FAST-TEV-093

FAST SPACECRAFT THERMAL VACUUM TEST PLAN (TV96)

FINAL

April 29, 1996

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1. INTRODUCTION

This document describes the thermal vacuum retest to be performed on the all-up Fast Auroral Snapshot Explorer (FAST) spacecraft. This test serves to verify proper spacecraft performance after the standdown period following the cancellation of the 1995 launch attempt. The spacecraft has been re-integrated to flight readiness following partial disassembly. The test plans for the TV/TB tests performed during 1994 and 1995, **FAST-TEV-065**, **FAST-TEV-079, and FAST-TEV-090**, should be used as references.

1.1 Test Item Description

The test article is the FAST spacecraft, including science instruments in the all up launch configuration.

2. TEST DESCRIPTION

2.1 Test Setup

Reference FAST-TEV-079 for basic setup and chamber requirements.

2.2 Test Plan

Please see the attached temperature profile and functional test plan. This test differs from those in 1994 and 1995 in that only one long cycle to acceptance level temperatures will be performed. A battery thermal balance will begin the test while the battery is offline and the spacecraft is powered off.

2.2.1 Instrument high voltage operation

During the test the instrument high voltages will be powered on for extensive periods. The high voltages can only be powered on after the chamber pressure has fallen and remained below 2.0e-6 torr for the previous 12 hours. After the high voltages are powered on, the pressure must remain below 2.0e-6 torr. If the pressure rises above 2.0e-6 torr the instrument high voltages must be powered off.

2.3 Instrumentation

The spacecraft flight thermistors will be primarily used to monitor spacecraft temperatures. Ten supplemental thermocouples will be used to monitor temperatures when the spacecraft is off. A list of required thermocouples, locations, and limits is attached.

3.0 THERMAL TEST PROCEDURE

3.1 Start pump down of thermal vacuum chamber.

3.2 When chamber pressure reaches 1.0e-5 torr, set:
Chamber: +40 deg C
Battery Cryo: -30 deg C

3.3 Verify spacecraft is powered off and battery is off-line.

3.4 When all TC's are stable and drifting less than .1 degrees C/hour for six consecutive hours instruct test director that battery thermal balance test is complete.

3.5 Set:

Battery Cryo: -70 deg C
Chamber: +10 deg C

3.6 When TCs 1-4 reach 30 deg C, inform test director that spacecraft can be powered up.

** Note ** The following steps(3.7-3.10 are only a guide to transition the spacecraft approximately 1 deg/hr for the next 36 hours. Transition time can be adjusted as directed by thermal and functional test directors to maintain schedule***********

3.7 After spacecraft is powered up set:

Chamber: +4 deg C

3.8 After chamber has been at set temperature for six hours set:

Chamber: -2 deg C

3.9 After chamber has been at set temperature for six hours set:

Chamber: -8 deg C.

3.10 After chamber has been set at temperature for six hours set:

Chamber: -14 deg C.

3.11 After chamber has been at set temperature for six hours set:

Chamber: -20 deg C.

3.12 After chamber has been set at temperature for six hours continue to adjust chamber setting to insure that TC's 1-4 are approximately stable are at -7 deg C(+0/-2).

3.13 Keep spacecraft deck temperature (TC's 1-4) at -7 deg C until battery operational thermostats have cycled at least twice. If temperatures are relatively stable and battery thermostats have not activated adjust battery cryoplate temperature colder until they do.

*** The following steps are included only as a guide. The goal is to transition the spacecraft slowly back to ambient by the time of test end. Watch pressure closely.******

3.14 With thermal test director's and functional test director's approval set:

Battery Cryo: -30 deg C
Chamber: : -10 deg C

3.15 After chamber has been set at temperature for twelve hours set:
Chamber: 0 deg C

3.16 After chamber has been set at temperature for twelve hours set:
Chamber: 10 deg C.

3.17 When chamber has been set at temperature for twelve hours and TCs 1-4 are below 20 deg C set:

Chamber: +15 deg C.

3.18 When all functional testing is complete and spacecraft is off and if some TC's are below +20 deg C set

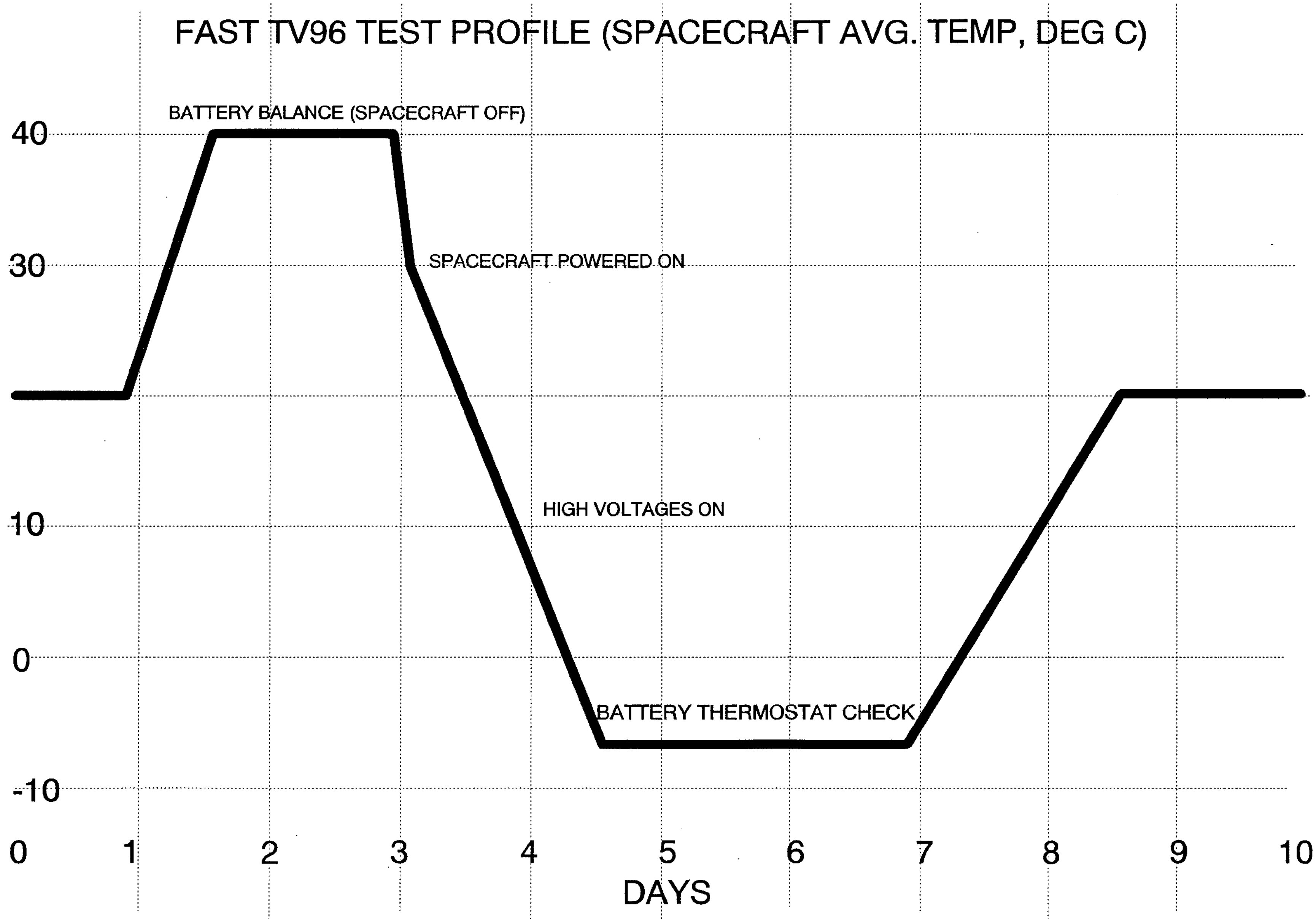
Chamber: +25 deg C.
Battery Cry: +25 deg C.

until all TC's are above + 20 deg C.

3.19 When all TC's are above +20 deg C backfill chamber and prepare for chamber door opening.

TV96 Thermocouples

TC#	Location	Test Yellow Limits
1	Deck, Under ESA (-X,+Y)	(-20,+50)
2	Deck, Under ESA (-X,-Y)	(-20,+50)
3	Deck, Under ESA (+X,-Y)	(-20,+50)
4	Deck, Under ESA	(-20,+50)
5	TEAMS Cover	(-25,+50)
6	Deck, Under Battery	(-20,+50)
7	Battery Radiator	(-5, +25)
8	Battery Radiator	(-5, +25)
9	Battery Closeout Duct	(-10,+35)
10	Battery Closeout Duct	(-10,+35)
11	Battery Cryoplate	(-150,+100)
12	Battery Cryoplate	(-150,+100)


FAST TV96 TEST PROFILE (SPACECRAFT AVG. TEMP, DEG C)
BATTERY BALANCE (SPACECRAFT OFF)
SPACECRAFT POWERED ON
HIGH VOLTAGES ON
BATTERY THERMOSTAT CHECK
40
30
10
0
-10
0
1
2
3
4
5
6
7
8
9
10
DAYS

Parrish, Keith

From: deverett[SMTP:deverett@sunland.gsfc.nasa.gov]
Sent: Wednesday, April 03, 1996 5:33 PM
To: ;
Subject: Thermal Vacuum

Here's the plan for thermal vacuum:

Day 0:
STRENDUP
SFUNCTIONAL
STRENDDOWN

Day 1:
Close door/pump down
Increase s/c temp to 40 degrees C
Start battery thermal balance

Day 2:
Complete battery thermal balance
Begin transition to cold

Day 3:
After s/c reaches 30 degrees C, power up
SEEYA
Launch and early orbit simulation (eclipse cycles)
Cover deployment (if necessary) during sim
Spacecraft remains powered

Day 4:
Continue L&EO dynamic simulation
Turn on instrument high voltages during passes
Spacecraft remaings powered

Day 5:
Start campaign dynamic simulation (full sun)

Day 6:
Continue campaign (eclipse cycles)

Day 7:
Start slow transition to warm
Continue campaign (full sun)

Day 8:
Continue campaign (full sun, anomalies)

Day 9:
High voltages off due to pressure increase, s/c above 20 degrees C
SPWRDWN
SEEYA
Start L&EO simulation (anomalies)
STRENDDOWN
transition to ambient

Day 10:
Open chamber

The spacecraft is not powered on Day 1 or Day 2.

We will operate around the clock from 8am on Day 3 until 6pm on Day 9. We need test-conductor support and shift-manager for this entire time.

For both L&EO simulations (Day 3 and Day 9), everyone who will be at Vandenberg for launch should be with the spacecraft, and everyone who will be at the POCC for launch should be at the POCC. This is our chance to practice, so launch day goes smoothly.

Instrument support in the POCC is required for high voltage turn-on (Day 4). Commanding to the spacecraft is only allowed during passes (unless there is a real emergency).

Additional instrument support is TBD, but we want the campaign simulations to be realistic, so we do need substantial science support.

Notice that all powered operations except SEEYA are from the POCC.

Day 0 is not defined yet, but it should be around April 22.

Let me know what you think!

Dave

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