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FOR RELEASE: MONDAY PM's
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PROJECT: RADIATION-DETECTION SATELLITE

SCHEDULED LAUNCH: DECEMBER 16,1964

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NEWS NASA
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**NASA SCHEDULES LAUNCH
OF RADIATION-DETECTION
SATELLITE THIS MONTH**

A 101-pound radiation-detection satellite carrying five experiments will be launched by the United States into an egg-shaped orbit around the Earth no earlier than Dec. 16, from Cape Kennedy, Fla.

The Energetic Particles Explorer D (EPE-D), formerly designated S-3c, will continue the National Aeronautics and Space Administration's intensive program to study the natural and artificial radiation belts surrounding the Earth. Earlier satellites in the energetic particles series included Explorers XII, XIV, and XV.

Primary objective of the new satellite is to help scientists understand how high energy particles are injected, trapped and eventually lost in the radiation belts.

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Information obtained from the mission is expected to make important contributions to the Apollo manned lunar landing program, specifically in the design of protective spacecraft shielding and in planning flight trajectories for Moon landing. Information on the depth of penetration of the geomagnetic field by high energy solar protons--particles of potential danger to Moon-bound astronauts--may also be obtained.

The EPE-D will be launched by a three-stage Delta into an oval orbit carrying it deep into the Van Allen radiation belt to an apogee (high point) of about 15,800 miles. Its intended perigee (low point) is 200 miles. Its orbital period will be slightly more than seven hours at an angle of inclination to the Equator of about 21 degrees--keeping it near the Earth's geomagnetic equator.

The five experiments carried by the compact radiation detector--including a solar cell radiation damage experiment--are the same as those flown on the Explorer XV satellite launched Oct. 27, 1962. Purpose of Explorer XV was to study the artificial radiation belt created by the U.S. high altitude nuclear explosion called STARFISH July 9, 1962, over Johnson Island in the Pacific Ocean.

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The EPE-D experiments were contributed by the Bell Telephone Laboratories, Murray Hill, N.J.; the University of California, San Diego; the University of New Hampshire, Durham; and the NASA Goddard Space Flight Center, Greenbelt, Md. Goddard also is responsible for construction of the satellite, its launch and the collection and distribution of the scientific data obtained.

Trapped energetic particles, consisting primarily of high and low energy electrons and protons, form what may be described as a lopsided doughnut-shaped ring around the Earth roughly following the magnetic field lines of the magnetosphere.

Called the Van Allen radiation belt after its discoverer, Dr. James A. Van Allen of the State University of Iowa, this Region begins roughly 600 miles above the Earth over the geomagnetic equator and extends out to more than 40,000 miles.

The belt is a complex mixture of energetic particles--best described as the fourth state of matter because it is neither a solid, liquid or gas.

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Exactly how particles stream into the belt from interplanetary space, become trapped and eventually are lost is still unclear. It is hoped that the EPE-D satellite studying both the Van Allen belt and the remains of the artificial belt created by STARFISH will provide some of the answers to these critical questions.

Although it is essentially the same satellite as Explorer XV, the EPE-D carries an improved telemetry system and many of its electronic components have been made more radiation resistant. The pulse frequency modulation (PFM) telemetry system will operate continuously to allow real time data acquisition by tracking stations.

Design lifetime of the satellite is one year, although project officials will consider the mission successful if more than three months' data are obtained.

The EPE-D mission is part of the scientific space exploration program of NASA's Office of Space Science and Applications. Project management is assigned to the NASA Goddard Space Flight Center.

Electrical integration of the satellite was accomplished by Electro-Mechanical Research, Inc., College Park, Md. Prime contractor for the Delta launch vehicle is Douglas Aircraft Co., Santa Monica, Calif.

(Background Information Follows)

BACKGROUND INFORMATION

The Energetic Particles Explorer Satellite and its Experiments

The main body of the 101-pound EPE-D satellite is a fiber-glass honeycomb platform octagonal in shape which houses most of the experiments, electronics and other instruments needed for operation. It is 17 inches high and slightly more than 27 inches in diameter. Its cover is made of thin aluminum.

Predominant external features of the satellite include four solar panels protruding from sides of the main body, and a 34-inch magnesium tube extending from the center of the main body on which is mounted the flux gate magnetometer experiment.

The five experiments carried onboard EPE-D are:

--Electron-Proton Angular Distribution and Energy Spectra provided by Dr. Walter L. Brown, Bell Telephone Laboratories. This is a series of solid-state detectors to measure the spatial and angular distribution and energy spectra of electrons and protons.

--Electron-Proton Directional-Omnidirectional Detectors provided by Dr. Carl E. McIlwain of the University of California, San Diego. These scintillator-type detectors were originally

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developed for use on the Relay communications satellite; however, they were flown instead on Explorer XV. Their purpose is to measure the intensity and angular distribution of protons and electrons.

--Magnetic Field Measurements (Flux gate Magnetometer) provided by Dr. Laurence Cahill of the University of New Hampshire. This instrument will measure the magnitude and direction of the Earth's magnetic field from about 6,000 miles above the Earth out to the satellite's apogee. Data from the electron and proton experiments will be correlated with the magnetic field data from this experiment.

--Ion-Electron Detector provided by Leo R. Davis and James M. Williamson of the Goddard Space Flight Center. This scintillator detector is designed to measure relatively low energy particles by type and energy as a function of direction, time and position. It has been flown on Explorers XII, XIV and XV.

--Solar Cell Damage provided by Luther W. Slifer, Jr., of the Goddard Space Flight Center. The primary objective of this experiment is to provide a means of determining damage to a group of solar cells by radiation from the Van Allen and

STARFISH belts. It includes four groups of ten "n on p" silicon solar cells with different base-resistivities and cover shield thicknesses. The cells are mounted on the side of the satellite's main body.

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FACT SHEET

Energetic Particles Explorer D Satellite

Weight:	101 pounds (including about 26 pounds for experiments)
Main Structure:	Octagon, 27 3/4 by 27 3/4 by 17 inches, fiberglass honeycomb platform with aluminum honeycomb cover and magnesium center tube to support magnetometer
Appendages:	Four solar panels, 20 inches long by 13 inches wide Four antennas, 24 inches long Flux gate magnetometer mounted on 34-inch boom
Launch:	Delta rocket number 27 from Pad 17A, Cape Kennedy, Fla., no earlier than Dec. 15, 1964
Launch Window:	Approximately 30 minutes
Apogee:	15,800 statute miles
Perigee:	200 statute miles
Period:	Approximately seven hours
Inclination:	21 degrees
Power System:	6,144"p on n"solar cells mounted on four panels (1,536 cells per panel) to charge 13 silver-cadmium battery pack to meet required power of about 15 watts

Communications and Data-Handling System:

Telemetry:	Pulse-frequency modulation (PFM)
Transmitter:	Two-watt output at 136.275 mcs
Encoder:	16 channels, using five analog and four digital oscillators

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* <u>Tracking and Data-Acquisition Stations</u>:

Blossom Point, Md.; Fort Myers, Fla.; Johannesburg, Republic of South Africa; Lima, Peru; Mojave, Calif.; Quito, Ecuador; Santiago, Chile; Woomera, Australia; College, Alaska; East Grand Forks, Minn.; St. Johns, Newfoundland; and Winkfield, England.

*Stations of the world-wide Space Tracking and Data Acquisition Network (STADAN) managed by the Goddard Space Flight Center.

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The Delta Launch Rocket

The NASA-developed, three-stage Delta rocket will be used to put EPE-D into orbit.

The Delta rocket has the following general characteristics:

Height:	90 feet
Maximum Diameter:	8 feet
Lift-off Weight:	about 57 tons

First Stage: Modified Air Force Thor, produced by Douglas Aircraft Co.

Fuel:	Liquid (kerosene with liquid oxygen as oxidizer)
Thrust:	170,000 pounds
Burning Time:	About two minutes and 25 seconds
Weight:	Over 50 tons

Second Stage: Aerojet General Corp., JA 10-118A propulsion system

Fuel:	Liquid
Thrust:	About 7,500 pounds
Burning Time:	About one minute, 40 seconds
Weight:	Two and one-half tons

Third Stage: Alleghany Ballistics Laboratory X-258 motor

Fuel:	Solid
Thrust:	About 5,700 pounds

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Third Stage: (cont'd)

Burning Time:	22.5 seconds
Weight:	About 576 pounds
Length:	59 inches
Diameter:	18 inches

During first and second stage powered flight, the Bell Telephone Laboratory radio-guidance system is used for in-flight trajectory corrections. It also commands second-stage cutoff when the desired position, velocity and altitude have been achieved.

Following second stage cutoff, a four-minute coast period occurs. During this period, small rockets mounted on a table between the second and third stages ignite and spin up the third stage and the satellite. The second stage then separates and third stage ignition occurs, giving the EPE-D its final boost toward orbital injection. Once in orbit, the EPE-D spin rate will be about 25 RPM.

Project management of the Delta rocket program is exercised by the Goddard Space Flight Center.

The EPE-D Team

The National Aeronautics and Space Administration's Office of Space Science and Applications is responsible for the Energetic Particles Explorer program. The EPE-D satellite was designed, built and underwent environmental testing at the Goddard Space Flight Center, Greenbelt, Md. Electrical integration of the satellite was accomplished by Electro-Mechanical Research, Inc., College Park, Md.

The prime contractor for the Delta launch rocket is the Douglas Aircraft Co., Santa Monica, Calif. Douglas also is responsible for pre-launch and launch operations under supervision of the Goddard Launch Operations Branch at Cape Kennedy. Logistic support is provided by the Air Force Eastern Test Range.

The following key officials are responsible for the Energetic Particles Explorer D program:

NASA Headquarters

Dr. Homer E. Newell, Associate Administrator of Space Science and Applications

Dr. Alois W. Schardt, EPE-D Program Scientist

Frank Gaetano, EPE-D Program Engineer

T. Bland Norris, Delta Program Manager

Goddard Space Flight Center

Dr. Harry J. Goett, Director

Dr. John W. Townsend, Jr., Associate Director, Office of Space Science and Satellite Applications

Gerald W. Longanecker, EPE-D Project Manager

Herbert Meyerson, EPE-D Assistant Project Manager

John Braham, EPE-D Project Coordinator

Leo R. Davis, EPE-D Project Scientist

William R. Schindler, Delta Rocket Project Manager

Robert H. Gray, Manager, Goddard Launch Operations

John Neilon, Associate Manager, Goddard Launch Operations (Eastern Test Range)

The Experimenters

Electron Energy Distribution	Dr. Walter L. Brown Bell Telephone Laboratories
Directional and Omidirectional Detectors	Dr. Carl E. McIlwain University of California, San Diego
Magnetic Field Measurements	Dr. Laurence Cahill University of New Hampshire

Ion-Electron Detector	Leo R. Davis and James M. Williamson Goddard Space Flight Center
Solar Cell Damage	Luther W. Slifer, Jr. Goddard Space Flight Center

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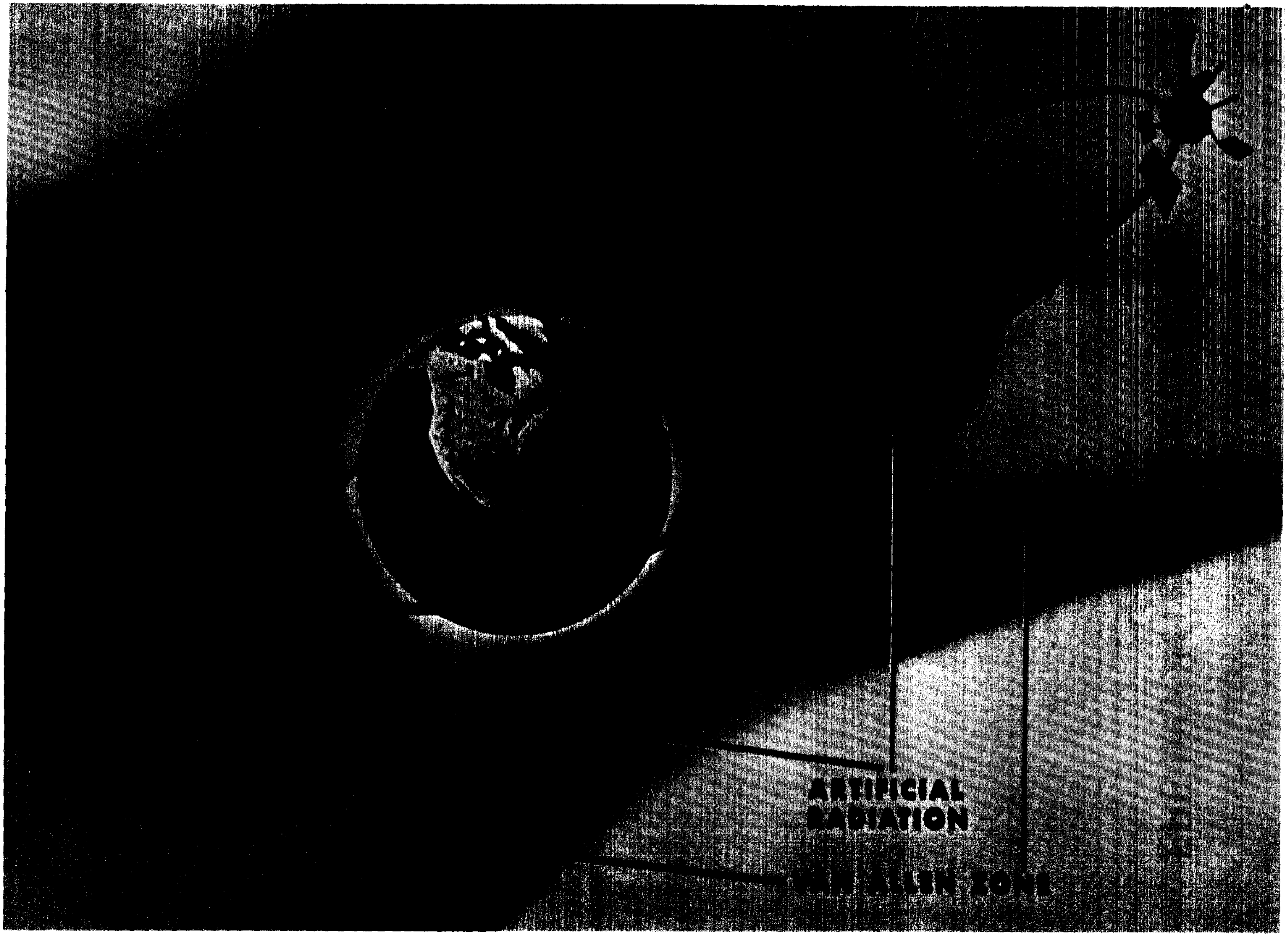
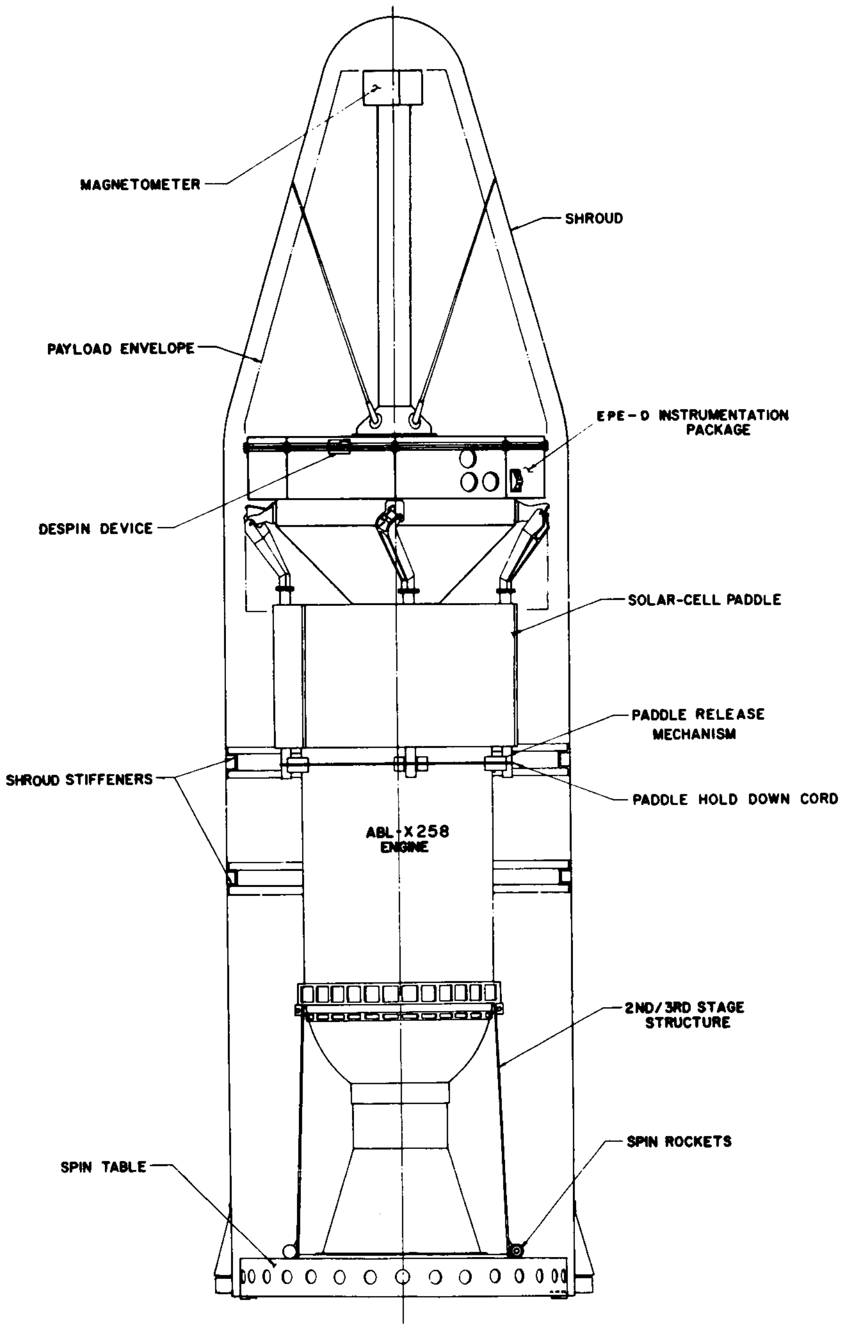
EXPLORING THE RADIATION BELTS

Only a few years ago men believed they lived on an oblate sphere revolving about the Sun, and were shielded from its radiation and other hazards in space by the atmosphere--a mixture of gases which included life-sustaining oxygen. The atmosphere was believed to be only about 100 miles thick. The Earth had a magnetic field, because its molten iron core revolved on its axis and around the Sun; but it was envisioned as an orderly affair: symmetrical lines of force spreading out perhaps hundreds of thousands of miles, losing strength as they went, until they disappeared completely somewhere in empty space.

The space age changed this picture. Explorer I, the first satellite launched by the United States, was designed to study cosmic rays using a simple Geiger counter. The radiation count would increase progressively, it was felt, as Explorer I climbed toward its apogee of 960 miles, for most cosmic rays are absorbed in the atmosphere. Experimenters found instead that the satellite went dead over long stretches. Perhaps, they reasoned, the Geiger tube had been somehow damaged at launch. However, the silent periods occurred with regularity as Explorer I


ARTIFICIAL
RADIATION
VAN ALLEN ZONE

EPE MOUNTED ON DELTA ROCKET



crossed the equator and the count seemed to decrease on upward climbs and increase on the way back to perigee.

Another Geiger tube was put on Explorer III to repeat the experiment. The same results were found. It was realized that the Geiger tube was not faulty, but that it was jammed into silence in certain areas by a tremendous flood of energetic particles.

These results seemed to verify a theory of a Norwegian geophysicist, Carl Stormer, who in 1907 suggested that the Earth's magnetic field acted as a trap for charged particles, deflecting at right angles to both their paths and to lines of magnetic force as they entered the field at high speeds.

The newly-found regions--one of the most significant space science discoveries--were named the Van Allen belts, after the Explorer I experimenter.

Later satellite investigations seemed to indicate that there were two Van Allen belts, one some 2,000 miles above Earth consisting of high-energy protons, and another 10,000 miles above Earth of high-energy electrons. The lower belt, an ovular shaped area in profile, hangs above the equator with protons spiraling about the magnetic lines of force, traveling from hemisphere to hemisphere in a few seconds, mirroring and returning on another line. The upper belt, loops in a banana shape in profile, its ends curling toward Earth at about 75 degrees north and south of the equator. Above the polar regions space was believed to be free of trapped energetic particles.

Later satellite explorations--especially Explorers XII and XIV--altered this view. Low energy protons were discovered in the upper belt, and electrons in the lower belt. Not only did the constituency prove to be more complex than it appeared to be at first, but the Van Allen belts proved to be one region, of varying intensity, and of greater extent than had been first presumed.

This whole region, now called the magnetosphere, appears to be egg-shaped, more than 100,000 miles long on the axis away from the Sun, and much less on its other axis. Charged particles stream from the Sun, at times of solar flares with considerable strength and intensity. On the sunlit side of the Earth the magnetosphere is compressed by the solar wind; the outer boundary, about 40,000 miles from Earth when the wind is normal, can be compressed to within 25,000 miles by a strong gust. The solar wind creates a shock wave when it hits the magnetosphere, then streams around it and tapers out as it leaves the Earth, shaping the magnetosphere as a long tail on the dark side, leaving an area of turbulence.

The process by which particles are trapped remains unknown. It is theorized that particles come from two sources, from the solar wind and, in the lower belt, from cosmic ray reactions with atoms in the atmosphere. Also, it is not known how electrons disappear into the atmosphere or outer space and at what rate. It is not known how the trapped particles maintain themselves and accelerate in energy. It is believed that particles, fed into the atmosphere, perhaps by the pressure of solar storms, have an effect upon weather, causing such phenomena as the Aurora Borealis and temperature changes in the atmosphere.

The Department of Defense and the Atomic Energy Commission detonated the STARFISH device 250 miles above Johnston Island July 9, 1962. It created a low altitude artificial radiation belt. Although initial predictions were that the test would temporarily increase the electron density of the natural radiation belts, it had not been expected that the artificial radiation would be as intense as it proved to be.

Seconds after the explosion, auroras were observed in New Zealand and Samoa. All radio communications in the Pacific area were disrupted. Within a month, three satellites were seriously effected by radiation--Ariel I, Transit IVB, and TRAAC.

The potential hazard to future spacecraft, manned and unmanned, made it important to measure and understand the artificial radiation belt as soon as possible.

Explorer XV was launched Oct. 27, 1962, into an orbit of 10,460 miles apogee and 185 miles perigee. The orbit was chosen in order to measure the new artificial belt. The experiments were designed to study the pitch-angle distribution of the particles at various distances from Earth above the magnetic equator, as well as to study how particles are injected into the belt, the trapping mechanism, and how they are lost.

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The heart of the artificial belt existed about 2,000 miles overhead, and dipped low enough to create a "hot" area above South Atlantic Ocean that could be grazed by manned spacecraft.

At low altitudes, the radiation was rather quickly dispersed into the atmosphere. At high altitudes the radiation disappeared into space with magnetic fluctuations. This was proven by observation of high-altitude Russian explosions which occurred after Explorer XV was in orbit. These devices were detonated at high altitudes over the Caspian Sea. Most of the radiation was quickly dispersed.

Except for the intermediate altitudes of 1,000 to 2,000 miles above Earth, the STARFISH belt decayed rapidly. The particles in that area are expected to last 10 years more as a distinct belt and their residue may last at least 20 years among the naturally trapped particles.

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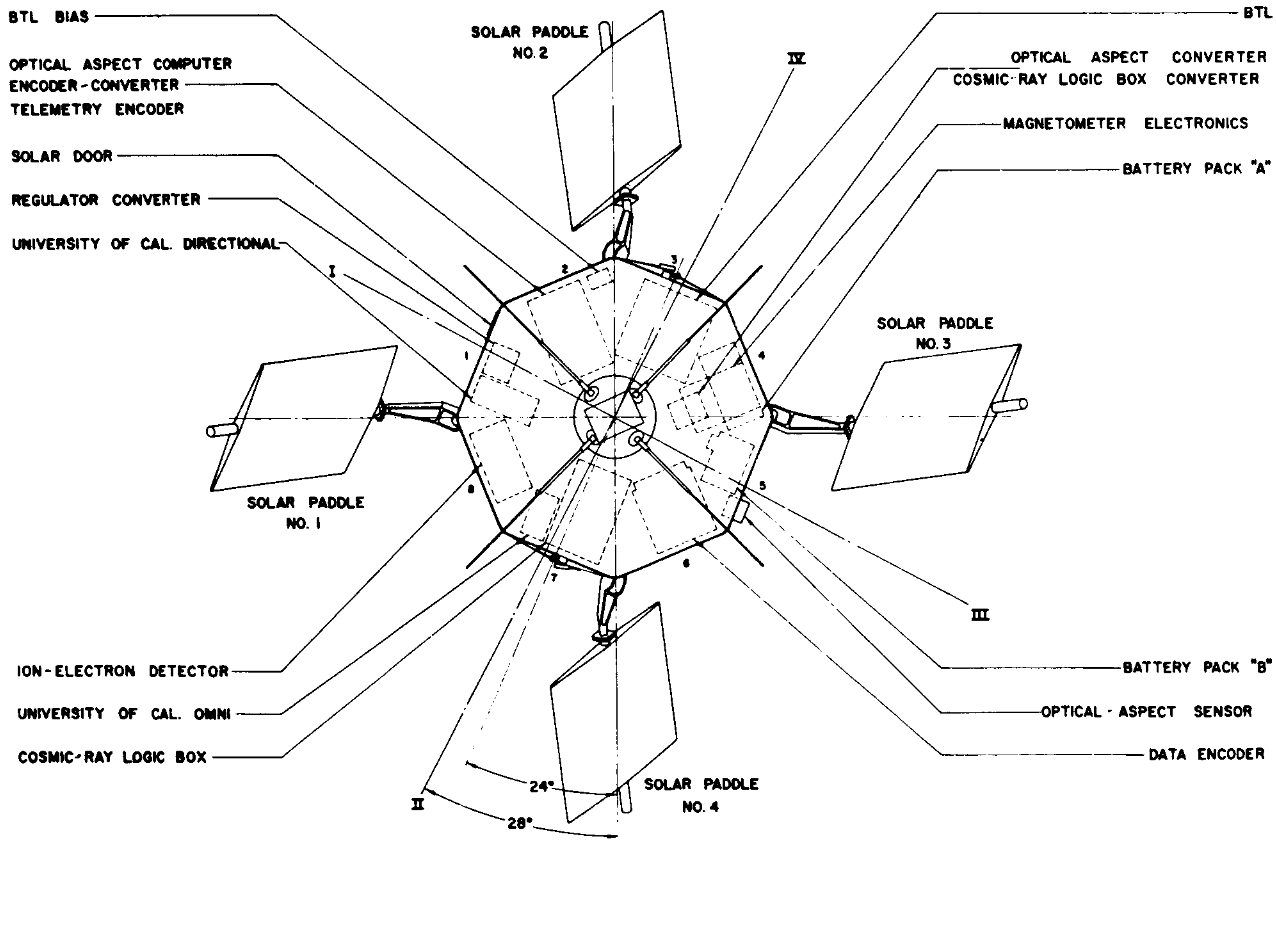
ENERGETIC PARTICLES EXPLORER D

EXPERIMENT/EQUIPMENT LOCATIONS



ENERGETIC PARTICLES EXPLORER D

DIMENSIONS (inches)