Bendix

Aerospace Systems Division

System Level Non Corona Verification Test	NO. ATM 919 / REV. NO.
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The purpose of this ATM is to describe the System Level Non Corona Verification Test that was conducted on the MSFN Central Station and to summarize the results of this test.

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1.0 INTRODUCTION

Engineering thermal-vacuum tests conducted on Bendix transmitters EM-2 and EM-3 have indicated that the transmitters exhibit corona effects in the pressure range of 10^{-1} through 10^{-3} torr. These tests were conducted by turning-on a transmitter at ambient pressure and subjecting it to a decreasing pressure environment. It was found that the corona effects are self-extinguished as the pressure drops below the 10^{-3} torr range and that the corona may be extinguished in the 10^{-2} torr range by momentarily turning the transmitter off and then on again.

On the basis of the above information it was decided at the transmitter delta QTRR that a system level thermal-vacuum test should be conducted on a central station representative of the Array A-2/Array D configuration to determine the worst case pressure environment that the transmitters will see and to demonstrate that corona will not occur in this environment.

The System Level Non-Corona Verification Test was conducted on the 22nd and 23rd of October 1970 in accordance with TP 2347077. Representatives of BxA Quality Assurance and DCASR were present to witness the subject test and to verify the test data.

2.0 TEST OBJECTIVES

The objectives of the test were to establish:

1. The Central Station Thermal Bag pressure environment at the time of simulated lunar turn-on and at-simulated lunar noon conditions.

2. The pressure differential existing between the inside and outside of the thermal bag during a worst case mission simulation.

3. Verification that transmitter corona would not occur at simulated lunar turn-on and lunar noon conditions.

3.0 TEST SETUP

3.1 Test Item

The test item consisted of the MSFN Central Station (2340975) and thermal bag in the stowed configuration. The ASE Central Station Electronics package was removed and vacuum gages mounted in its place. Changes to the MSFN Central Station components were as follows:

1. The Philco transmitters were removed and a BxA engineering transmitter (EM-2) was installed.

2. The Motorola engineering receiver (EM-1) was substituted for the Philco receiver.

3. A Gulton timer (EM-1) was added. The Bulova timer was not removed because it was hard wired to the wiring harness.

For the subject test the only components in the Central Station that were operated were the transmitter, diplexer switch and filter. A layout of the Central Station test configuration is shown in Figure 1.

3.2 Instrumentation

The temperature of the Central Station Thermal Plate was monitored at seven different points by means of copper-constantan thermocouples and recorded on a Daystrom recorder. The location of these thermocouples is shown in Figure 2.

The pressure inside the thermal bag was determined by means of a thermistor vacuum gage (GE 22GT300) and a miniature nude ionization vacuum gage (GE 22ET115). The location of these gages is shown in Figure 1. The pressure of the space chamber was measured by an alphatron and an ionization vacuum gage.

At the time of transmitter operation, the transmitter input-output parameters were monitored periodically on the RF Test Set (Test Set #1). The parameters measured were +29V current and voltage, RF power, telemetry points, and transmitter frequency.

3.3 Test Configuration

The subject test was conducted in the BxA 4 ft by 8 ft space chamber with temperature control of the central station being maintained by a Tenny Heat Exchanger. The test setup is shown in Figure 3. A variable leak valve was installed on the space chamber to allow simulation of the SEQ Bay pressure environment since this pressure is greater than the ultimate pressure of the space chamber.

4.0 TEST SEQUENCE AND ENVIRONMENTAL CONDITIONS

The test sequence and corresponding environmental conditions were established to provide a worst-case simulation of the ALSEP mission. The elapsed time of each mission phase was accelerated and the pressure and temperatures were equal to or greater than those anticipated during the mission. The simulated mission phases were as follows:

1. SEQ Bay Environment - 5×10^{-4} to 5×10^{-5} torr for 10 hours at an average thermal plate temperature of $105^{\circ}F \pm 5^{\circ}F$. Transmitter non-operating.

2. Lunar Surface Turn-On Environment - 1×10^{-6} torr and average thermal plate temperature of $105^{\circ}F \pm 5^{\circ}F$. Turn-on of the transmitter occurred 90 minutes after completion of the SEQ Bay Environment.

3. Lunar Noon Environment - 1×10^{-5} torr or less for 6 hours at an average thermal plate temperature of $140^{\circ}F \pm 5^{\circ}F$. During this phase the transmitter was operated continuously.

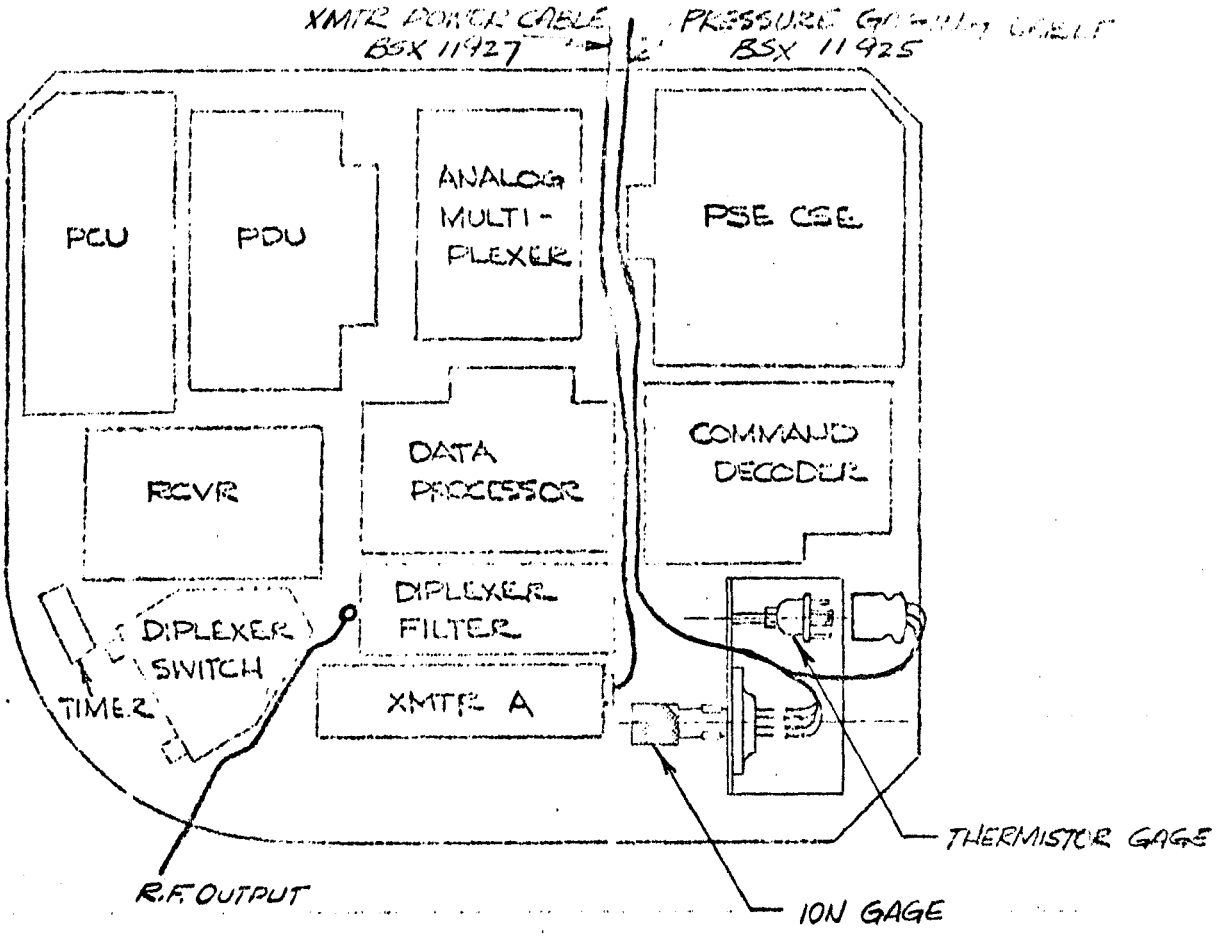
5.0 TEST RESULTS

At the time of transmitter turn-on the Central Station Thermal Bag pressure was 2×10^{-4} torr. This pressure did not rise above 9×10^{-4} torr throughout the operational phases of the mission. Figure 4 shows the Thermal Bag and space chamber pressures throughout the simulated mission. The pressures shown in this figure are corrected values based on a calibration of the vacuum gages prior to initiation of the test. As can be seen in this figure, the pressure profiles in the Thermal Bag and

and space chamber follow each other quite closely with a maximum pressure differential of approximately 2.5 decades at the lunar noon phase of the mission. At the time the transmitter was turned-on and throughout the period during which it was operated, there were no indications of corona. All of the transmitter input-output parameters remained within their specified limits throughout the test.

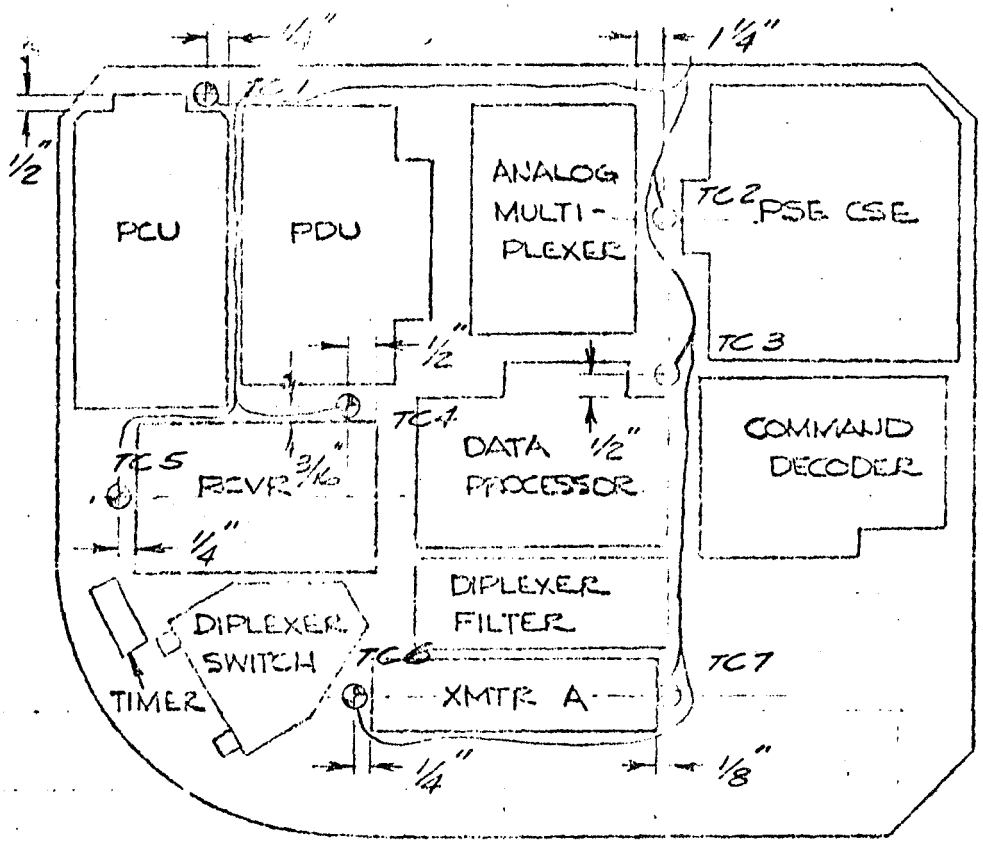
6.0 CONCLUSION

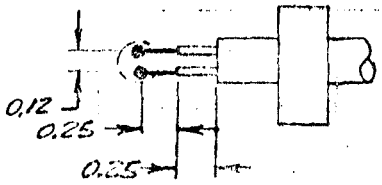
The test results indicate that even under worst case deployment conditions the environment within the Central Station Thermal Bag will will not support corona.



NOTE: C/S Harness was installed but was not used for functional tests. Harness not shown for clarity.

Figure 1 Central Station Test Configuration





1. SPOT WELD TO THERMAL PLATE
2. APPLY SPOT OF EPON 901 OVER WELDS
3. STRESS RELIEVE WITH 3M GREEN UTILITY TAPE AS REQUIRED.
4. THERMOCOUPLES CU-CON, 8FT ± .5 FT. NO. 30 AWG

Figure 2 Central Station Thermocouple Locations

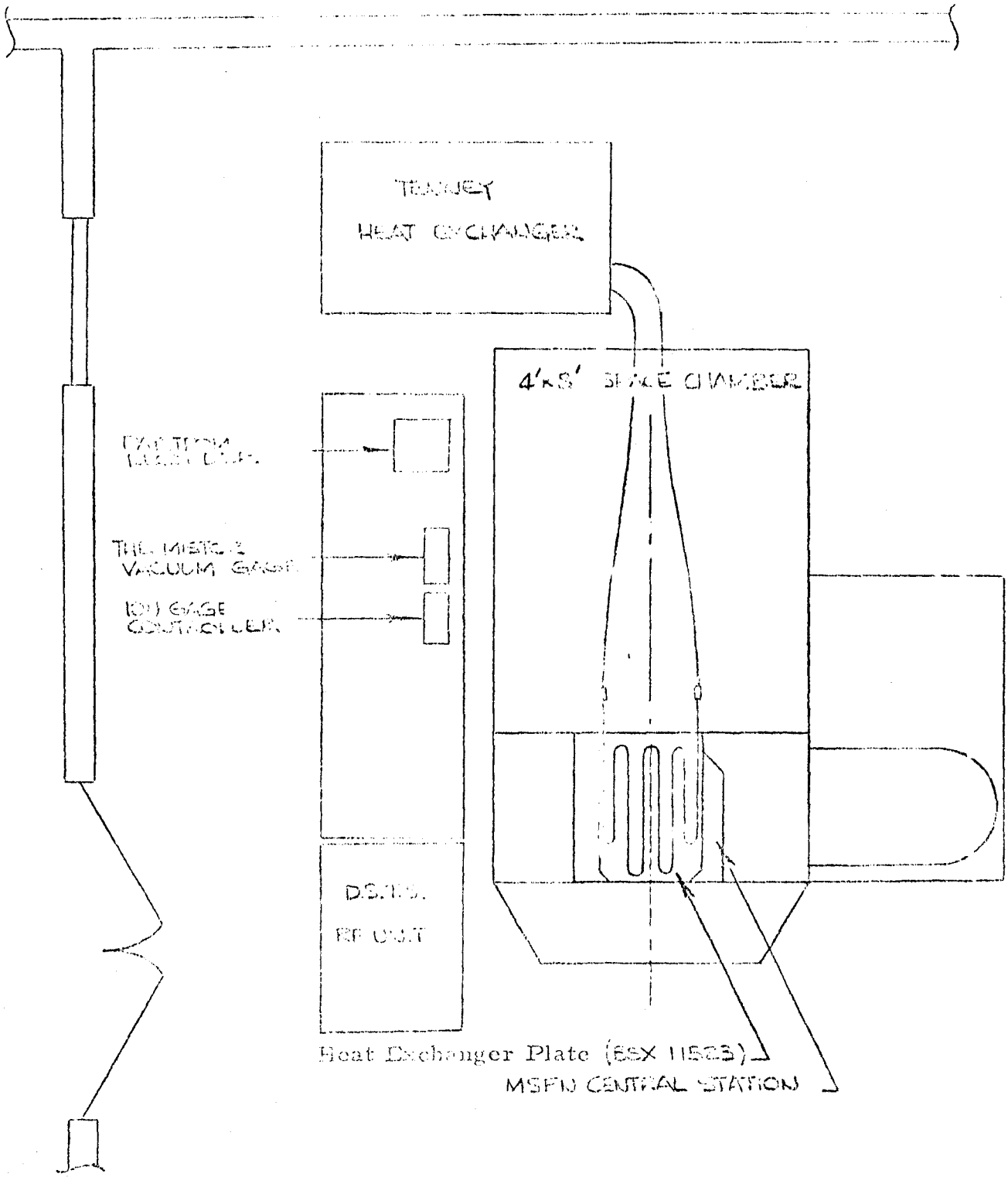


Figure 3 Test Configuration

T/V CHAMBER VERSUS THERMAL BAG PRESSURE