hr and a frequency ≤ 15 Hz/hr/hr for five consecutive hours. The criteria for the certification phase is a frequency ≤ 200 Hz/hr for five consecutive hours. All criteria is for a 10 MHz QCM at -20°C.

2.2.2.2 Cold finger:

The total accumulation of the contaminants on the cold finger over the eight hour period will be analyzed for its chemical contents. The results will be forwarded to the Project and appropriate actions will be taken by the Project to resolve any potential problems.

2.3 Data Acquisition:

QCM readings and chamber pressure shall be monitored every hour, with hard copies printed every 8 hours.

3.0 SAFETY

GENERAL:

The safety of all personnel and equipment shall be properly guarded at all times in accordance with standard GSFC safety regulations and practices.

4.0 EMERGENCY PROCEDURES

GENERAL:

Interruption to the operation of the facility or its sub-systems will occur as a result of loss of electrical power, vacuum or chamber water supply. Malfunction or failure of the facility sub-systems such as LN_2, GN_2 or house air supply may cause abnormal facility operation, which may endanger the payload. Emergency procedures outlined in the Facility Operations Manual shall be followed.

All chamber systems, including the data collection system, shall be on the emergency generator. The following emergency procedures shall be followed in the event of equipment failure or need for building evacuation:

4.1 Power Outage:

4.1.1 Momentary:

4.1.1.1 Chamber:

Any loss of electrical power will shut down the facility. All chamber systems will be restarted when the power is restored.

4.1.1.2 Payload:

N/A

4.1.2 Extended:

4.1.2.1 Chamber:

The emergency generator will start automatically within 30 seconds of commercial power loss. The emergency generator shall be switched on and all chamber systems will be restarted. If the emergency generator is activated, it must be left on for at least 30 minutes. When the commercial power is restored, switching back from the emergency power is done manually.

4.1.2.2 Payload:

N/A

4.2 Loss of Chamber Thermal System:

If LN_2 supply is lost, it will be noted by changes in the shroud temperatures. If necessary, the chamber will be brought back to ambient conditions per emergency shutdown operating procedure. Ref. 1.10.1.

4.3 Loss of Vacuum:

If the chamber pressure reaches higher than 5×10^{-5} Torr, the system will be leak-checked for both internal and external sources. If the leak cannot be located and isolated, and/or it appears that ultimate vacuum in the chamber cannot be re-established or maintained, the thermal vacuum test engineer shall be informed and shall determine whether to abort the test. If the test is aborted, the chamber will be brought back to ambient conditions per standard shutdown operating procedure.

4.4 Building Evacuation:

In the event that the building should have to be evacuated, all personnel shall be notified immediately. The vacuum system will be left on. The thermal system shall be shut off and the shrouds will be allowed to thermally drift.

5.0 TEST SET-UP

5.1 Facility Description:

Facility 281 is a 3' x 4' cryo-pumped thermal vacuum chamber.

5.2 Test Article Set-up:

The harness will be placed on the chamber payload table.

5.3 Handling:

The harness shall be handled with latex gloves.

5.4 Instrumentation:

N/A

6.0 TEST PROCEDURE

6.1 Guidelines:

6.1.1 Changes to the approved test procedure:

The detailed test sequence described and outlines in this test procedure and in the Facility Operations Test Procedure shall be strictly followed. All proposed changes to the approved test procedure shall be given to the thermal vacuum test engineer. If necessary, the changes shall be initialed and dated by the test engineer and the Project engineer, or their designated representatives.

6.1.2 Reaching the target temperature:

When the average of the control thermocouples is within 2°C of their desired temperature level, then the target temperature has been achieved. The control thermocouples are designated below.

6.1.3 Control thermocouples:

The control thermocouples are the average of the facility shroud thermocouples.

6.1.4 Temperature limits:

The yellow and red hot temperature limits for the harness are +93°C and +95°C.

*The overall facility sub-systems and contamination instrument temperature tolerance shall be +/- 2°C.

6.1.5 Vacuum:

The chamber vacuum shall be maintained below 1 x 10^{-5} Torr throughout the test. The test conductor and the Project Engineer must be immediately notified if this pressure limit gets violated.