Juno II Served As Explorer Satellite Launcher

The Soviet Union opened the Space race with America on October 4, 1957 when the Russians orbited the Sputnik I satellite. As a result, American leadership quickly realized that the Soviets had beaten the United States into space and in response directed the U.S. Army in Huntsville to modify an existing 1,500 mile range Jupiter missile and use it to launch a satellite.

The configuration for the satellite and the launch vehicle was designed simply by adding a single solid rocket motor as a fourth stage and attaching a scientific payload provided at its forward end, later wrote rocket expert Wernher on Braun.

Launched from Florida on January 31, 1958 the rocket lifted the Explorer I satellite into space, an event celebrated ever since as the first major milestone in the U.S. space program. The 18-pound satellite discovered the first of the natural radiation belts of the earth, identified by Dr. James A. Van Allen of Iowa State University.

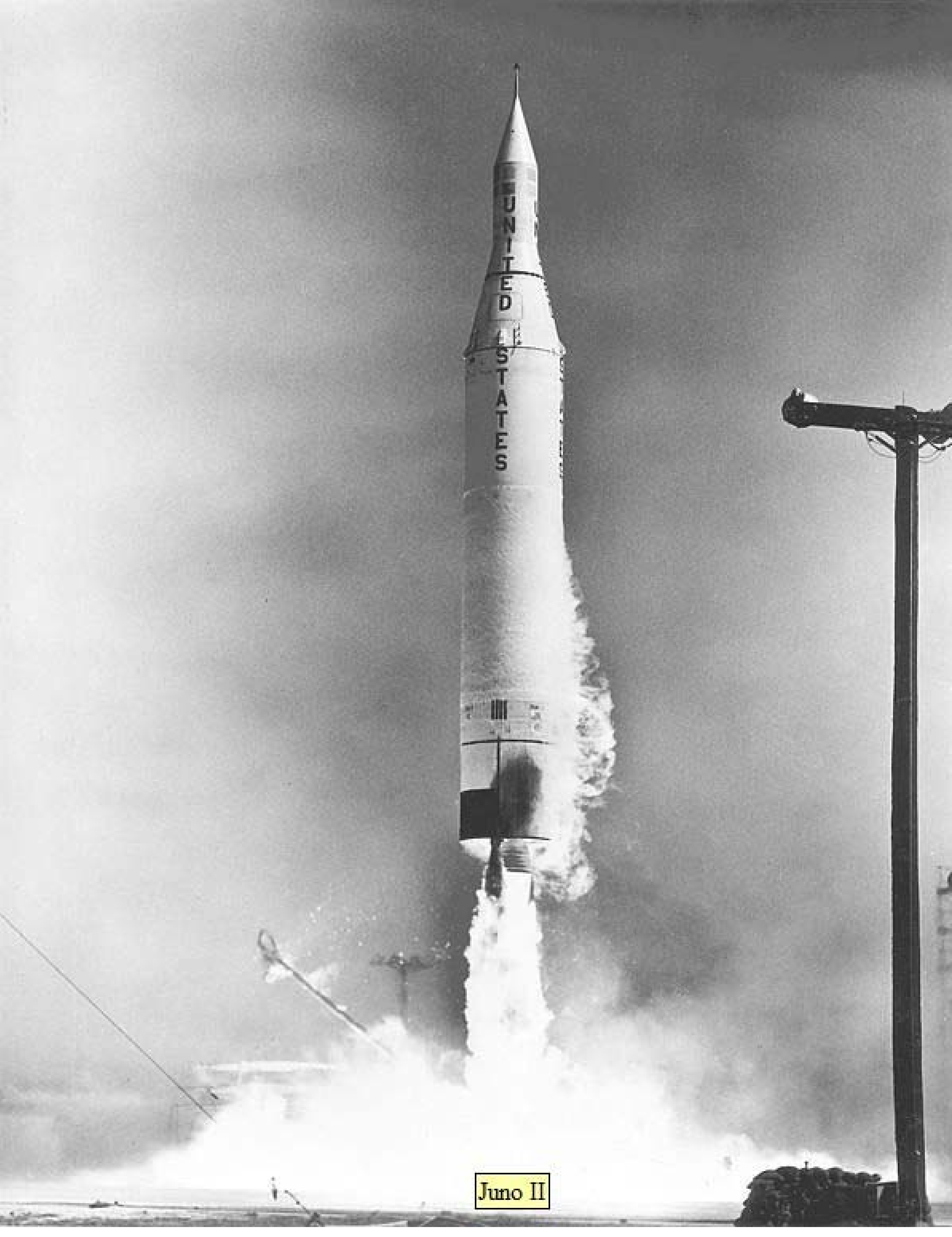
Space experts referred to Explorer's modified launch vehicle as Jupiter C or Juno I. The Explorer I launch in January brought success. Unfortunately Explorer II failed to orbit on March 5, 1958 because a last stage failed to ignite. Other Explorer launches using the Jupiter C came on July 26 and on August 24 when all the rocket stages fired but failed to achieve orbit because of a a collision between parts of the booster and instrument compartment.

Earlier in the year on March 26, NASA used a Juno II rocket to successfully launch Explorer III that yielded more data about the Van Allen radiation belt and on micro meteorite impacts and temperatures. Explorer IV, also launched by a Jupiter C yielded even more data about the Van Allen radiation belt.

This Juno II series of launches began in the spring of 1958 under the Army in Huntsville. After NASA was created on October 1, 1958, the Army conducted the satellite launchings on behalf of the new space agency. On July 1, 1960, NASA created the George C. Marshall Space Flight Center in Huntsville which involved transferring about 4,000 Army personal in Huntsville to NASA. As a result, NASA moved its responsibility for Juno II to the Marshall Center.

Unfortunately, other events during the late 1950s and early 1960s have obscured historical interest in the Juno II. For example, the significance of Explorer I has often overshadowed any focus on the satellite launchings that later depended on Juno II. In addition, historical interest in Marshall's role in the Mercury Redstone program and in the Saturn moon rocket program has clouded interest in the Center's work regarding Juno II.

"One Juno II innovation was a shroud covering the upper-stage cluster assembly. This shroud was necessary to protect the payload and upper stages from aerodynamic heating during ascent, Von Braun wrote adding "Although the Juno II was not an optimum vehicle, it provided a quick and economical way to launch a payload over three times as heavy as that lifted by its Redstone predecessor, the Juno I many other things in this early era of space achievements, it was available for minimum expenditure of time and money." Writing in the journal Technology and Culture in 1963, Von Braun, who served as director of the Marshall Center from 1960 until 1960 traced the history of the Juno II satellite program.



Juno II

Explorer VII A Year Old

From the Marshall Star, October 19, 1960

The United States earth satellite, Explorer VII, celebrated its first anniversary in space yesterday by continuing to provide scientists with a "wealth of data" as it has since it was boosted aloft on October 13, 1959.

Containing seven highly-miniaturized experiments, the 92.3 pound "space laboratory" has yielded vital information on such space phenomena as cosmic radiation, solar energy and weather. Completing its 5290th pass today around the earth, it has been the longest transmission of such a completely instrumented satellite orbited to date.

The Satellite, designed, tested and launched by personnel of the Marshall Center has been a major contribution to International Geophysical Year programs.

Explorer VII was launched into an eliptical orbit from Cape Canaveral, Fla., by a Juno II rocket, similar to those used in boosting Pioneer III to an altitude of 63,000 miles and Pioneer IV into orbit around the sun.

The satellite's orbital period has decreased less than one minute, as it circles the earth every 101.2 minutes. Continuing to travel an eliptical path, Explorer VII is presently circling out to an approximate apogee ol 675 miles and into a perigee of about 344 miles.

In addition to data from its 20 megacycle transmitter, the satellite will continue to provide new and valuable information in other areas, for approximately another 13 years. Optical sightings and photographs can not only be used in computing more precise orbital data, but can also serve to pinpoint exact geographical positions, necessary in making accurate geodetic surveys.

The data relayed to the ground from the satellite's radio over the past year have been recorded on approximately 1,200 miles of magnetic tape. Explorer VII was the first worldwide supplier of systematic data on Forbush phenomena, meterology, heavy nuclei, entrapped low energy particles.

The Cosmic Ray Experiment, conducted by Dr. James A. Van Allen of the State University of Iowa, netted additional information on the short-time effects on the outer radiation zone by geomagnetic storms. Vital data were also uncovered on the decrease in primary cosmic ray intensity following a solar flare (Forbush phenomena).

In addition, the experiment resulted in some valuable data on sun radiation in space as opposed to radiation on the earth, which correlated with findings from Pioneer V. The Cosmic Ray Experiment also measured energetic particles of radiation from the sun and their time of travel to different regions in space.

(The belt of radiation surrounding the earth was discovered by Dr. Van Allen with instrumentation built into Explorer I, also designed, developed and launched for the Army by MSFC personnel.)

Measurement of radiation from the sun, effects of this radiation on earth and measurement of cloud coverage provided new meteorological data from the Radiation Balance Experiment, proposed by Dr. Harry Wexler of the U. S. Weather Bureau and sponsored by Dr. Verner E. Suomi of the University of Wisconsin.

The Lyman-Alpha X-ray Experiment, sponsored by Dr. Talbot Chubb and Dr. Herbert Friedman of the Naval Research Laboratory, confirmed that low energy particles were trapped at low altitudes as previously reported by the Russians. The experiment’s solar X-ray instrument was saturated by low energy particles mapped within the region transversed by Explorer VII. Measurement and classification of heavy nuclei within the areas covered by Explorer VII were recorded from the Heavy Primary Cosmic Ray Experiment. Originally sponsored by thc late Dr. Gerhard Groetzinger of the Research Institute for Advanced Studies (Martin Company), the experiment is now under the direction of Dr. Martin Pomerantz of the Bartol Research Foundation and Dr. Phillip Schwed of RIAS. In the exposed Solar Cell Experiment, personnel of the Marshall Space Flight Center and the Signal Corps' Research and Development Laboratories demonstrated that an unprotected solar cell will function properly without damage from sun radiation or micrometeorite collisions in the paths traveled by Explorer VI I.

Useful data were also received from the Temperature Measurement Experiment, sponsored by Gerhard Heller of the Marshall Center's Research Projects Office, and the Micrometeorite Experiment, sponsored by Herman E. La Gow of NASA's Goddard Space Flight Center. Explorer VII's power supply in operation longer than that of any other satellite of its kind has proven that combinations of rechargeable batteries and solar cells can operate in both light and dark regions of the orbit for one year. These batteries have undergone approximately 5,000 charge-discharge cycles. This has been the primary power supply for each of the seven experiments as well as the 20 megacycle radio transmitter.

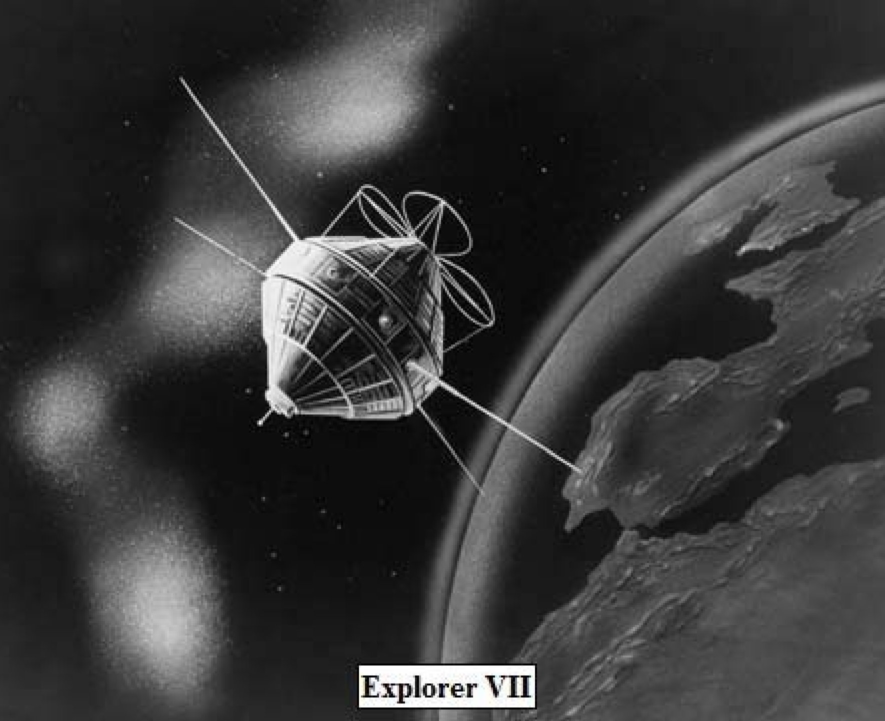
For example, Pioneer III launched by a Juno II on December 6, 1958 attained a 24,000 mile per hour velocity and discovered 24 radiation belts around the earth and on March 3, 1959, a Juno II launched Pioneer IV the first U.S. satellite to orbit the sun.

Explorer earth satellites carrying more sophisticated space science experiments and weighing about 90 lbs. were orbited by Juno II on October 13, 1959, November 3, 1960, and April 27, 1961, to end Juno II's space adventures. EXPLORER VII provided significant data on magnetic fields, magnetic storms, solar flare activity, and radiation belts; EXPLORER VIII carried eight experiments and transmitted information on electron density and temperature, positive-ion mass and density, and micrometeorite distribution; and EXPLORER XI returned valuable data on gamma rays.

Juno III-V

The successes of Junos I and II were projected to generate several other Juno configurations at Redstone Arsenal in the 1956-58 period. While the Juno III and Juno IV concepts never reached the hardware stage, the design and study of Juno V led directly to the giant Saturn.

Juno III studies began in 1956. These considered a vehicle based on the standard Jupiter booster, with a 500-600-lb. orbital payload capability. The upper stages were to consist of solid rockets somewhat larger than the scaled Sergeants of the earlier Junos, and the second-stage cluster would have had 12 motors instead of 11. The heavier cluster presented design problems, so the proposal was abandoned.



Explorer VII

Juno II Launches Explorer VIII

Ionosphere Data Sent Constantly By New Satellite

From the Marshall Star November 9, 1960

The United States added another chapter to its already voluminous history on space research a week ago tonight when it hurled a unique scientific satellite into, a 1,000-mile-deep orbit within the ionosphere.

A project of the National Aeronautics and Space Administration, the satellite was designed, prepared and tested by the Marshall and Goddard Space Flight Centers.

Containing eight experiments, it is the first attempt to take direct, continuous readings of the ionosphere at such altitudes. Knowledge of the structure of and changes in this relatively unexplored outer zone will further advancement of long-range radio, communications. The ionosphere is the tangent surface off which radio beams are bounced in long-distance transmissions. Circling the earth every 113 minutes, the 90-pound payload is designed to unveil vital data on composition of and changes in this outer fringe of the atmosphere.

Though its 108-megacycle transmitter is scheduled to operate for only two-to-three months the satellite will continue in orbit for several years.

In addition to investigating the ions and electrons of the ionosphere, the satellite has a secondary mission of gathering data on the frequency, momentum and energy of micrometeorite impacts. These small meteorites, if of sufficient size and force, could present obstacles to the future orbiting of communication and other satellites.

The booster or first stage of the Juno II launch vehicle was designed, developed and launched by the Marshall Center. The rocket's second stage was furnished by NASA's Jet Propulsion Laboratory.

Launched into an elliptical orbit at a 51 degree inclination to the equator, the satellite is presently circling out to an approximate apogee of 1,400 miles and in to a perigee of about 250 miles.

The success of this experiment was but another in a series of calculated steps being taken by the United States to utilize the advantages of outer space for the advancement of science and the betterment of all mankind.

Among those witnessing the successful launching of Explorer VlII were eight widely-known industrial and financial leaders visiting the Launch Operations Directorate following a tour of facilities at the George C. Marshall Space Flight Center. Included in the group were: Keith Funston, president of the New York Stock Exchange; Thomas J. Watson, president of International Business Machines Corp.; Mr. Charles H. Percy, president of Bell & Howell Co.; Mr. A. L. Williams, IBM Corp.; Dr. Henry Heald, Ford Foundation; Mr. Frederick C. Crawford, Thompson Products; Mr. Ward Canaday, Overland Corp.; and Mr. A. K. Watson, IBM Corp.

Explorer VII Has Colorful Red Exterior

From the Marshall Star published on December 14, 1960

In a space-age version of protective coloring, the Explorer VIII earth satellite is speckled wi'th red and stripped with silver.

Launched into orbit on November 3 by the George C. Marshall Space Flight Center, the satellite is transmitting data concerning 1he earth's ionosphere as collected by its eight scientific experiments. Powered by mercury batteries, the transmitters and experiments are expected to operate for about two months from date of launch.

The red and silver paints used on the satellite exterior were one of several measures taken to protect the interior of the orbiter from the temperature extremes which could occur on a body in space. In particular, space scientists wanted to keep temperature of the instrument pack and batteries within the range of 32 to 122 degrees Fahrenheit (0-50 degrees Centigrade). It is estimated that use of the red and silver exterior paint lowered temperatures in these areas by 45 degrees F (25 degrees C).

The red paint—an air-dry silicone paint pigmented with red iron oxide—was applied on the upper and lower cones in one-half inch squares making up two, seven and one-half inch bands. In all, there were 1,388 squares, covering 347 square inches. The paint was spray applied, using a template.

The red paint was chosen because, of those paints which could be used for temperature control, it is one of the more resistive to the space environment — particularly to ultra-violet radiation. Because it is a non-conductive paint, it was applied in numerous squares making up grid-like patterns. In this arrangement, it has the least effect on the electrical conductivity of the satellite surface.

Scientists wanted to keep the surface of the orbiter electrically conductive because as such, its effect on the ionosphere is minimized and more easily measured.

The silver paint, which is electrically conductive, was applied in strips above and below both bands of red paint and in two patches on the satellite center band. A total area of about 610 square inches received the silver paint. It was spray-applied, using masking techniques.

Thirty-eight per cent of the satellite's sand-blasted aluminum surface was painted with either red or silver. To reduce possible effects on the satellite experiments, the paint was kept at least-

Explorer VIII Now Silent

From the Marshall Star January 11 1961

Explorer VIII, the ionospheric direct measurement satellite, is no longer transmitting. The last signal heard from the spacecraft, which was launched by the National Aeronautics and Space Administration on November 3 from Cape Canaveral, was received at Quito, Ecuador, at 7:20 a.m. EST on December 27.

Throughout the previous week, erratic telemetry had been reported from Explorer VIII. Before launch, a useful lifetime of between two and three months had been predicted for the spacecraft. The satellite was entirely dependent for power upon a self-contained battery pack.

The 90-pound Explorer spacecraft traveled 20,866,706 miles in the 694.3 orbits it made about the earth until its telemetry ceased. It transmitted for 1302.8 hours during its useful lifetime. More than 700 miles of magnetic tape were required to record the data the satellite transmitted, including that from an unusually severe solar storm in early November. This information, received by the Goddard Space Flight Center's minitrack stations, is now being analyzed.

The Explorer spacecraft's mission was to take direct, continuous readings on the composition of the ionosphere on its orbital path of 258 miles perigee and 1,423 miles apogee. Besides measuring electron and ion concentrations and temperatures, Explorer VIII reported the number ' and velocity of micrometeorites in its path.

three inches from the center point of each of the numerous sensors located on the satellite exterior.

A combination of silver and red paint was used because of several factors. The silver paint was not as effective for the thermal control as the red. If it had been used exclusively, a greater area of the satellite would have had to be painted, and scientists wanted to use as little paint as possible to achieve the thermal control required. Exclusive use of red, on the other hand, would have interfered to a greater degree with the electrical conductivity of the satellite surface.

Thermal control of the orbiter was the responsibility of Gerhard Heller, deputy director of the Research Projects Division at the Marshall Center. William C. Snoddy, a physicist in the division, was assigned as project engineer for the thermal design of Explorer VIII. As project engineer, he determined what control was necessary and what methods would be used to carry it out.

In addition to the exterior paint, other thermal control measures included the use of sandblasted aluminum on the satellite surface, insulation of the instrument pack and batteries from the satellite skin, and use of a white, air-dry silicone paint pigmented with anatase titanium dioxide on the satellite interior.

In selecting paints for use on Explorer VIII, Snoddy turned to Gene A. Zerlaut, a chemist in the Engineering Materials Branch of the Marshall Center's Structures and Mechanics Division. Zerlaut's knowledge of chemistry, applied to paints, had been utilized in controlling the interior temperature of the Explorer VII satellite, also launched by the Marshall Center's rocket development team and he was responsible for the development of the paint used on the exterior of Explorer VIII and the white paint used on the satellite's interior.

The NASA Goddard Space Flight Center provided the scientific instrumentation of the satellite and was in charge of the project.

G&C Pilot Manufacturing Branch Builds Satellites

From the Marshall Star February 8, 1961

Tolerances measured in millionths of an inch—machining "unmachinable" materials—delivery schedules in terms of hours—it's all part of the job at Pilot Manufacturing Development Branch, Guidance and Control Division of the Marshall Center.

Headed by Wilhelm Angele, the group has made significant contributions to the manufacture of satellites and guidance systems. The Branch has dedicated its facilities and the energies of 150 of the nation's finest instrument makers and other highly skilled craftsmen to the development of manufacturing and measuring techniques suitable for the Space Age.

Materials such as beryllium tungsten, titanium, tantalum, molybdenum, gold, ferrite, epoxies, tetrafluoroethylene, glass and quartz are handled on a routine basis. Some must be machined to tolerances so close that measuring has to be done with light waves!

Mr. Angele had this to say about the Branch activities: "It has been our privilege to work with many of the nation's outstanding scientists and designers. Our contribution has been to put at their disposal fine manufacturing techniques, thus enabling them to transfer blueprints quality hardware. The ever-increasing demands of the Space Age require skills and accuracy unheard of only a few years ago. We have made improvements in the fields of machining, measuring, plating, printed circuit processing, coil winding and instrument calibration, and we also contribute "know-h o w," experience, and cooperation required for getting the job done. We are confident that the satellites now under construction will add additional facts to man's knowledge of the universe which surrounds him.

"While we are at the present time devoting a large percentage of our energies to payloads, our normal work is pioneering production techniques so that private industry can produce hardware to the exacting specifications of NASA scientists. We realize that ever new, and always challenging, problems will be presented to us and to private industry. Under the direction of Dr. Walter Haeussermann, it is our intention to maintain the capability and "know-how" necessary to solve these problems

In addition to manufacturing components for the Guidance and Control Division, the Branch also maintains an active development program. Significant contributions have been made in the fields of air bearings, flexible printed cables, measuring techniques, miniaturization of electronic assemblies, and accelerometers.

F. W. Brandner, Guidance and Control Project Engineer for JUNO II, has this to say about the Branch contributions to the EXPLORER series of satellites:

"T h e cooperation, technical skills and conscientious attention to myriad details exhibited by the personnel of Pilot Manufacturing and Development Branch have been invaluable to the overall EXPLORER Program."

Beacon Satellite Launch Expected Soon at Cape

From the Marshall Star February 8, 1961

More knowledge of the ionosphere is the goal of a forthcoming scientific experiment to be launched on a Juno II by NASA from Cape Canaveral.

Several universities in the United States and New Zealand are participating in this experiment, intending to find out more about the shape of the ionosphere— where there are concentrations of electrons, where the ionosphere's profile has peaks or valleys in its structure.

So far, little is known about the ionosphere, the ionized fringe area over the earth's atmosphere, from 50 to several hundred miles above the earth. Lack of this knowledge is costly.

L o n g-range communications, dependent upon reliably bouncing signals off ionosphere layers, require much more information. Weather forecasting, upon which agriculture and transportation must rely, needs more ionospheric data in order to better perfect that art.

The new payload being prepared for orbit is called the Ionosphere Beacon Satellite S-45. It looks very much like Explorer VII and Explorer VIII, two truncated cones back to back. The S-45, however, has a 6-foot loop antenna around its equator to transmit its low frequency signals to ground stations.

Unlike Explorer VIII, this 74-pound satellite will not be an experiment in itself. Explorer VIII measured the positive ion and electron concentrations in its orbital path around the earth. The new satellite will merely transmit on six frequencies at varying levels of power. Ground stations receiving the signals will analyze the signals received by various methods such as change in polarization or Doppler shift. The satellite is expected to orbit the earth every 116 minutes with an apogee of about 1,600 miles and a perigee of about 240 miles.

The Ionosphere

Until the beginning of space exploration, very little indeed was known about the ionosphere. Until the advent of radio broadcasting, a generation ago, no one had seriously investigated the ionosphere at all. Since measurements were necessarily made from the ground, much ionospheric theory developed before the age of rocketry has since proven to be erroneous.

United States rocketry has produced a tremendous amount of data about the ionosphere. Miles upon miles of magnetic tape have been analyzed to date. The trial and error of science has already resulted in findings that have led to better methods. Yet the surface of space, so to speak, has scarcely been scratched. When the object is to map the whole ionosphere, its content from region to region about the earth, its profile for hundreds of miles into space, there imust be a great deal of research.

Rocket measurements have revealed the cause of radio blackouts in high latitudes and crude means of predicting them have been devised. These flights have brought about an explanation for

Telescope to Be Put Into Orbit

From the Marshall Star March 29, 1961

Within the next day or two a four-stage Juno II Rocket will boost a telescope satellite into orbit.

Primary purpose of the satellite, known as the S-15, will be to detect high energy gamma from cosmic sources such as from own galaxy, and neighboring Galaxies such as the Magellanic Clouds and map their distribution in the sky.

This NASA experiment will be the first attempt of this kind of space astronomy from a satellite. Scientists are now limited in their study of extraterrestrial gamma radiation because their measurements are interfered with by existing radiation in the earth's atmosphere.

The Juno is composed of a modified Jupiter, developed by Marshall Center personnel, and three solid propellant upper stages, provided by Jet Propulsion Laboratory of Pasadena, California. The Marshall Center was also responsible for designing and building the S-15's structure, as well as the supporting electronic equipment for the gamma ray instrument package. Bill Greever is the Marshall Center project manager.

The experiment will be conducted by two professors at the Massachusetts Institute of Technology, Drs. William Kraushaai and George Clark. The S-15 gamma ray telescope was developed and built at MIT.

Resembling an old-time street lamp, the 82-pound S-15 looks unlike any satellite orbited to date. It combines, structurally, a 12-inch-diameter, 23 1/2 - inch - long octagonal aluminum box mounted on a 6-inch-diameter, 20-inch-long aluminum instrument column. The box provides both housing for the gamma ray telescope and four of the external surfaces for the satellite's solar cells. The 44-inch-long fourth-stage rocket will remain with the satellite. This extension will act as a section of a transmitting antenna and provide the additional length and weight needed In attaining S-15's tumbling action. The fourth stage (burned out) weighs 12.8 pounds.

Solar cells, which recharge the system's 12 nickel cadmium batteries, are also located around the face of a 17-inch-diameter octagonal plate fitted on the top of the box. A thin aluminum shield covers the end of the housing, protecting the telescope from damaging micrometeorites. This shield can be removed by radio command from the earth.

In orbit, the gamma ray astronomy satellite will tumble end-over-end at the rate of about 10 times every minute. This motion will enable the gamma ray telescope aimed out through the end of the octagonal box, to scan a portion of surrounding space every six seconds.

S-15 Astronomy Satellite Orbited from Canaveral

From the Marshall Star May 3, 1961

The Marshall Center orbited a complex gamma ray astronomy satellite from Cape Canaveral last Thursday. A Juno-II space vehicle was used to put the 82-pound satellite, resembling an old time street lamp, into orbit.

The results of this experiment may well answer the question of where cosmic rays come from, and, in addition, furnish us with a gamma ray map of the sky.

The useful lifetime of the satellite, designated as an S-15, will be about one year. A gamma ray telescope “looks” out of the top of the satellite. Also incorporated in the S-15 is a tape recorder system designed to record a complete orbital set of data and playback on command. With this system, if successful, tracking can be accomplished from a single station, vastly reducing necessity for data reduction and integration methods used at present.

The telescope and tape recorder were designed by Massachusetts Institute of Technology and Raymond Engineering Labs, Inc. The satellite otherwise was designed and fabricated by personnel of the Guidance and Control Division at the Marshall Center.

This S-15 experiment may well represent one of the most important steps forward in gamma-ray astronomy, while, at the same time, proving a new satellite navigation system as well as a simplified data gathering system.

The Component and Power Supply Section of the Division's Electrical Systems Integration Branch, which is headed by W. J. Fichtner, accomplished the task of electrical systems integration and the design and development of the Power Supplies and Special Timers for the S-15, as well as final electrical assembly and wiring of the payload.

The power supply of the S-15 is a solar cell-battery type using nickel cadmium batteries and high conversion efficiency solar cells. Design of the power supply was based on the principal of using battery power during periods of darkness and utilizing power from the solar cells to power the instrumentation and recharge the batteries during periods of sunlight.

The S-15 solar cell power supply consists of 1698 cells (1x2 centimeter size) and 234 cells 1/2x2 centimeter) arranged about the exterior configuration of the satellite in series and parallel combinations to provide a predetermined output from a give number of solar cells exposed to the sun.

Electrical System integration of the satellite entailed the creation of an electrical system within the satellite shell which connected the sensing devices, the telemetry equipment the receiver and the power supplies to form a small automatic Space laboratory. Details in designing the electrical system included consideration of all electrical, mechanical, and physical aspects \of the satellite, the Juno II launch vehicle, and the ground support equipment in order to insure electrical and mechanical compatibility.

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Nine people of the Component and Power Supply Section played key roles in the design, development, and launching of the S-15. These were R. J. Boehme, Section Chief; Eugene Cagle, Project Engineer; Ed Berg and Garvis Richmond, engineers; J. B. Allen, Charles Needham, Robert Cobb, Rupert McElyea, technicians, and Lawrence Reddick, designer.

The Division's Instrumentation Development Branch, directed by Otto Hoberg, played a major role in developing and launching the S-15 with Heinz Kampmeier, Chief of Special Projects Office, coordinating all instrumentation efforts including environmental testing of components and systems.

The RF Systems Development Section of the Branch headed by Grady Saunders, was responsible for all the antennas, the two transmitters with built-in modulation circuits, and the Green Mountain tracking station. The station on Green Mountain is part of the "quick-look" tracking system. This station was recently moved to Green Mountain from Madkin Mountain and the new location has proved to be very superior.

Operation of the Green Mountain station was so successful that station personnel were fairly certain that S-15 was in orbit only ten minutes after injection. Actual doppler frequencies fell directly on the doppler curve pre-calculated by John Gregory, Chief of the Propagation Studies Unit.

Some of the work performed by the RF Systems Development Section for the S-15 includes the design, construction and testing of the satellite antennas; low-power and high-power transmitters; a highly efficient command receiver and decoder. The Measuring Systems Section, headed by J. T. Powell, was responsible for the aspect sensor system, earth 'sensors and amplifiers, temperature measurement equipment, and the Radio Telemetry Section, under the direction of J. E. Rorex, was concerned with subcarrier oscillators, mixer amplifiers and convertor decks; and a number of other items.

The Planning and Engineering Section, headed by John Cox, prepared instrumentation documentation not only for the S-15 pay-load but also for the Juno II vehicle which launched it. Also, technical papers describing instrumentation and checkout procedures for the gamma ray satellite.

Gamma Ray measuring instrumentation for the S-15 was designed and developed by the Massachusetts Institute of Technology, and functioned with a tape recorder designed by Raymond Engineering Labs; and a ground controlled command system developed by Avco Corporation.

Fabrication and assembly of Payload S-15 presented quite a challenge to the men and equipment of Pilot Manufacturing Development Branch which is headed by Mr. W. Angele.

An interesting challenge arose in the manufacture of the earth cell and solar cell collimators which are components of the aspect unit. These parts required several hundred small holes and a compound angular slot in brittle carbon. Conventional machining techniques were unsatisfactory and after a thorough study, ultrasonic machining was decided upon. The technique worked perfectly and the parts were finished in a few hours with a tremendous saving in cost.

A major problem was maintaining proper alignment in the final assembly. Because of t.he large number of cumulative tolerances, each part had to be carefully checked to see what its effect on the overall assembly would be. The importance of this is emphasized by the care taken in matching the fourth stage motor case to the payload — one side of this ring was machined at Marshall and the ring was then shipped to Jet Propulsion Lab in California where the other side was machined to match the fourth stage motor case.

Overall planning and scheduling was the responsibility of Production Specialists Pearce and Starkey. Mr. Andrew Crutcher of the Finishing and Assembly unit was responsible for the final fitting and assembly.

The Division's Electro-Mechanical Engineering Branch directed by Josef Boehm, played a major role in the design, development, environment testing, and launching of S-15 pay load.

Project Engineer from the Electro - Mechanical Engineering Branch was Leonard L. Mitchum, Jr. The Mechanical Systems Section of the Branch, headed by Helmuth Pfaff, was responsible for the mechanical design and dynamic behaviour of the payload. Considerable engineering was necessary in order to meet all the requirements of the payload structure and the dynamic conditions under which the payload must operate.

Some of the design considerations included: a structure that would withstand the environment of the Juno II vehicle, proper isolation of the gamma ray telescope from this environment, provide proper thermal control, provide analysis of dynamic behaviour of payload after obtaining orbit, assure proper ratio of moment of inertia in order to fulfill the mission of the experiment.

A removable top cover and a mercury damper were two important features of the design which were necessary to fulfill the orbital requirement and mission of the payload. The top cover of the satellite is a protective plate; this plate protects the sensitive end of the gamma ray telescope from micrometeorite impact. During the first phase of the experiment this plate remained in place and shields the telescope with a .050" thick aluminum shield. At a prescribed time the shield was released by ground command by firing pressure squibs which operated a release cam. The shield was kicked forward and away from the satellite.

The mercury damper is attached to the extreme lower end of the fourth stage motor. This damper assists in, and speeds the transition from spin about the thrust axis to a flat spin about the maxi-mum-moment-of-inertia axis.

The overall environmental test program of S-15 was the responsibility of the Electro-Mechanic Engineering Branch at Marshall.

Second Stage of Final Juno II Fails to Ignite

From the Marshall Star, May 31, 1961

A Juno II rocket, launched by.the Launch Operations Directorate at Cape Canaveral last Wednesday failed to place in orbit a 75-pound ionosphere beacon satellite,S-45a.

The Although the irst stage performance appeared to be normal, the second-stage of the rocket was not ignited.

It was the final rocket in the Juno II series. Among payloads launched previously by the Juno II were Pioneers III and IV p-.space probes, and Explorers VII, VIII and XI earth satellites. A total of ten vehicles were fired in the series.

Dr Kurt Debus, LOD director, was in charge of last week's firing. The payload was designed, fabricated and tested by the Guidance and Control Division. Juno II management was provided by Bill B. Greever.

Carl Seddon, in charge of S-45a project coordination and data reduction at the Goddard Space Flight Center, pointed to the great scientific interest in the satellite and indicated another attempt to orbit such a payload might be made in the future, using another type of rocket.

Nine people of the Component and Power Supply Section played key roles in the design, development, and launching of the S-15. These were R. J. Boehme, Section Chief; Eugene Cagle, Project Engineer; Ed Berg and Garvis Richmond, engineers; J. B. Allen, Charles Needham, Robert Cobb, Rupert McElyea, technicians, and Lawrence Reddick, designer.

The Division's Instrumentation Development Branch, directed by Otto Hoberg, played a major role in developing and launching the S-15 with Heinz Kampmeier, Chief of Special Projects Office, coordinating all instrumentation efforts including environmental testing of components and systems.

The RF Systems Development Section of the Branch headed by Grady Saunders, was responsible for all the antennas, the two transmitters with built-in modulation circuits, and the Green Mountain tracking station. The station on Green Mountain is part of the "quick-look" tracking system. This station was recently moved to Green Mountain from Madkin Mountain and the new location has proved to be very superior.

Operation of the Green Mountain station was so successful that station personnel were fairly certain that S-15 was in orbit only ten minutes after injection. Actual doppler frequencies fell directly on the doppler curve pre-calculated by John Gregory, Chief of the Propagation Studies Unit.

Some of the work performed by the RF Systems Development Section for the S-15 includes the design, construction and testing of the satellite antennas; low-power and high-power transmitters; a highly efficient command receiver and decoder. The Measuring Systems Section, headed by J. T. Powell, was responsible for the aspect sensor system, earth 'sensors and amplifiers, temperature measurement equipment, and the Radio Telemetry Section, under the direction of J. E. Rorex, was concerned with subcarrier oscillators, mixer amplifiers and convertor decks; and a number of other items.

The Planning and Engineering Section, headed by John Cox, prepared instrumentation documentation not only for the S-15 pay-load but also for the Juno II vehicle which launched it. Also, technical papers describing instrumentation and checkout procedures for the gamma ray satellite.

Gamma Ray measuring instrumentation for the S-15 was designed and developed by the Massachusetts Institute of Technology, and functioned with a tape recorder designed by Raymond Engineering Labs; and a ground controlled command system developed by Avco Corporation.

Fabrication and assembly of Payload S-15 presented quite a challenge to the men and equipment of Pilot Manufacturing Development Branch which is headed by Mr. W. Angele.

An interesting challenge arose in the manufacture of the earth cell and solar cell collimators which are components of the aspect unit. These parts required several hundred small holes and a compound angular slot in brittle carbon. Conventional machining techniques were unsatisfactory and after a thorough study, ultrasonic machining was decided upon. The technique worked perfectly and the parts were finished in a few hours with a tremendous saving in cost.

A major problem was maintaining proper alignment in the final assembly. Because of t.he large number of cumulative tolerances, each part had to be carefully checked to see what its effect on the overall assembly would be. The importance of this is emphasized by the care taken in matching the fourth stage motor case to the payload — one side of this ring was machined at Marshall and the ring was then shipped to Jet Propulsion Lab in California where the other side was machined to match the fourth stage motor case.

Overall planning and scheduling was the responsibility of Production Specialists Pearce and Starkey. Mr. Andrew Crutcher of the Finishing and Assembly unit was responsible for the final fitting and assembly.

The Division's Electro-Mechanical Engineering Branch directed by Josef Boehm, played a major role in the design, development, environment testing, and launching of S-15 pay load.

Project Engineer from the Electro - Mechanical Engineering Branch was Leonard L. Mitchum, Jr. The Mechanical Systems Section of the Branch, headed by Helmuth Pfaff, was responsible for the mechanical design and dynamic behaviour of the payload. Considerable engineering was necessary in order to meet all the requirements of the payload structure and the dynamic conditions under which the payload must operate.

Some of the design considerations included: a structure that would withstand the environment of the Juno II vehicle, proper isolation of the gamma ray telescope from this environment, provide proper thermal control, provide analysis of dynamic behaviour of payload after obtaining orbit, assure proper ratio of moment of inertia in order to fulfill the mission of the experiment.

A removable top cover and a mercury damper were two important features of the design which were necessary to fulfill the orbital requirement and mission of the payload. The top cover of the satellite is a protective plate; this plate protects the sensitive end of the gamma ray telescope from micrometeorite impact. During the first phase of the experiment this plate remained in place and shields the telescope with a .050" thick aluminum shield. At a prescribed time the shield was released by ground command by firing pressure squibs which operated a release cam. The shield was kicked forward and away from the satellite.

The mercury damper is attached to the extreme lower end of the fourth stage motor. This damper assists in, and speeds the transition from spin about the thrust axis to a flat spin about the maxi-mum-moment-of-inertia axis.

The overall environmental test program of S-15 was the responsibility of the Electro-Mechanic Engineering Branch at Marshall.

Sun and earth sensors, peering out through small apertures in the micrometeorite shield, will permit scientists on the ground to know at all times the exact orientation of the satellite with respect to the earth, sun and stars, thus pinpointing the direction from which gamma rays are coming. An insulated temperature sensor, also directed out through the thin shield, is designed to study the thermal radiation balance of a body in orbit.

To effect this necessary tumbling or propeller-like action on achieving orbit, the satellite is equipped with a unique damping mechanism. This device, fitted into the after end of the fourth-stage rocket's motor case, is a hollow, mercury-filled cylindrical adapter, resembling a retainer ring. When injected into orbit, S-15 will be spinning about its longitudinal axis at about 380 rpm. Although it would eventually slow down and begin tumbling by the very nature of its structure, scientists want a controlled tumble, beginning shortly after the satellite has gone into orbit.