**QuakeSat
Thermal Vacuum
Test Plan**

**QuakeFinder
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Version	1.0	**Approved By**	
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Reference No		**Updated as Run**	
Distribution			

This is the execution baseline and as tested
document, post test data will be added as required.

WARNING:
   The test must start with the satellite power OFF while the <u>vacuum chamber is pulled down to a hard vacuum</u>, and again <u>the power must be off when the air is being let back in</u>. Failure to do so may result in arcing of power across small air gaps (circuit board traces) and MAY DESTROY THE SPACECRAFT. This is known as the corona effect. Corona under low air pressure conditions can destroy the electronics in a spacecraft.

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1.1   Scope

This is the thermal vacuum test plan for the QuakeSat satellite and P-Pod launcher assembly. This document addresses the parameters and high level procedures to conduct the thermal vacuum test.

1.2   Applicable Documents

The following documents are for references:

2   Thermal Vacuum Test

2.1   Overview

For this test the QuakeSat spacecraft and the P-Pod launcher assembly will both be placed in the 5' thermal vacuum chamber. The QuakeSat spacecraft will be placed in a flight like configuration (ie boom and panels deployed) and the P-Pod will be placed next to the QuakeSat in a launch like configuration (ie door closed, lanyard tensioned and batteries charged.)
The test will consist of two hot cold cycles, shooting for a spacecraft temperature range of +60C to -20C.
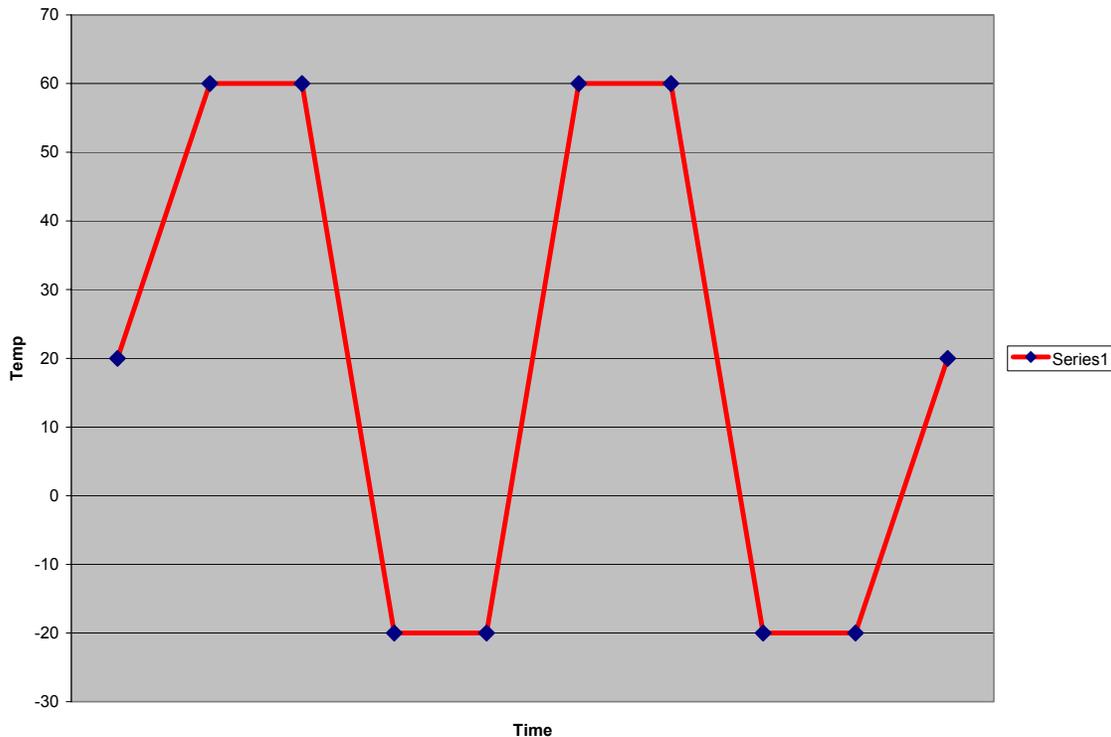
Approximate test profile. Expected dwell time at max and min temperatures is about 30min. The overall test run time is approximately 4 hours.

The chamber will slightly overshoot the desired temperature to allow spacecraft to reach its expected temperatures within 30 min. This will be controlled manually in real time. The QuakeSat spacecraft will be controlled thru the DB-9 umbilical and a special non-flight umbilical that will run out thru the spacecraft structure thru the solar panel wire holes. These umbilicals will allow for a laptop to be configured to monitor the real time processing of the OBC and the other to act as a pseudo ground station commanding the spacecraft thru the umbilical (by-passing the radio)
The line cutter on the P-Pod will be commanded manually, applying voltage to it initiation line. This is the only time we will see the line cutter in operation in a vacuum and batteries at low flight temperature.
The on-board radio will be configured to a non-flight dummy load instead of the flight antenna. The dummy load will be connected to the radio by a cable that will also run thru a hole in the spacecraft structure. The dummy load will have an approximately 3' cable and will be place somewhere inside the chamber.
The spacecraft DB9 umbilical, the non-flight umbilical and the P-Pod line cutter command line have been configured thru a special thermal/vac chamber interface cable. Thermal/vac dry runs will be run at our lab to insure that our interface into the chamber is correct.

2.2   Test Execution Overview

The QuakeSat spacecraft and P-Pod assembly will be place in the thermal vacuum chamber. The necessary umbilicals will be connected, and the test run. During the cold cycle recovery of the last cycle, the lanyard cutting signal will be sent to the P-Pod.   The lanyard will be cut while the spacecraft and P-Pod are still in the chamber.

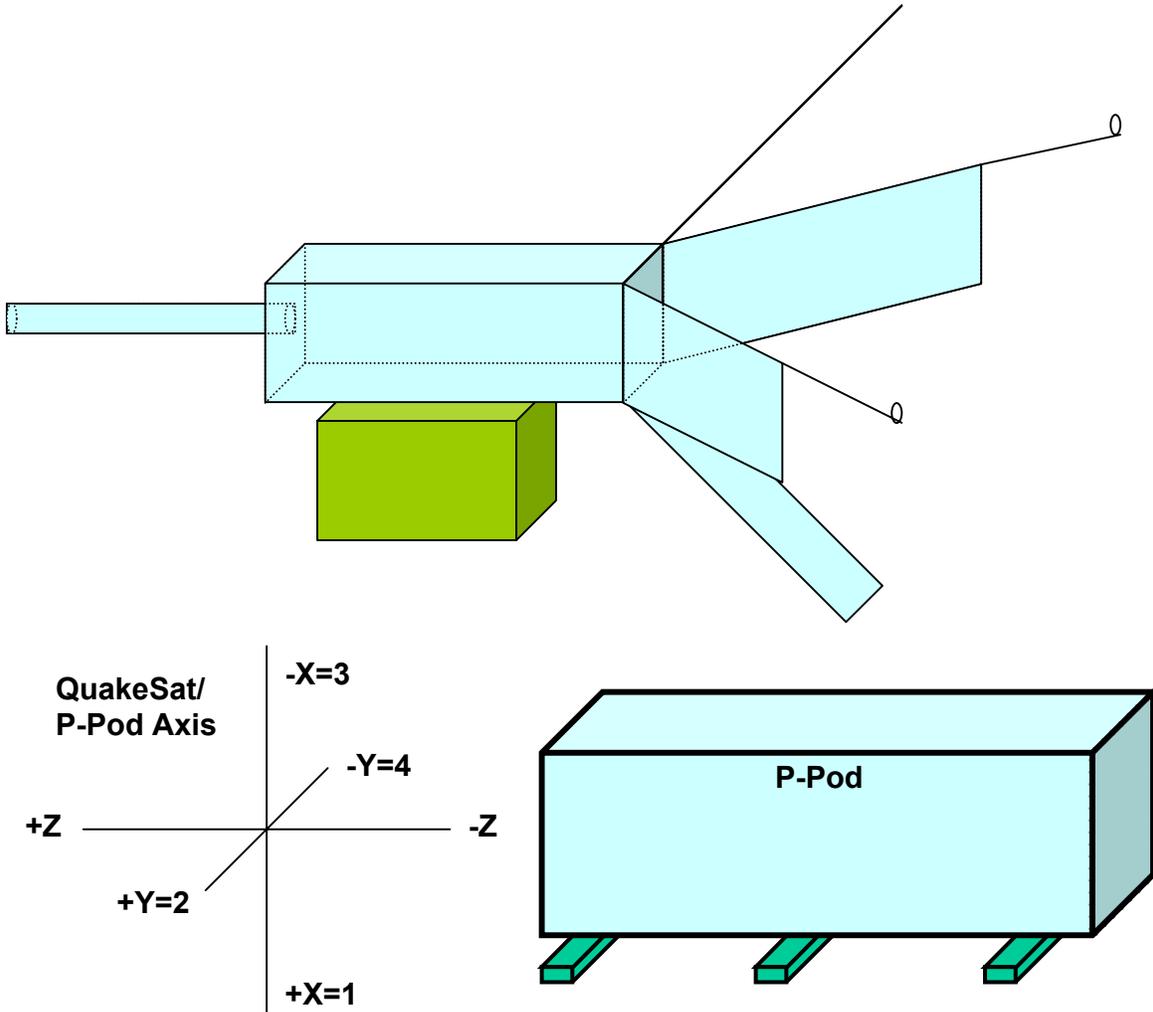### 2.3   Test Procedure

WARNING:
The test must start with the satellite power OFF while the <u>vacuum chamber is pulled down to a hard vacuum</u>, and again <u>the power must be off when the air is being let back in</u>.

Failure to do so may result in arcing of power across small air gaps (circuit board traces) and MAY DESTROY THE SPACECRAFT. This is known as the corona effect. Corona under low air pressure conditions can destroy the electronics in a spacecraft.

1. Install QuakeSat and P-Pod in the chamber. (See figure 2.1)
2. Configure umbilicals and remote laptop equipment.
3. Power up the spacecraft.
4. TBD (10) minutes of pretest spacecraft checkout, i.e. to verify that our initial. configuration is correct and we are communicating with the spacecraft.
5. Enable TVHK command load.

6. Enable and run the TVTest1 command load for the first time.
7. Start the Thermal Vacuum test. 2 hot-cold cycles, approximately 4 hours.
8. As necessary, (until the end of the test) request all points TLM samples. Monitor spacecraft performance and record the requested data.
9. When the boom temperature reaches 60C, request the heat off.
10. Enable and run the TVTest2 thru 9 command load again at each of the following chamber temperatures .At approximately 20C, 60C, 20C, -20C, 20C. These will occur at approximately 15 to 35 minute intervals.
11. During the 60C and –20C TVTest runs request the "Dummy" file transfer.
12. When CPU or other hot component reaches 60C, start cool down or at the end of the TVTest.
13. At 20C for the inner structure temperature during the cool down, the TV Test again. (No file request.)
14. When the inner structure temperature reaches –20C, or boom reaches –40C, start the TVTest run.
15. Again, request the "Dummy" file transfer.
16. At the end of the TVTest, start the heat up cycle again.
17. Continue the hot-cold cycling until -5C for the last cycle. Instruct the Lockheed test support personal that we are about to initiate the lanyard cutting (They will close a value in the chamber to protect their equipment from contamination.)
18. At this point initiate the lanyard cutting
19. Note the start time, the start of the heating and the cutting of the lanyard.
20. Continue to the end of the hot-cold cycling.
21. Download the housekeeping data files and other files collected during the test.
22. Power down spacecraft and remove from the chamber.

QuakeSat/P-Pod Axis
Figure 2.1