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ENVIRONMENTAL TEST PROGRAM OF THE BEACON EXPLORER SPACECRAFT

OCTOBER 1964

GODDARD SPACE FLIGHT CENTER
GREENBELT, MD.

Copy No. 27

ENVIRONMENTAL TEST PROGRAM
OF THE
BEACON EXPLORER SPACECRAFT

TEST AND EVALUATION DIVISION
OFFICE OF TECHNICAL SERVICES, GSFC

ENVIRONMENTAL TEST PROGRAM

OF THE

BEACON EXPLORER SPACECRAFT

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TEST PROGRAM

STATUS

This report covers the Environmental Test Program for the Prototype Spacecraft (SN 34), Flight I Spacecraft (SN 35), and Flight II Spacecraft (SN 36).

Flight I Spacecraft (SN 35) is now in orbit and is designated Explorer 22.

The BE-C program remains to be accomplished.

AUTHORIZATION

GSFC Job Order No. 320-S-95-01

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ENVIRONMENTAL TEST PROGRAM
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SUMMARY

The Environmental Test Program for the Beacon Explorer Spacecraft was performed by the Applied Physics Laboratory of the Johns Hopkins University, Silver Spring, Maryland, from March 1963 thru September 1964. Testing of BE-C (Prototype refurbished) remains to be accomplished.

The primary problem areas during the test program were in the optimization of the thermal design affecting the batteries, and developing a thorough evaluation of the current limiter through environmental test conditions.

Flight spacecraft II (SN 36) was launched from Cape Kennedy by Delta No. 24 on March 19, 1964 but failed to achieve orbit.

In a launch from the Western Test Range on October 9, 1964, the Scout vehicle placed the Beacon Explorer into orbit. The satellite is functioning satisfactorily except that the base plate temperature is higher than expected in 100% sun which necessitates turning off the APL Doppler Beacons temporarily to keep internal temperatures down. However, the mission of the satellite is being fulfilled, and about November 12, 1964 when the spacecraft went out of 100% sunlight, the dopplers were turned on and the spacecraft is now operating as planned.

ENVIRONMENTAL TEST PROGRAM
OF THE
BEACON EXPLORER SPACECRAFT

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INTRODUCTION

The environmental tests of the Beacon Explorer spacecraft, formerly called Polar Ionosphere Beacon S-66, and subsystems were performed by the Applied Physics Laboratory of the Johns Hopkins University, Silver Spring, Maryland. The test plans and specifications were approved by the Test and Evaluation Division of the Goddard Space Flight Center, and the spacecraft environmental tests were monitored by a representative from the Test and Evaluation Division in conjunction with the Beacon Explorer Project office.

The goal of the environmental test program is to provide a high degree of confidence that the flight spacecraft will survive the environments of storage, ground handling, prelaunch, launch, and injection into orbit, and will operate satisfactorily in the environment of space for a period of at least one year.

This report presents data and comments on the major events occurring during the environmental testing of the Prototype (SN 34) and Two Flight Spacecraft (SN 35 and 36). A bibliography of test specifications and test reports is listed in Appendixes C and D.

TEST OBJECTIVES

The Beacon Explorer Prototype Environmental Test Program objectives were to:

(a) Demonstrate the ability of the design to meet all performance requirements and have a satisfactory life expectancy.

(b) Subject the spacecraft to test levels and time durations of sufficient magnitude to assure finding and correcting major design weaknesses and attempting to exceed the "infant mortality stage" of the system. Specifications are set at the 99% confidence level to meet this objective.

(c) Verify that particular samples of previously employed hardware are suitable in a new application.

(d) Discover unexpected interactions between subsystems when the spacecraft is exposed to environmental stress.

The Beacon Explorer Flight Acceptance Environmental Test Program objectives were to:

(a) Locate latent defects in material and workmanship.

(b) Verify design practices were carried over to flight spacecraft, or to evaluate deviations from the qualified design which may affect performance.

(c) Demonstrate the compatibility of all parts of the system under simulated launch and orbital environments.

(d) Provide reasonable assurance that the environmental stresses associated with spacecraft handling, shipment, launch, and orbit could be sustained. Specifications are set at the 95% confidence level to meet this objective.

(e) Provide training of personnel who will be responsible for the spacecraft at the launching site and those who will be responsible for data reduction and analysis.

TEST PLAN

The Beacon Explorer test plan covered four phases:

(a) Prototype testing of spacecraft subsystems

(b) Prototype Design Qualification of complete spacecraft

(c) Flight Acceptance testing of spacecraft subsystems

(d) Flight Acceptance testing of complete spacecraft.

The test plans and specifications are listed in Appendix C. The emphasis of this report will cover phases (b) and (d).

TEST SETUP

Briefly, the test setup for vibration and thermal vacuum was as follows:

(a) Vibration: The spacecraft was first mounted on a Ling 10,000 lb. force vibration exciter in the thrust plane and subjected to a sinewave sweep between 5 and 1000 cps. The spacecraft was mounted on a rocket case to accommodate the flight solar blades. The attenuation of mechanical vibrations above 1000 cps by the rocket case necessitates the completion of the 5-2000 cps sinewave specification with the blades and rocket case removed, and the adapter attached directly to the shaker for vibration above 1000 cps. All lateral plane vibration was done without flight solar blades.

(b) Thermal Vacuum: The spacecraft was suspended in the vacuum chamber by means of a nylon rope looped through a steel ring which contained the steel cables upon which the spacecraft hung. Two aluminum brackets attached to the solar blade mounting fixtures were used as the suspension points for the spacecraft. The external thermal flux was simulated by using a LN_2 cryowall in conjunction with infrared lamps. The laser reflector heating was accomplished by using one bank of four 375 watt infrared reflector lamps. The outer shell side panels and partial laser reflector heating was accomplished by using three banks of eight 375 watt reflector lamps. The radiator or baseplate heating was accomplished by attaching an aluminum foil skirt at the baseplate in order to shield the entire baseplate from all heat sources external to the two 500 watt tubular quartz lamps centrally located beneath the spacecraft. There was individual and automatic control of the heat being applied to the laser reflector, the outer shell side panels, and the baseplate.

The solar blade stub heating was accomplished by attaching electrical resistance heaters to the stubs.

TEST RESULTS

Prototype Spacecraft (SN 34)

During shock and vibration tests, the spacecraft incurred two minor failures during vibration. These failures were (1) a shift in frequency due to loosening of a tuning screw and a broken mica glass capacitor in the antenna coupler, and (2) a sheared rivet on locating key between spacecraft and adapter. Following repairs, the spacecraft passed the tests successfully.

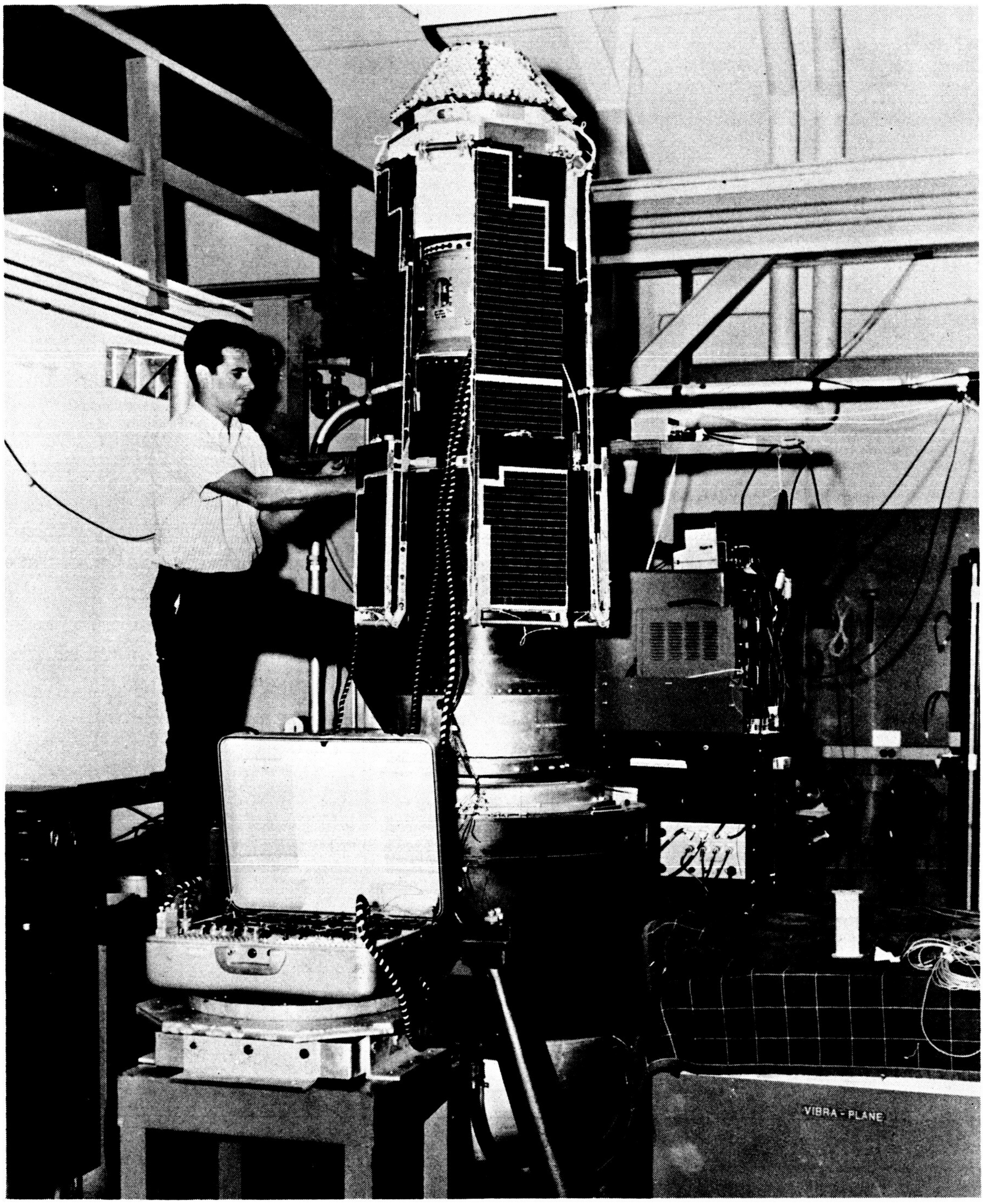


Figure 1 – Satellite S-66 SN 35 Mounted on Vibration Table

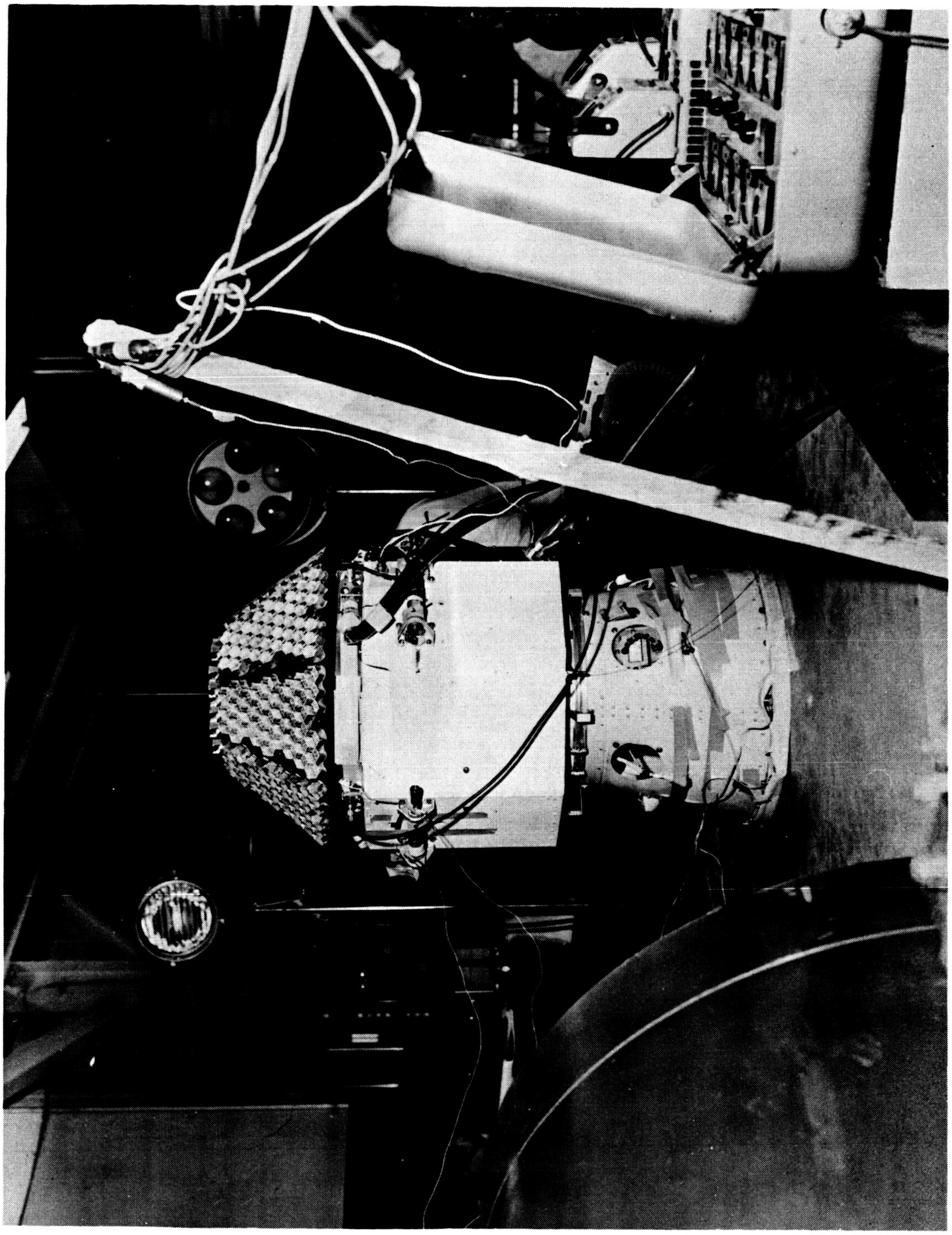


Figure 2 – S-66 Flight Payload Mounted on Vibration Slippery Table

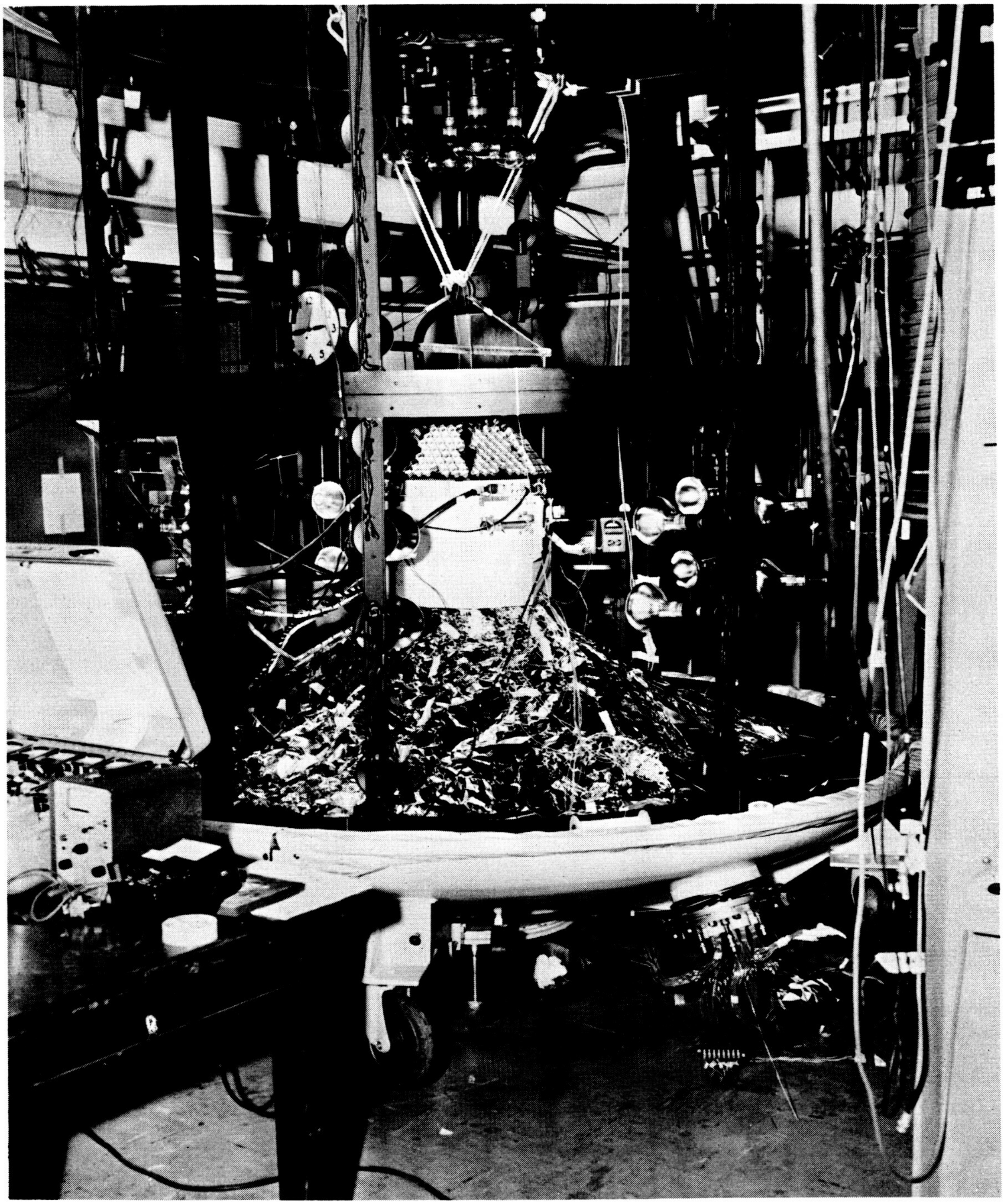


Figure 3 – Satellite S-66 SN 35 Mounted on Vacuum Chamber Door

Three problems developed during the thermal vacuum tests. These were:

(1) After one hour under vacuum in the hot cycle simulating the transition orbit just after entering or just prior to leaving 100% sun, a transistor and a diode in the heat sink on the power amplifier stage of the 324 Mc transmitter failed. The heat sink was changed from Boron Nitrate to Beryllium and missing hold down screws were installed and tightened.

(2) After 136 hours under vacuum during the hot cycle, a transistor in the current limiter failed. To provide additional capacity, two Germanium transistors were connected in parallel and installed on the baseplate. After 66 additional hours under vacuum, the hot cycle was considered satisfactory.

(3) After 88 hours under vacuum during the cold cycle, it was determined that the battery temperatures were running too cold for long life (50°F). Additional insulation was installed around batteries. After 117 additional hours under vacuum, the thermal vacuum test was considered satisfactory.

The total time in thermal vacuum for the Prototype spacecraft was 470 hours.

Flight Spacecraft I (SN 35)

This spacecraft was subjected to two series of complete environmental tests for flight spacecraft. The first series was during March and April of 1963 in preparation for a Scout launch from the Western Test Range. Due to launch vehicle problems, this launch was cancelled and a second series of tests were run during June through August of 1964 for the Scout launch of October, 1964 (using rocket motor X-258 fourth stage). The spacecraft was refurbished for the second series of tests with replacement of several structural members and subsystems.

SN 35 First Series of Tests, March-April 1963

During vibration tests, one antenna coupler adjusting screw loosened (See Prototype tests). This was solved by placing lock nuts over the screws as the screws could not be permanently secured before final tuning.

After the vibration tests, welds in the bottom ring of this laser reflector were found to be cracked. The ring was redesigned and welding techniques were changed. All retests were satisfactory.

After 67 hours of thermal vacuum, it was determined that the Command Receiver battery temperatures were running lower than desired. This situation arose in the Prototype spacecraft and was substantiated during this test. After removal from the chamber for insulation modification, it was discovered that the PDM commutator was not counting properly and was replaced. Following modifications, the spacecraft proceeded to the completion of thermal vacuum with no further trouble. Total time under thermal vacuum conditions was 161 hours.

SN 35 Second Series of Tests, June-August 1964

During the first thrust plane sinewave sweep, a prism vibrated loose from the laser reflector at approximately 100 cps. Following repairs, no further failures occurred.

Three problems developed during the thermal vacuum testing which were:

(1) The battery to battery support plate thermal resistance was less than preferred value. This problem occurred on all spacecraft. Mica washers were installed to reduce the significance of the uncertainty of a thermal contact resistance. This did not work and additional insulation was added. In addition, the mica washers were replaced with silicone glass bushings. The thermal resistance was still less than calculated value. The discrepancy was traced to an installation error. (Wrong number of layers of insulation.) Upon correction, and addition of insulation to the ends of the battery tube, the problem was solved.

(2) Due to reduced levels in the artificial radiation belt, it was decided to include a power dump capability to the regulator over-ride circuit by adding two 360 ohm resistors in parallel on the baseplate. This was later changed to three series zener diodes in place of the two 360 ohm resistors.

(3) The SCO drive to the phase modulator in the TM transmitter was reduced to improve TM compatability between the spacecraft and NASA tracking stations.

Total time under thermal vacuum conditions was 362 hours.

Following environmental tests, it was determined that the spacecraft was three pounds overweight (133 lbs vs 130 lbs). To reduce the weight, the radiation shields were changed from brass to aluminum. A vibration retest was satisfactory.

Flight Spacecraft II (SN 36)

Following the cancellation of the Scout launch in 1963, approval was obtained to switch to a Thor Delta launch from the Eastern Test Range and Delta No. 24 was assigned. This change required a different adapter, and of course different vibration specifications. Prior to commencing environmental tests on SN 36, the Prototype spacecraft was requalified to the latest Delta vibration levels using the new adapter.

(SN 36)

During random thrust vibration, a connector became loose between the buffer and oscillator for the 162-324 Mc frequency. The connector was tightened. No further trouble.

After approximately 4 hours of thermal vacuum testing, it was determined that spacecraft internal temperatures were running cooler than desired and the Active Temperature Control remained on almost continuously to compensate for this difference. A second series of tests confirmed that the radiator and outer shell temperatures, in accordance with thermal design values, were too low. By changing the surface a/e ratio (paint from white to gray), the temperatures were raised to acceptable levels.

Total time under thermal vacuum conditions was 195 hours.

Subassemblies

All subassemblies were tested under vibration and thermal vacuum conditions in accordance with prescribed specifications before integration into the spacecraft structure.

The flexible despin strap was qualified for flight by a test program at APL and AEDC with the X-258 rocket motor.

FIELD OPERATIONS

Western Test Range

During operations in April 1963, items replaced at the range include the buffer-regulator card burned out by defective GSE, thermistor on the blade assembly, thermistor on the aspect sensor, blade erection telltale microswitch, and a jumper harness. The launch was postponed and field operations were cancelled while the Scout vehicle was undergoing a reliability review.

In July 1963, while the spacecraft was in storage at WTR, APL and GSFC personnel made estimates of radiation damage using GSFC curves for radiation fluxes. With Germanium transistors in the outer books,where shielding was practically negligible, perceptible damage would have occurred to the transistors in about one week. On August 13-16, 1963, brass radiation shields were installed over the outside books. No retest was performed.

Due to launch vehicle problems, the launch was cancelled, and the spacecraft (SN 35) was returned to APL in November 1963.

Following the Delta failure at the Eastern Test Range, a Scout launch was once again attempted during September-October 1964.

The combined BE-B (SN 35) and the Scout 4th stage (X-258) required an excessive amount of spin time (60 spins for a total of 200 minutes) attempting to achieve a stringent balance of 77 oz-in^2 which LRC requested. Afterwards, LRC accepted 104 oz-in^2 as being adequate, especially since the Air Force could not do any better with the existing balancing equipment. The equipment does not give a direct reading of balance, and there was some difference of opinion as to the actual balance from calculations.

On October 9, 1964 the BE-B (SN 35) was successfully launched into orbit.

Eastern Test Range

Flight spacecraft II (SN 36) was launched by Delta No. 24 on March 19, 1964 but due to third stage burn of only 22 seconds, the spacecraft failed to achieve orbit.

Changes in the field included a new Yo-Yo despin cable (one was too short for the particular X-248 used), and modification to two sublimation switches to ensure shorting on all contacts before launch. These switches initiate separation. The switches were qualified in vibration and vacuum after modification.

CONCLUSIONS

The expected temperature range from test results for the BE-B satellite (SN 35) instrument section is 50 to 85°F and for the main batteries from 60 to 100°F.

Results from the Prototype spacecraft (SN 34), and first series of thermal vacuum tests on Flight spacecraft I (SN 35) suggested that a more thorough evaluation of the current limiter could be accomplished by test conditions that include temperature cycles and power cycles that more nearly represent the expected orbital conditions rather than using average integrated values. These conditions were simulated on Flight spacecraft II (SN 36), and retest of Flight spacecraft I (SN 35).

The thermal vacuum test was designed to provide a thorough evaluation of the current limiter and an extensive simulation of expected orbital conditions.

During tests simulating power inputs degraded to one year values, it was necessary to operate the spacecraft in the "power boost" mode to supply the spacecraft electrical loads. This was not unexpected.

The current limiter duty cycle from tests indicate for an orbital period of 108 minutes, the limiter would be in high mode for 36 minutes per orbit in a 100% sunlit orbit, and 57 minutes per orbit in a 67.6% sunlit orbit (SN 36).

A good illustration of the calculated risk the project takes when making design changes between the Prototype and Flight spacecraft is shown by the change in the PAM Commutator from a Hathaway type to the Strothers Dunn type. Although the change was considered an improvement, it resulted in the necessity to move the spacecraft orientation magnet to the opposite side of the spacecraft because of interference with the sensitive REED relays.

There was good correlation between all spacecraft concerning the type of malfunctions or problem areas that occurred, particularly in the thermal design and current limiter fields. This indicates that planned design practices were in fact carried over from one spacecraft to the next. It also indicates that the test program was valid for qualifying and accepting these spacecraft for launch.

It was unfortunate that the problem of radiation damage was not known earlier in the program. This was attributed to lack of data at the time of design. However, the problem was recognized and a satisfactory solution developed.

SPACECRAFT PERFORMANCE IN ORBIT

Flight spacecraft I (SN 35), designated Explorer 22, has an apogee of 1076 km, perigee of 884 km, inclination of 79.7°, and a period of 104.7 min.

During the first 48 hours of spacecraft operation, the internal temperatures were at the top of the tolerance band, which necessitated turning off the APL Doppler beacons (162 and 324 Mc) temporarily. Base plate temperature is still higher than expected, probably due to spacecraft oscillation, and limited operation of the APL Doppler will be maintained in 100% sun.

Ten days after launch, in 100% sunlight, the latest data indicates that the baseplate temperature is higher than anticipated by about 34°F. The temperature is running from 33°F to 100°F. Investigation of data is continuing. The temperatures near the laser reflector end of the satellite are as expected. This situation results in typical average temperatures of the electronic books at 94°F, main batteries at 106°F, and command batteries at 116°F. The internal temperatures are therefore about 13°F to 22°F higher than expected for 100% sunlight although not out of the tolerance band. The oscillator is running about 84°F as expected. Since November 12, 1964 with the spacecraft in partial shadow, the baseplate temperature is near nominal.

The current regulator batteries, etc., are performing well and the differential temperature is as expected.

Thus far, the laser tracking experiment has given inconclusive results, due to the return beam being apparently too weak to differentiate between system noise and other interference. Further tests are continuing.

All beacon experiments are functioning properly and are transmitting strong, clear signals.

Latest information indicates the primary cause of higher temperatures in 100% sunlight was the peculiarity of the orbit at the time of launch in that not being a true polar orbit, i.e., 80° inclination, and the fact that the geomagnetic pole is off of true north, resulted in the baseplate facing the sun at a more direct angle than anticipated. This condition is exaggerated twice a year, either maximum or minimum, and since this launch was subjected to the maximum condition, the temperatures will not exceed those already encountered. Correcting for these facts accounts for all but a 10°F differential.

Appendix A

BACKGROUND INFORMATION

MISSION*

The mission of the Beacon Explorer program is to conduct ionospheric measurements on a worldwide basis. The program will determine the total electron content of a vertical cross-section of the ionosphere located between the satellite and the earth. Accomplishing this objective will aid in establishing the behavior pattern of the ionosphere as a function of latitude, time of day, season, and solar cycle.

DESCRIPTION OF SPACECRAFT

The Beacon Explorer is an octagonal-shaped spacecraft 18" in diameter and 12" high, with four solar panels 10" wide and five and one-half feet long extending from its sides like the blades of a windmill. It weighs 130 pounds. The shell is made of honeycomb nylon and Fiberglas.

Four signals will be transmitted for ionospheric experiments. These are 20, 40, 41, and 360 megacycles. Two signals at 162 and 324 megacycles will be used for the Doppler tracking experiment.

The LASER reflector is made up of 360 one-inch prisms mounted on an eight-sided pyramid. The prism material is fused silica.

A bar magnet will passively orient the Beacon Explorer along the Earth's magnetic field.

An automatic temperature control system will maintain the minimum internal temperature at about 70°F.

An Electron Density Experiment (GSFC) is also on the spacecraft.

*Beacon Explorer B (BE-B) Project Development Plan, Rev. 1.

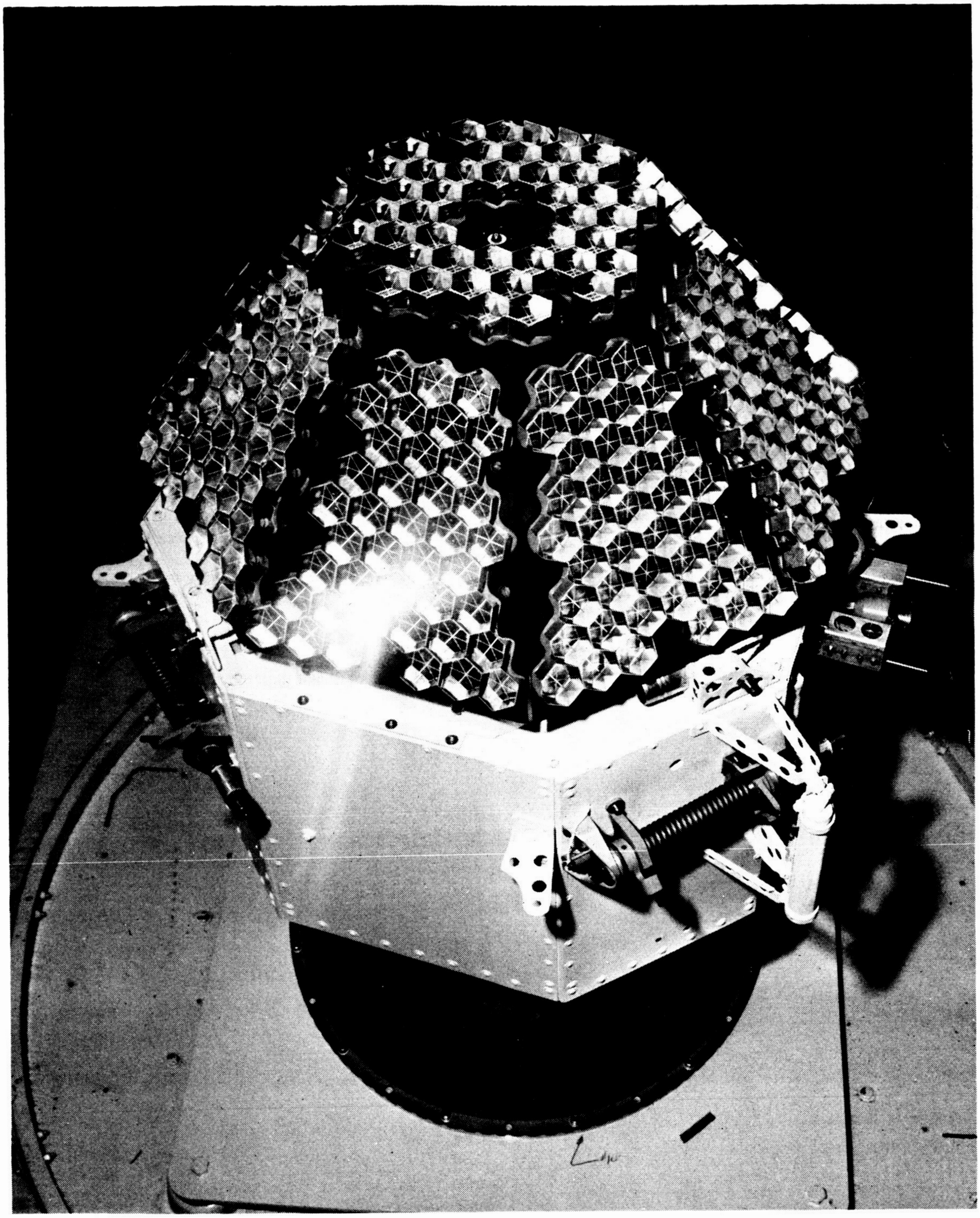


Figure A-1- Laser Reflector Mounted on Spacecraft

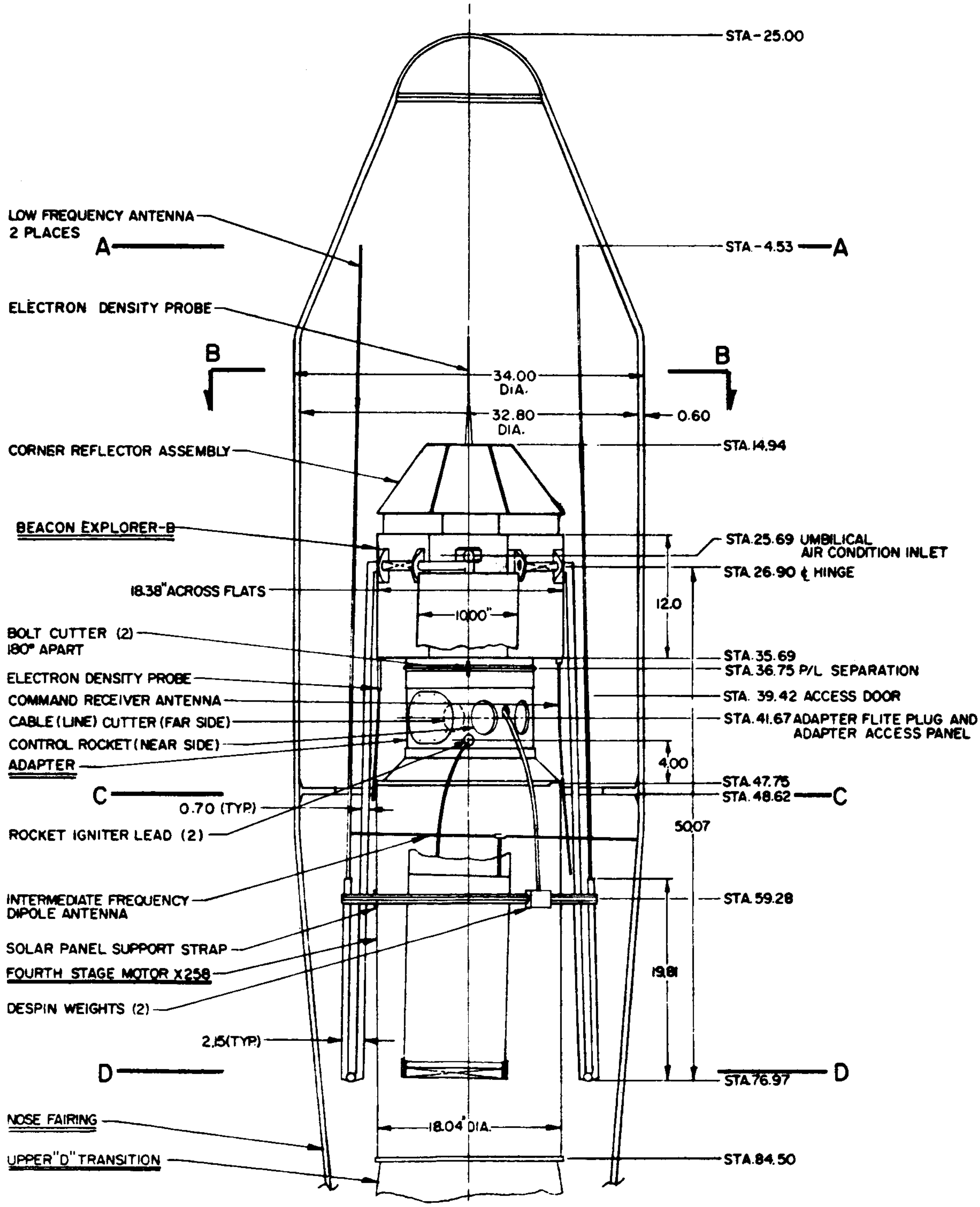
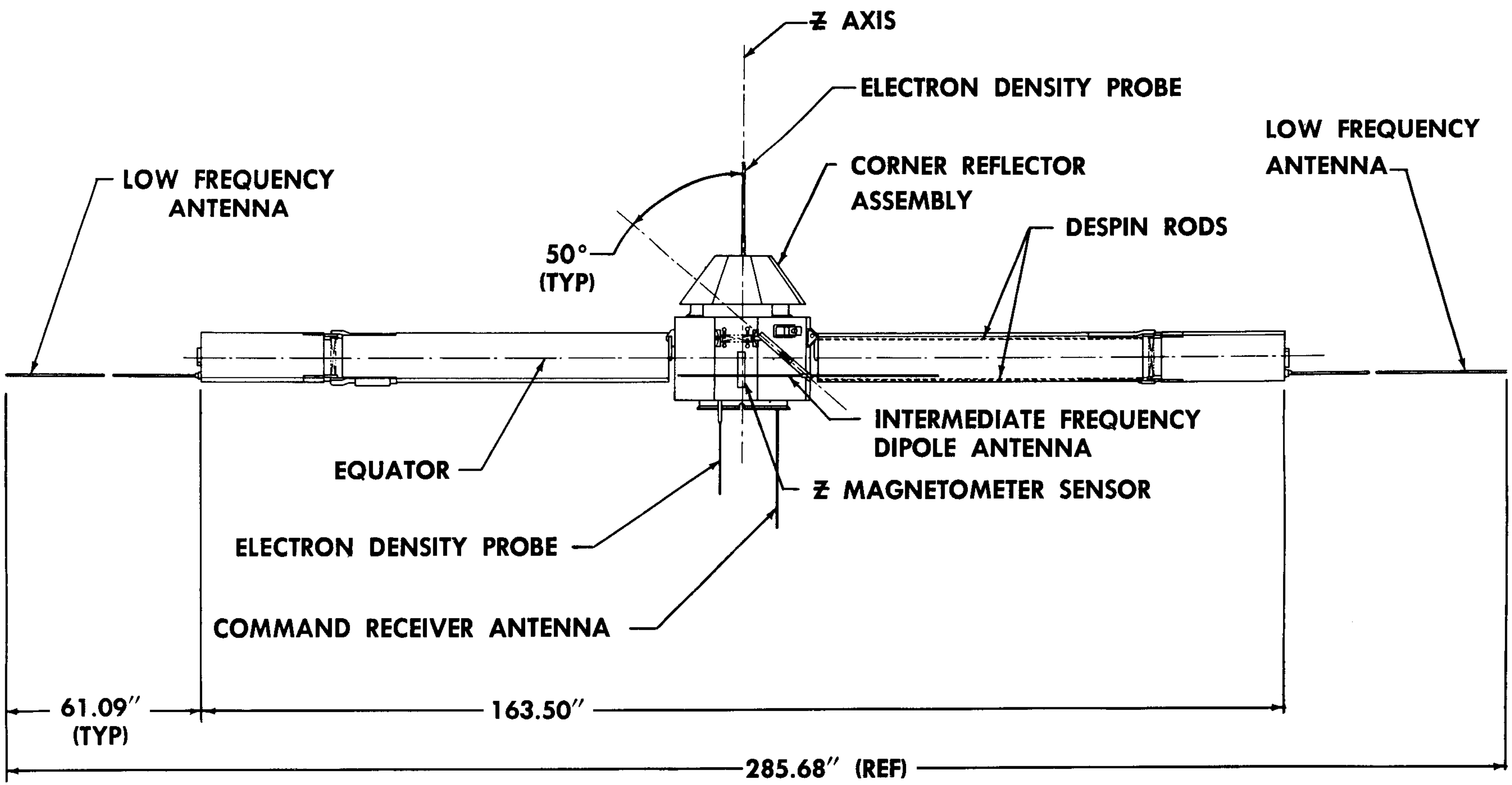


Figure A-2- Launch Configuration NASA S-66/Scout



NASA S-66 SATELLITE

ORBIT CONFIGURATION

EQUATORIAL VIEW

Figure A-3– NASA S-66 Satellite, Orbit Configuration

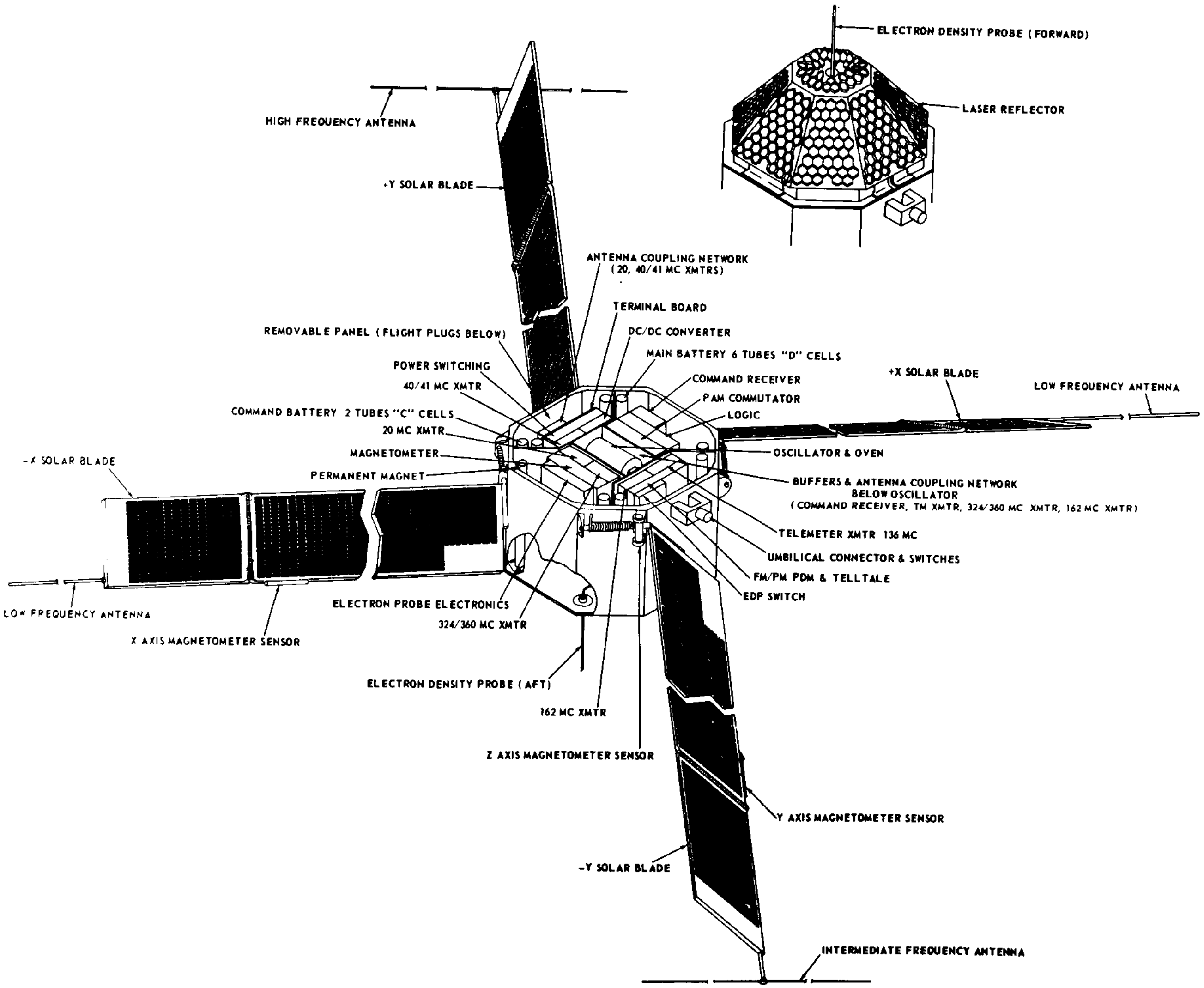


Figure A-4- BE-B Spacecraft, Cutaway View

Appendix B

SPACECRAFT PERFORMANCE REVIEW
BE-B FLIGHT SPACECRAFT SERIAL NO. 35

SUMMARY

Flight Spacecraft, Serial No. 35, has satisfactorily passed environmental tests from the period June 19 to August 6, 1964 in accordance with APL Design Data Sheets which were approved by GSFC. The spacecraft is now qualified for launch.

All retests were in conformance with GSFC policy with no waivers requested or granted for these tests. The retests consisted of thrust random vibration at flight levels for two and one-half minutes, and thermal-vacuum for six days.

Spacecraft, Serial No. 35, successfully passed flight acceptance tests during March and April of 1963 in preparation for a PMR launch which was later cancelled due to vehicle problems. Since that time, the spacecraft has been refurbished for the current series of tests. All items suspected of being degraded or of possible fatigue, if subjected to another test program, were replaced prior to the current flight acceptance tests.

The major problem encountered during tests was pertaining to the thermal insulation design properties affecting the batteries. Although not in the category of a failure mode, the theoretical calculations and actual test results did not agree and the battery temperatures were not optimum. This was corrected by adding additional insulation around the batteries and by a minor modification to the battery mounts to provide a known thermal path to the support structure.

Two design improvements were incorporated during the testing period. These were (a) changing the command batteries from 1-1/4" "C" size Sonotone (8) to 1-3/4" "C" size Sonotone (8) in order to provide additional capacity, and (b) modifying the regulator override to eliminate any possible battery overcharge condition. This modification was deemed advisable due to reduced radiation levels in the artificial radiation belt which eliminated the necessity for the override except as a redundant feature.

The other items noted on the boxscore were either minor items or not directly resulting from environmental tests and were easily corrected.

Two special tests were added at the end of the thermal-vacuum retest which were:

(a) Minimum sun override test to determine the protection the zener diodes (override modification) would provide to the batteries and how high the battery temperature would go; and

(b) Regulator normal, 82% sun to test the cycling of the regulator from high to low modes of charging rate. Both tests were satisfactory and were within design limits.

SPACECRAFT PERFORMANCE REVIEW

BE-B FLIGHT SPACECRAFT SERIAL NO. 35

GENERAL

1. (a) The solar cell blades, represented by line items B-2 to B-27, E-2 to E-27, and J-2 to J-27, were tested as a subsystem to vibration on March 25, 1964, and under thermal-vacuum conditions for 212 temperature cycles from nominal -70°F to +150°F on April 8, 1964, through April 20, 1964.

(b) The Yo-Yo and Despin Strap, indicated by line items G-2 to G-27, were tested as a subsystem to the following tests:

Date of Test	Type Test	Results
2/3/64	Expansion test with dummy X-258 (3/16" expansion).	No measureable change in Yo-Yo tension.
2/4/64	Flexibility of silicon sponge rubber used on strap (in a vacuum).	Satisfactory.
2/5/64	Vibration - Flight and Prototype Scout Levels using dummy blades, X-258 dummy, Satellite.	No damage. No excessive loads.
2/26/64	Static firing test at AEDC.	Satisfactory. Approved by LRC.

2. There were six periods of shut-down in the thermal-vacuum test, shown by columns 6, 10, 13, 15, 18, and 22. Column 6 was for the purpose of changing a thermistor, column 10 prior to second liftoff phase, and column 13, 15, and 18 for modifications. Column 22 represents a shutdown to repair a chamber cable and feed-through (TM 136, 162 Mc to dummy load outside chamber).

BOXSCORE LINE ITEM REFERENCE

1. STRUCTURE

Line Item	Comments
C 12-13	During minimum sun conditions with steady boundary temperatures and steady power input, the thermal resistance between the main batteries and supporting structure was approximately 15°F per watt instead of desired 25°F per watt. Additional insulation was added to batteries.
C 14-15	Thermal resistance did not change. Additional insulation was added to batteries.
C 17-18	The thermal resistance still did not change to an appreciable degree. Insulating spacers were added to the battery mounting which will channel the thermal path through the bolts to the supporting structure. Insulation added to top and bottom of batteries.

2. POWER

Line Item	Comments
D 12-13	The regulator override, which allows approximately 10% additional power in 100% sun, and 40% additional power in 67% sun over the regulator normal mode, is no longer required, except as a redundant feature, due to reduced levels in the artificial radiation belt. During initial power, minimum sun condition, the batteries could be overcharged by as much as 900 m.a. in the override mode. This is considered dangerous to the life of the batteries. This mode could occur by spurious command, sticking in this position when changing modes, or by ground station error. <u>Action</u> — A decision was made to add a resistor in the regulator override which will reduce current by about 40% in minimum sun, and 10% in 100% sun. This in effect will limit the override current to about the same value as in regulator normal, and will be a redundant switch in case the regulator fails. The danger of overcharging the batteries will be eliminated.
D 17-18	The command batteries were changed from 1-1/4" "C" size Sonotone (8) to 1-3/4" "C" size Sonotone (8) in order to provide more capacity.

Line Item	Comments
D 17-18 continued	The resistor added to the regulator override was changed to zener diodes in order to charge directly from solar panels to batteries.

3. SEPARATION

Line Item	Comments
F 1	The Adapter/Pieplate interface plug was wired wrong. Functions involved are: two tip-off rocket safety shorts, one rocket timer safety short, one telemetry channel for adapter functions, and one ground. The adapter batteries were too weak to receive telemetry. Solution — The adapter functions were monitored directly with a meter during the first phase of sinusoidal vibration. The primary purpose of this phase was to check structural integrity of combined setup using dummy X-258. Immediately following test, the interface plug was rewired and the batteries charged. All following vibration tests were satisfactorily accomplished through telemetry.

4. MINITRACK (HOUSEKEEPING)

Line Item	Comments
P 4 thru 6	Defective (marginal) thermistor on main battery 2-1 was replaced.
N 12-13	The telemetry transmitter modulation deviation must be reduced in order to be compatible with NASA ground stations. This is due to band widths and/or equipment presently set up at NASA ground stations. This affects only the telemetry tracking and housekeeping information. This condition should have been checked out during initial integration!

5. LASER EQUIPMENT

Line Item	Comments
S 1	One prism fell off during thrust vibration at approximately 100 cps. Determined to be workmanship problem. Prism bonded back on and several other prisms strengthened. No further trouble.

August 6, 1964

BE-B
(S-66a)
Serial No. 35

POLAR IONOSPHERE BEACON

			VIBRATION			THERMAL-VACUUM															VIB.	THERMAL-VACUUM								MAG.	SUN	BAL.		
		TEST CONDITION	Thrust Sine & Random w/X-25B 10-1000 cps	Thrust Sine 1000-2000 cps	Lateral X-X, Y-Y, Sine & Random	Max. Temp. Max. Power Dissipation	Normal Oper. after 1-yr orb. Earth-Sun Line	Test Stopped Chamber Open	Liftoff to 100% Sun	Steady State 100% Sun	Steady State 30% Degrad. of Solar Cells	Vent Chamber	Liftoff to Minimum Sun	Steady State Minimum Sun	Test Stopped S/C Removed	Max. Temp. Max. Power Dissipation	Test Stopped S/C Removed	Max. Temp. Max. Power Dissipation	Steady State Minimum Sun	Test Stopped S/C Removed	Thrust Random Vibration, 2½ Minutes	Max. Temp. Max. Power Dissipation	Steady State 100% Sun	Vent Chamber Repair Cable	Steady State Minimum Sun	Liftoff to Minimum Sun	Steady State Minimum Sun	Minimum Sun Override	Regulator Normal 82% Sun	Calibration of Magnetometers at NOL	Sunshine Test	Final Balance		
		OPERATING MODE	Launch	Launch	Launch	Orbital (2S)	Orbital (5S)	Off and Checkout	Orbital (1T)	Orbital (1S)	Orbital (4S1)	Off	Orbital (3T)	Orbital (3S)	Off and Checkout	Orbital (2S)	Off and Checkout	Orbital (2S)	Orbital (3S)	Off and Checkout	Launch	Orbital (2S)	Orbital (1S)	Off	Orbital (3S)	Orbital (3T)	Orbital (3S)	Orbital	Orbital	Calibration	Test	Off		
		DATE 1964	6/19	6/22	6/22	2100 6/23 to 2400 6/24	2400 6/24 to 2100 6/25	2100 6/25 to 1630 6/26	1630 6/26 to 1400 6/27	1400 6/27 to 0900 6/28	0900 6/28 to 2300 6/29	2300 6/29 to 0930 6/30	0930 6/30 to 2000 6/30	2000 6/30 to 1445 7/1	1445 7/1 to 2130 7/6	2130 7/6 to 1200 7/7	1200 7/7 to 1130 7/8	1130 7/8 to 1035 7/9	1035 7/9 to 1045 7/10	1045 7/10 to 7/21	7/21	2000 7/21 to 2330 7/22	2330 7/22 to 0900 7/24	0900 7/24 to 1400 7/27	1400 7/27 to 1400 7/28	1400 7/28 to 2100 7/28	2100 7/28 to 0930 7/29	0930 7/29 to 1345 7/30	1345 7/30 to 2209 7/30	8/3	8/4	8/6		
SYSTEM			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
STRUCTURE	Center, Shell, Antennas	A						N				N			N		N			N				N										
	Solar Blades	B		N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N			N		
	Thermal Shielding and Design	C						N				N		⬓	M^N	⬓	M^N		⬓	M^N				N										
POWER	26 Batteries and Power Switch	D						N				N		◫	M^N		N		◫	CM_N				N										
	Solar Cells	E		N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N			N		
SEPARATION	Components in Adapter	F	SR					N				N			N		N			N				N										
DESPIN	Yo-Yo & Despin Strap	G		N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N		N	N		
ATTITUDE CONTROL & DETECTION	Magnetic (Control)	H						N				N			N		N			N				N										
	3-Axis Fluxgate Magnetometer	I						N				N			N		N			N				N										
	Solar (Detection) Blades	J		N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N			N		
COMMAND	Receiver	K						N				N			N		N			N				N										
	Logic	L						N				N			N		N			N				N										
ACTIVE TEMPERATURE	Thermostats, Power	M						N				N			N		N			N				N										
MINITRACK	136 Mc Transmitter	N						N				N		◫	M^N		N			N				N										
	35-Channel PAM Commutator	O						N				N			N		N			N				N										
	Thermistors and PDM Commutator	P				⬓ — —	— —	C N				N			N		N			N				N										
APL	162 Mc, 324 Mc	Q						N				N			N		N			N				N										
NASA EXP. FREQUENCIES	20, 40, 41, 360 Mc	R						N				N			N		N			N				N										
LASER EX.	Structure & Prisms	S	■ R					N				N			N		N			N	N			N						N	N	N		
ELECTRO-STATIC	Probe Experiment	T						N				N			N		N			N				N										

CODE

E – Facility Induced Problem
■ – Failure
◪ – Questionable Operation
⬓ – Marginal Operation
⊠ – Procedural Failure
◫ – Special Problem
R – Subsystem Repaired
C – Subsystem Changed
M – Subsystem Modified
D – Subsystem Redesigned
N – Subsystem Not Under Test
S – Special Operating Condition For Test

PROBLEM AREAS ENCOUNTERED
DURING
ENVIRONMENTAL TESTING
OF THE
S-66 (SN 34) PROTOTYPE AND FLIGHT SPACECRAFT I (SN 35)

May 15, 1963

SYSTEM EVALUATION BRANCH
TEST AND EVALUATION DIVISION

S-66 PROTOTYPE SPACECRAFT TESTING SUMMARY

KEY	DATE	ITEM	DESCRIPTION OF PROBLEM	ENVIRONMENT	ACTION TAKEN	REMARKS
A-3	3/14/63	Antenna coupler	Mica glass capacitor (Johanson Model 803) broke on 20, 40, 41 Mc also detuned.	Vibration thrust axis sinusoidal	Capacitor replaced	Capacitor was thought to be cracked before test.
B-3	3/14/63	Locating key	Sheared rivet on locating key between spacecraft and adapter.	Vibration thrust axis sinusoidal	Larger plate and steel rivets installed	
C-6	3/19/63	Heat sink	Heat sink on power amplifier stage of 324 Mc transmitter was loose. Also considered a marginal design. Caused one diode and one transistor to burn out.	Thermal vacuum hot soak	Heat sink changed from Boron Nitrate to Beryllium	Several hold down screws were missing. Failure occurred 1-1/2 hours after starting test.
D-7	3/26/63	Current regulator	Transistor malfunctioned with 18 watt load. (Maximum load expected)	Thermal vacuum hot soak	Two Germanium transistors were connected in parallel and fastened to the baseplate	Improved version checked O.K. with ~40 watts input.
H-14	4/5/63	Command receiver battery	Battery running about 50°F (Books at 60°F). Could result in fatigue failure.	Thermal vacuum cold soak	Insulation installed around battery.	

S-66 FLIGHT SPACECRAFT TESTING SUMMARY

KEY	DATE	ITEM	DESCRIPTION OF PROBLEM	ENVIRONMENT	ACTION TAKEN	REMARKS
D-11	3/29/63	Current regulator	Change made on flight S/C similar to (D-7) on prototype.	Post-balance change		
E-12	4/1/63	Pam commutator	The Hathaway 35 channel commutator was not considered to be the best on the market. A.P.L. has had some trouble in the past. (Sticking and not as sensitive)	Pre-vibration change	Hathaway type changed to Strothers Dunn type.	Prototype spacecraft not changed.
F-12	4/1/63	Pam commutator	The Strothers Dunn type is more sensitive to magnetism. The orientation magnet near it affected the relays.	Pre-vibration checkout	The orientation magnet was moved to the opposite side of the spacecraft.	Prototype spacecraft not changed.
G-15	4/1/63	Antenna coupler	Detuned due to loosening of adjusting screws.	Vibration thrust sinusoidal	Lock nuts were machined and placed over adjusting screws.	Adjusting screws could not be permanently installed as final tuning is done at the launch site.
H-17	4/3-5/63	Command receiver battery	Battery temperature pattern corresponds to prototype.	Thermal vacuum hot soak	Insulation installed around battery.	
I-19	4/6-8/63	3-year timer	Timer is unreliable. Not desired to cut off at end of three years.	Thermal vacuum	Timer removed from spacecraft.	There was no malfunction involved.
J-19	4/6-8/63	PDM commutator	Not counting properly	Pre-T-V checkout 2nd start	PDM commutator replaced.	
K-19	4/6-8/63	Bracket	Holding bracket for command receiver battery was cracked at sharp bends.	After 1st T-V run	Bracket redesigned and strengthened.	
L-24	4/15/63	PAM 35 channel commutator (Strothers Dunn)	Channel 23, command battery current intermittent. Due to "REED" relay.	Noticed during random vibration in thrust direction	Relay module replaced.	Records indicate this problem was there before the vibration test.
M-25	4/16/63	Laser reflector	Welds in bottom ring are cracked.	Post test check-out	Bottom ring redesigned. Replaced with new ring. Welding technique charged	Probably caused by vibration

ENVIRONMENTAL TESTING OF S-66 SPACECRAFT
MARCH 1963 - APRIL 1963

Prototype SN34
Flight I SN35

	ITEM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
		Vibration Structural Model	Apparent Weight Structural Model	Vibration Prototype Spacecraft	Vibration Prototype Spacecraft	Shock Prototype Spacecraft	Hot Thermal-Vacuum 1st Run Prototype Spacecraft	Hot Thermal-Vacuum 2nd Run Prototype Spacecraft	Balance, C.G., Weight Flight Spacecraft	Vibration Flight Solar Cell Blades	T-V +120°F, -60°F, 30 to 90°F 4 cycles Flight Solar Cell Blades	Change After Balance Flight Spacecraft	Pre-Vibration Check Flight Spacecraft	Hot Thermal-Vacuum 3rd Run Prototype Spacecraft	Cold Thermal-Vacuum Prototype Spacecraft	Vibration-Thrust Sinusoidal Flight Spacecraft	Vibration Flight Spacecraft	Hot Thermal-Vacuum 1st Run Flight Spacecraft	Cold Thermal-Vacuum 2nd Run Prototype Spacecraft	Flight Spacecraft	Hot Thermal-Vacuum Recheck Prototype Spacecraft	Hot Thermal-Vacuum 2nd Run Flight Spacecraft	Cold Thermal-Vacuum Flight Spacecraft	Final Balance Flight Spacecraft	Re-Vibration Random Thrust Flight Spacecraft	Post Test Checkout	Re-Vibration Random Thrust Flight Spacecraft	Magnetometer Calibration Flight Spacecraft (At N.O.L.)	Vibration Laser Reflector Ring
		MAR 12	MAR 11-14	MAR 14	MAR 15	MAR 15	MAR 19	MAR 20-26	MAR 22	MAR 25	MAR 26-27	MAR 29	APR 1	MAR 29 APR 1	APR 1-5	APR 1	APR 1-2	APR 3-5	APR 6-9	APR 6-8	APR 9-11	APR 9-11	APR 11-13	APR 15	APR 15	APR 16	APR 16	APR 17-18	APR 18
A	Mica Glass Capacitor Antenna Coupler			■ R																									
B	Locating Key and Rivets			■ R M																									
C	Heat Sink 324 mc Transmitter						■ R D																						
D	Current Regulator							■ D				D																	
E	35 Channel PAM Commutator												D																
F	Orientation Magnet (Affects PAM Comm.)												D																
G	Antenna Coupler															◫ C M													
H	Command Receiver Battery														▬ M			M											
I	Three Year Timer																			◫									
J	PDM Commutator																			◪ C									
K	Bracket for Command Receiver Battery																			D									
L	35 Channel PAM Commutator																								■ R				
M	Laser Reflector Ring																									■ D C			
N																													
O																													
P																													
Q																													
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Y																													
Z																													

LEGEND

- ■ SUB-ASSEMBLY FAILURE OR MALFUNCTION
- ◪ QUESTIONABLE OPERATION
- ▬ MARGINAL SUB-ASSEMBLY OPERATION
- ⊠ PROCEDURE FAILURE
- ◫ SPECIAL PROBLEMS
- R SUB-ASSEMBLY REPAIRED
- C SUB-ASSEMBLY CHANGED
- M SUB-ASSEMBLY MODIFIED
- D SUB-ASSEMBLY REDESIGNED

Appendix C

BIBLIOGRAPHY OF TEST PLANS AND SPECIFICATIONS

REFERENCES FOR GSFC APPROVAL OF APL TEST PLANS AND SPECIFICATIONS

(a) R. M. Tysdal to F. T. Martin Memo of 1-18-63, Review of APL S-66 Test Plan.

(b) GSFC Mechanical Test Section Memo of 1-11-63, Review of APL Test Document.

(c) GSFC Vibration Section Memo of 1-15-63, Comments on the Shock and Vibration Test Requirements on S-66.

(d) GSFC Thermal-Vacuum Test Section Memo of 1-16-63, Review of Polar Ionosphere Beacon Satellite, S-66, Evaluation Program.

REFERENCES FOR TEST PLANS AND SPECIFICATIONS USED FOR PROTOTYPE SPACECRAFT (SN 34) DURING MARCH-APRIL 1963 (SCOUT WITH X-248)

(a) APL Report No. TG-416A, Revised May 1962-TRANSIT Testing Procedures Including Environmental Conditions for Payload Equipment and Assembled Payloads.

(b) APL Design Data Sheets IV B 1, 2 dated 2-8-63 and IV B 3 dated 3-8-63, Centrifuge, Shock, Vibration Test Program.

(c) APL Design Data Sheets IV A 3 thru 8 dated 3-20-63, Thermal-Vacuum Test Plan for the Satellite Payload (Prototype).

REFERENCES FOR TEST PLANS AND SPECIFICATIONS USED FOR FLIGHT SPACECRAFT (SN 35) DURING MARCH-APRIL 1963 (SCOUT WITH X-248). NOT LAUNCHED.

(a) APL Report No. TG-416A, Revised May 1962-TRANSIT Testing Procedures Including Environmental Conditions for Payload Equipment and Assembled Payloads.

References continued (SN 35)

(b) APL Design Data Sheet III B 3 dated 3-8-63, Balancing Specification.

(c) APL Design Data Sheets IV B 1, 2 dated 2-8-63 and IV B 3 dated 3-8-63, Centrifuge, Shock, Vibration Test Program.

(d) APL Design Data Sheets IV A 9 thru 12 dated 4-4-63, Thermal-Vacuum Test Plan for Satellite Payload.

REFERENCES FOR TEST PLANS AND SPECIFICATIONS USED FOR PROTOTYPE SPACECRAFT (SN 34) DURING JANUARY 1964 (REQUALIFICATION TO DELTA LEVELS)

(a) APL Report No. TG-416A, Revised May 1962-TRANSIT Testing Procedures Including Environmental Conditions for Payload Equipment and Assembled Payloads.

(b) GSFC General Environmental Test Specification for Delta Launched Spacecraft and Components, Spec No. G-2-000.

(c) APL Memo SDO-806 dated 1-29-64, S-66 Spacecraft; Vibration Test Levels.

(d) APL Design Data Sheet IV B 4 thru 6, dated 1-27-64, Centrifuge, Shock, Vibration Test Program.

REFERENCES FOR TEST PLANS AND SPECIFICATIONS USED FOR FLIGHT SPACECRAFT (SN 36) DURING FEBRUARY 1964 (DELTA LEVELS WITH X-248)

(a) APL Report No. TG-416A, Revised May 1962-TRANSIT Testing Procedures Including Environmental Conditions for Payload Equipment and Assembled Payloads.

(b) GSFC General Environmental Test Specifications for Delta Launched Spacecraft and Components, Spec No. G-2-000.

(c) APL Design Data Sheet III B 3 dated 3-8-63, Balancing Specification.

(d) APL Memo SDO-806 dated 1-29-64, S-66 Spacecraft; Vibration Test Levels.

References continued (SN 36)

(e) APL Design Data Sheet IV B 4 thru 6, dated 1-27-64, Centrifuge, Shock, Vibration Test Program.

(f) APL Design Data Sheets III E 1 and 2, dated 1-17-64, Orbital Temperature Ranges for Satellite Payload.

(g) APL Test Plan and Specification, SSE-7-131A dated 2-10-64, Payload SN 36 Flight Acceptance Test (T-V)

REFERENCES FOR TEST PLANS AND SPECIFICATIONS USED FOR FLIGHT SPACECRAFT (SN 35) DURING JUNE-AUGUST 1964 (SCOUT WITH X-258)

(a) APL Report No. TG-416C, Revised October 1963, Satellite Testing Procedures Including Environmental Conditions for Payload Equipment and Assembled Payloads.

(b) APL Design Data Sheet III B 3, dated 3-8-63, Balancing Specification.

(c) APL Design Data Sheet Information for NASA S-66 SN 35 Spacecraft, dated 5-27-64, Centrifuge, Shock, Vibration Test Program.

(d) APL Design Data Sheets IV A 22 thru 29, dated 5-27-64, Payload SN 35 Flight Acceptance Test (T-V)

COMPONENT TEST SPECIFICATIONS

(a) APL Memo SSE-5-184 dated 2-18-64, Package Level Vibration Testing of S-66 Laser Unit SN 2, Proposal for.

(b) APL Report No. TG-416A, Revised May 1962, TRANSIT Testing Procedures Including Environmental Conditions for Payload Equipment and Assembled Payloads.

(c) APL Design Data Sheet IV A 2 dated 11-20-62, Thermal Vacuum Environmental Test Program (Temperature Ranges for Package and Subassembly Tests).

Appendix D

BIBLIOGRAPHY OF TEST REPORTS

PROTOTYPE SPACECRAFT (SN 34)

Test Reports

(a) R. M. Tysdal Memo to F. T. Martin dated 6-11-63 S-66 Problem Areas During Test.

(b) APL Environmental Test Report, BBE-641-A dated 5-13-63, S-66 Satellite-Thermal Vacuum Testing of S-66 Prototype Satellite.

(c) APL Memo, SSE-5-195 dated 5-4-64, Centrifuge Test of an APL 7208 Type Payload (SN 28) at Allegany Ballistics Laboratory.

(d) APL Memo, SSE-5-183, dated 2-14-64, Expandable Despin Strap Test Program.

(e) APL Memo, SDO-833, dated 3-4-64, Comments on 7208 Hardware Tests Performed on X-258 Motor at AEDC.

(f) APL Memo, SSE-7-128, dated 1-17-64, S-66 Thermal Vacuum Tests-Past and Future.

(g) APL Environmental Test Report, BBE-ETR 644-A dated 2-20-64, Shock and Vibration Testing of S-66 Satellites-Prototype and First Flight Payload. Revised-Supersedes ETR 644.

(h) T.&E. Structural Dynamics Branch Memo dated 2-5-64, Retest of Prototype S-66.

(i) GSFC Directors Weekly Reports.

(j) APL Memo SSE-5-195A, dated 5-27-64, Summary of ABL Data for Centrifuge Test of APL Type Payload (SN 28).

FLIGHT SPACECRAFT I (SN 35)

Test Reports

(a) R. M. Tysdal Memo to F. T. Martin dated 8-7-64, BE-B Flight Spacecraft Performance Review.

FLIGHT SPACECRAFT I (SN 35) continued

(b) APL Environmental Test Report, BBE-ETR 641-B, dated 5-16-63, S-66 Satellite-Thermal Vacuum Testing of S-66 Flight Satellite.

(c) APL Environmental Test Report, BBE-ETR 719, dated 7-20-64, Vibration Testing of S-66 Satellite SN 35.

(d) APL Environmental Test Report, BBE-ETR 751, dated 8-10-64, Vibration Test of S-66 Satellite SN 35.

(e) APL Environmental Test Report, BBE-ETR 750, dated 8-10-64, Thermal Vacuum Testing of S-66, SN 35 Satellite.

(f) APL Memo S4M1-2 dated 8-12-64, S-66 (SN 35) Flight Acceptance Thermal Vacuum Test Results.

(g) APL Environmental Test Report, BBE-ETR 644-A, dated 2-20-64, Shock and Vibration Testing of S-66 Satellites-Prototype and First Flight Payload. Revised-Supercedes ETR 644.

(h) APL Memo SSE-7-128, dated 1-17-64, S-66 Thermal Vacuum Tests-Past & Future.

(i) APL Memo S4M1-1, dated 8-11-64, Orbital Temperature Ranges for the S-66 Satellite (Revised 11 August 1964)

(j) APL Memo SSE-5-43 dated 7-29-63, Optimization of S-66 (SN 35) Balance Weights During Checkout at PMR.

(k) NASA, Wallops Station Memo from Francis S. Karick, dated 5-29-63, Dynamic Balancing Data on the Scout vehicle 120.

(l) T&E Division Memo Report No. 631-137, dated 5-8-63, Composite Balancing of Scout Fourth Stage Including S-66 Spacecraft at the Pacific Missile Range.

(m) R. M. Tysdal Memo to F. T. Martin, dated 6-11-63, S-66 Problem Areas During Test.

(n) GSFC Directors Weekly Reports

(o) APL Environmental Test Report, BBE-ETR 733A dated 4-30-64, Thermal Vacuum Test of the S-66 Solar Blades for SN 35.

FLIGHT SPACECRAFT II (SN 36)

Test Reports

(a) APL Memo SSE-7-147, dated 3-18-64, S-66 (SN 36) Flight Acceptance Thermal Vacuum Test Results.

(b) APL Environmental Test Report, BBE-ETR-728, dated 3-12-64, Thermal Vacuum Testing of S-66, SN 36 Satellite.

(c) APL Environmental Test Report, BBE-ETR 729, dated 8-2-64, Vibration Testing of the S-66-2 Satellite, SN 36.

(d) GSFC Directors Weekly Reports.

COMPONENT TEST REPORTS

(a) APL Environmental Test Laboratory Component Package Test Summary, Weekly.

(b) APL Environmental Test Report, BBE-ETR 749, dated 8-11-64, Environmental Testing of Components for S-66, SN 35.

(c) APL Environmental Test Report, BBE-ETR 617, Environmental Testing of Components for the S-66 Satellite and Spare Parts.

(d) APL Environmental Test Report, BBE-ETR 665, Environmental Testing of Components for Satellite S-66, SN 35 and SN 36.

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