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FOR RELEASE: FRIDAY P.M.
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PRESS KIT

PROJECT: PIONEER E
(To be launched no earlier than Aug. 27.)

contents

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NEWS

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546 TELS: (202) 962-4155 (202) 963-6925

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PIONEER E LAUNCH SCHEDULE

The National Aeronautics and Space Administration will launch the last in the current series of interplanetary Pioneer spacecraft, Pioneer-E, from Cape Kennedy, Fla., no earlier than August 27, 1969. The launch window is 6:06 to 6:15 p.m. EDT.

Upon successful launch it will become Pioneer 10.

The long-tank Delta launch vehicle will place the spacecraft in a solar orbit along the path of Earth's orbit. The spacecraft will pass inside and outside Earth's orbit, alternately speeding up and slowing down relative to Earth. This unique orbit will keep Pioneer within 10 million miles of Earth during its six months to two and one-half years operational lifetime. The spacecraft will continue to transmit scientific data at a high rate throughout this period, and possibly longer.

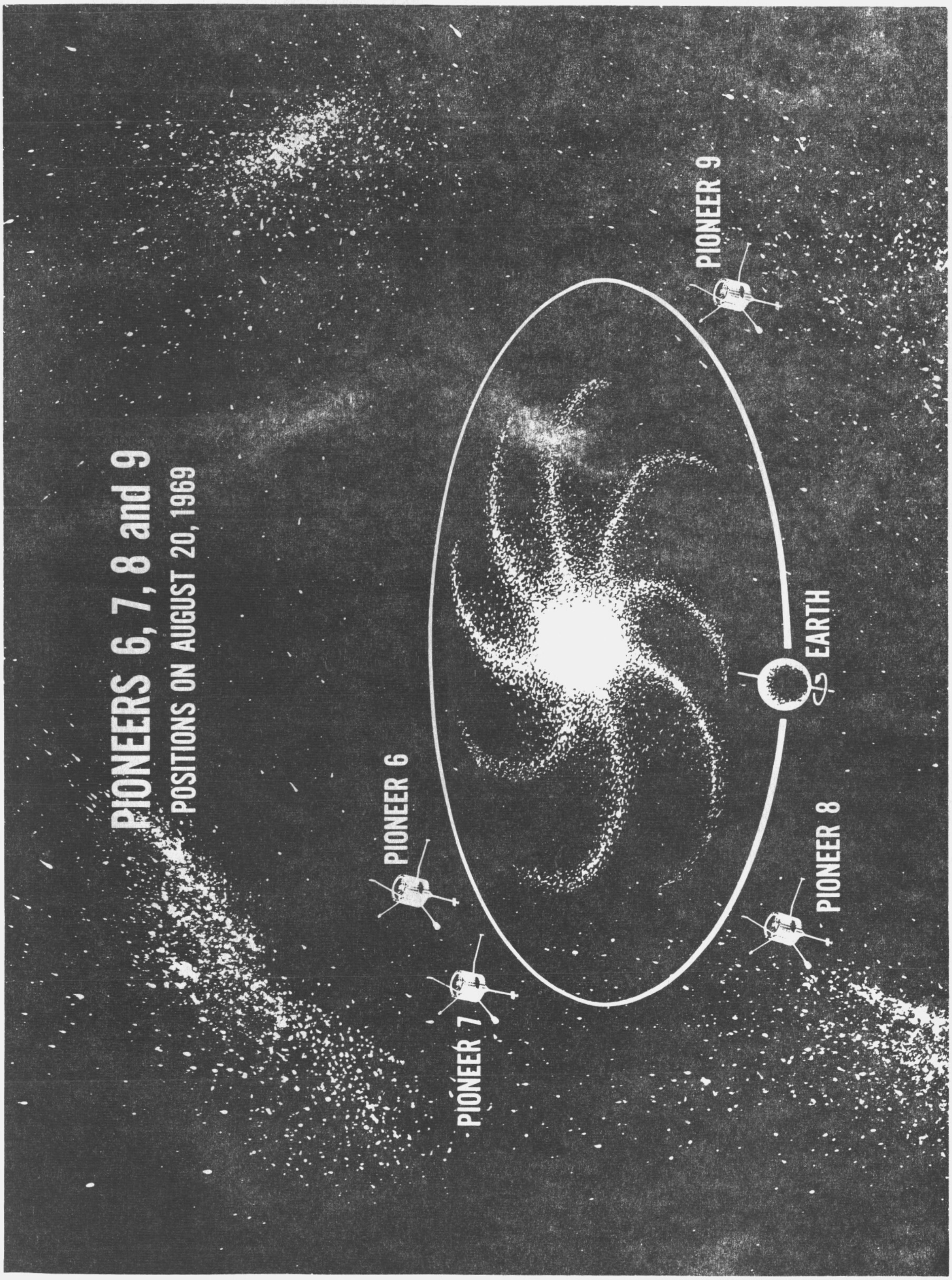
A Test and Training Satellite (TETR-C) will be launched as a secondary payload with Pioneer E.

Pioneer-E's mission is to acquire data on plasma, energetic particles, magnetic and electric fields radiating outward from the Sun toward Earth. These data will be combined with those from the four preceding Pioneers 6, 7, 8 and 9 as well as Mariners 4 and 5, and seven Interplanetary Explorers (IMPs) three of which are still operating. All these spacecraft are expected to monitor the high activity period of the 11-year solar cycle, which peaks this year.

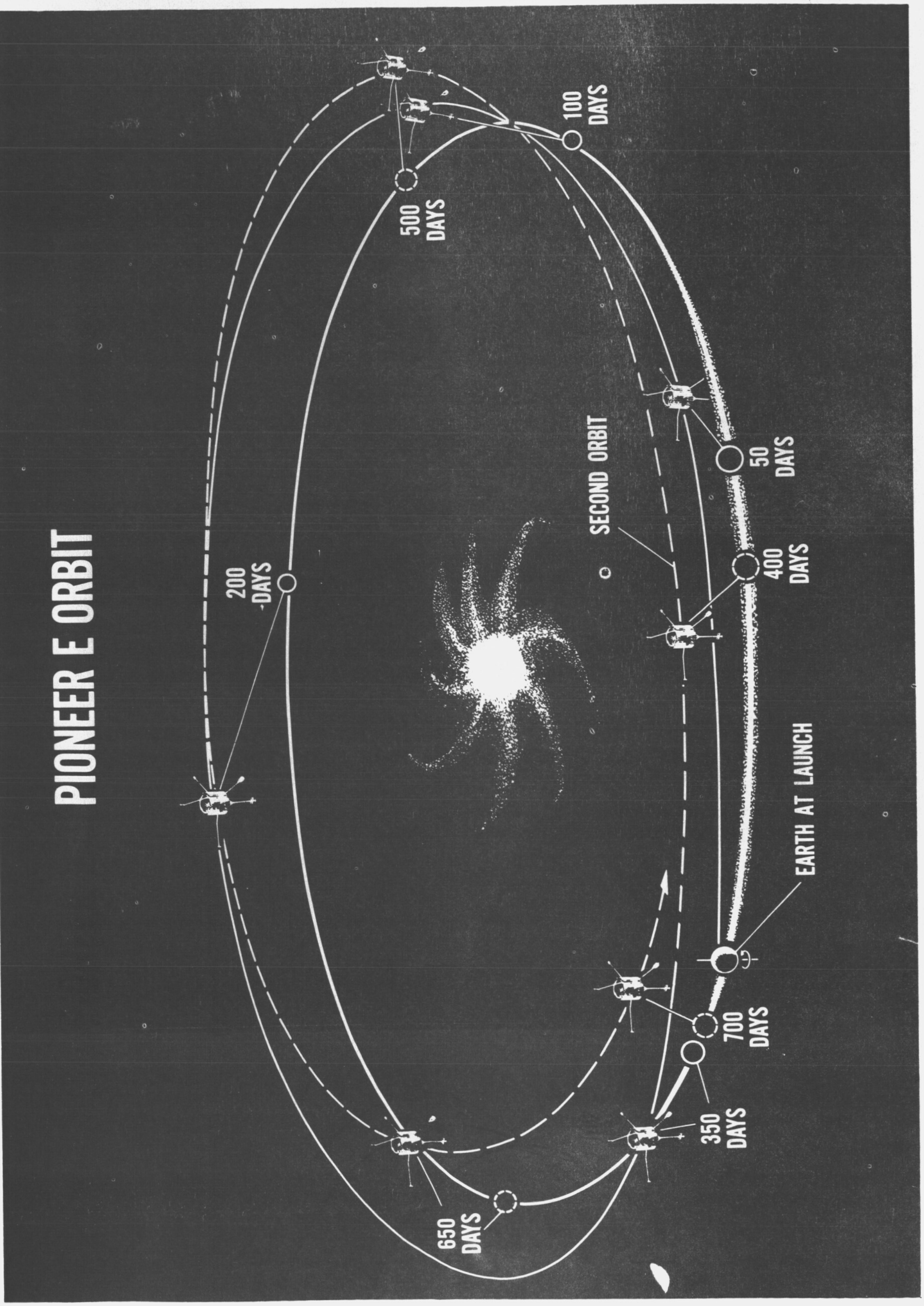
The combined data will help scientists further understand solar processes, the interplanetary medium and the effects of solar activity on the Earth.

Solar disturbance warnings are supplied to the Environmental Science Services Administration's Space Disturbance Forecast Center, Boulder, Colo. They are then issued to about 1,000 primary users. These include the Federal Aviation Agency, commercial airlines, power companies, communications organizations, and organizations doing electronic prospecting, surveying and navigation.

Pioneer data, taken simultaneously at many points, millions of miles apart, around the Sun, are reduced by computers to produce solar weather tables.



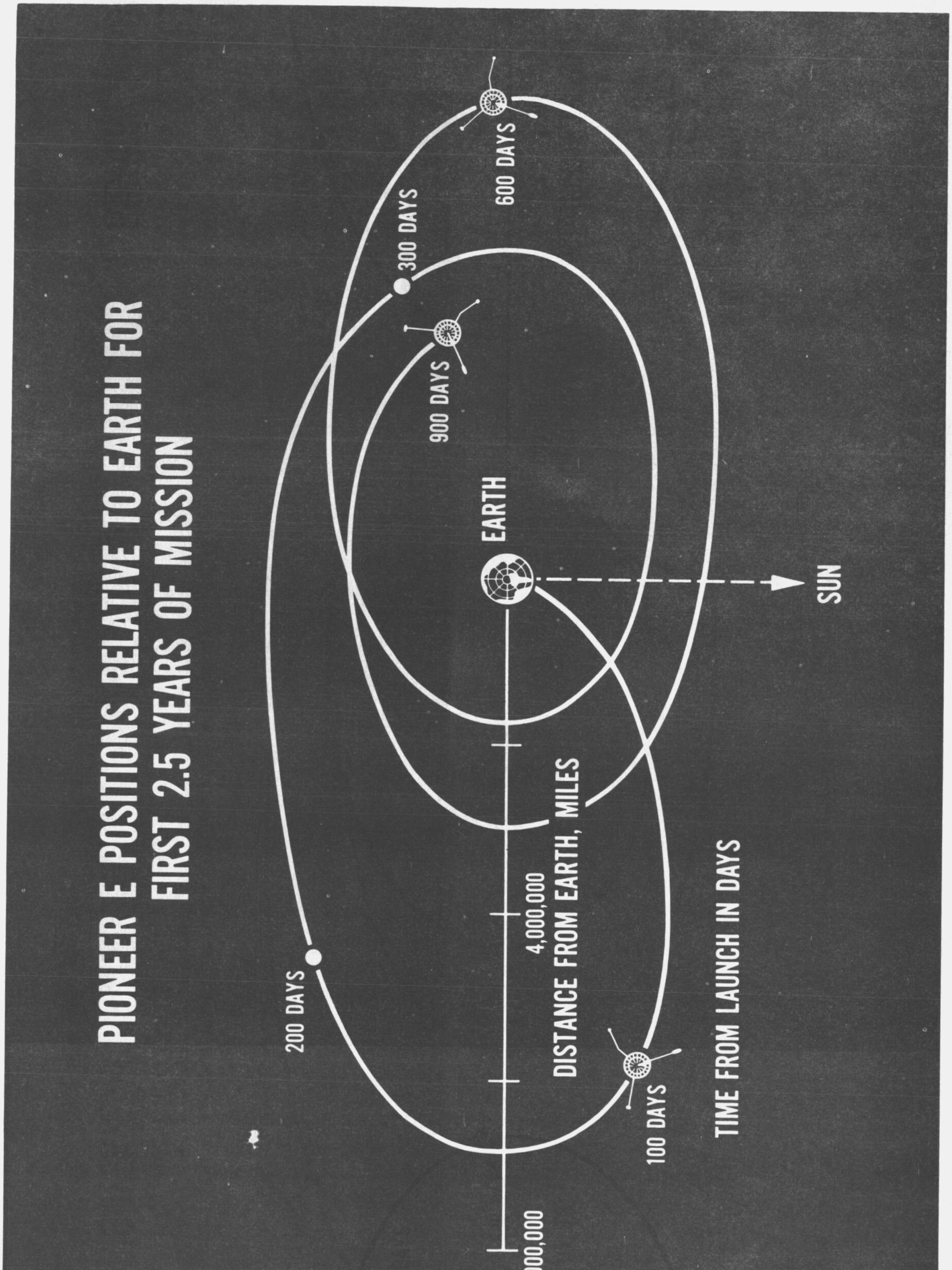
PIONEERS 6, 7, 8 and 9
POSITIONS ON AUGUST 20, 1969
PIONEER 6
PIONEER 7
PIONEER 8
PIONEER 9
EARTH


PIONEER E ORBIT
100 DAYS
500 DAYS
200 DAYS
SECOND ORBIT
50 DAYS
400 DAYS
EARTH AT LAUNCH
700 DAYS
350 DAYS
650 DAYS

These "solar weather stations" provide up to two weeks' warning on the effects of solar activity on Earth. Another practical application of solar data is expected to be an improved ability to predict or control certain aspects of our terrestrial environment. U.S. weather scientists have found statistical correlations between solar disturbances and frequency and intensity of Earth storms. Some scientists believe climate, earthquake activity, even life pattern and growth rate are directly related to solar activity.

Pioneer spacecraft are now providing warnings of communications blackouts and electric power interruptions. During the Apollo lunar landings, hourly reports on solar activity were sent to the Apollo Mission Control Center, Houston, Texas. The Apollo reports were to guard against any unexpected arrival of intense showers of solar protons which could be dangerous to astronauts on the Moon.

Adequate solar forecasting is essential to the success of many aerospace activities. There are more than 1500 objects in orbit around Earth today, and with the coming age of supersonic aircraft flying on the fringes of space, solar proton warnings will be needed for passenger safety.


PIONEER E POSITIONS RELATIVE TO EARTH FOR FIRST 2.5 YEARS OF MISSION
200 DAYS
300 DAYS
600 DAYS
900 DAYS
100 DAYS
EARTH
SUN
8,000,000
4,000,000
DISTANCE FROM EARTH, MILES
TIME FROM LAUNCH IN DAYS

Geomagnetic storms (intense variations in the magnitude and direction of the Earth's magnetic field) and other space disturbances modify the orbits of spacecraft, and charged particles degrade or damage solar cells, instruments and other electronic components used in space vehicles. Increased knowledge of space disturbances can result in more effective protection against them.

Geomagnetic storms for years have caused trouble for equipment such as compasses and other devices depending on a stable magnetic field.

Companies exploring for oil or minerals with aircraft are forced to suspend operations during an intense geomagnetic storm. There is evidence that overloads, opened circuit breakers and other disruptions to large electric power utility systems, particularly in northern latitudes, have been caused by such storms. This may become an increasing problem as utility operations encompass larger (geographically dispersed) interconnected power networks.

Malfunctions in wireline communications, communication and navigation detection systems utilizing high frequency radio signals, and telemetry from spacecraft are attributed to geomagnetic disturbances. During intense storms, high frequency communications along some routes become impossible for many days, even a week or more.

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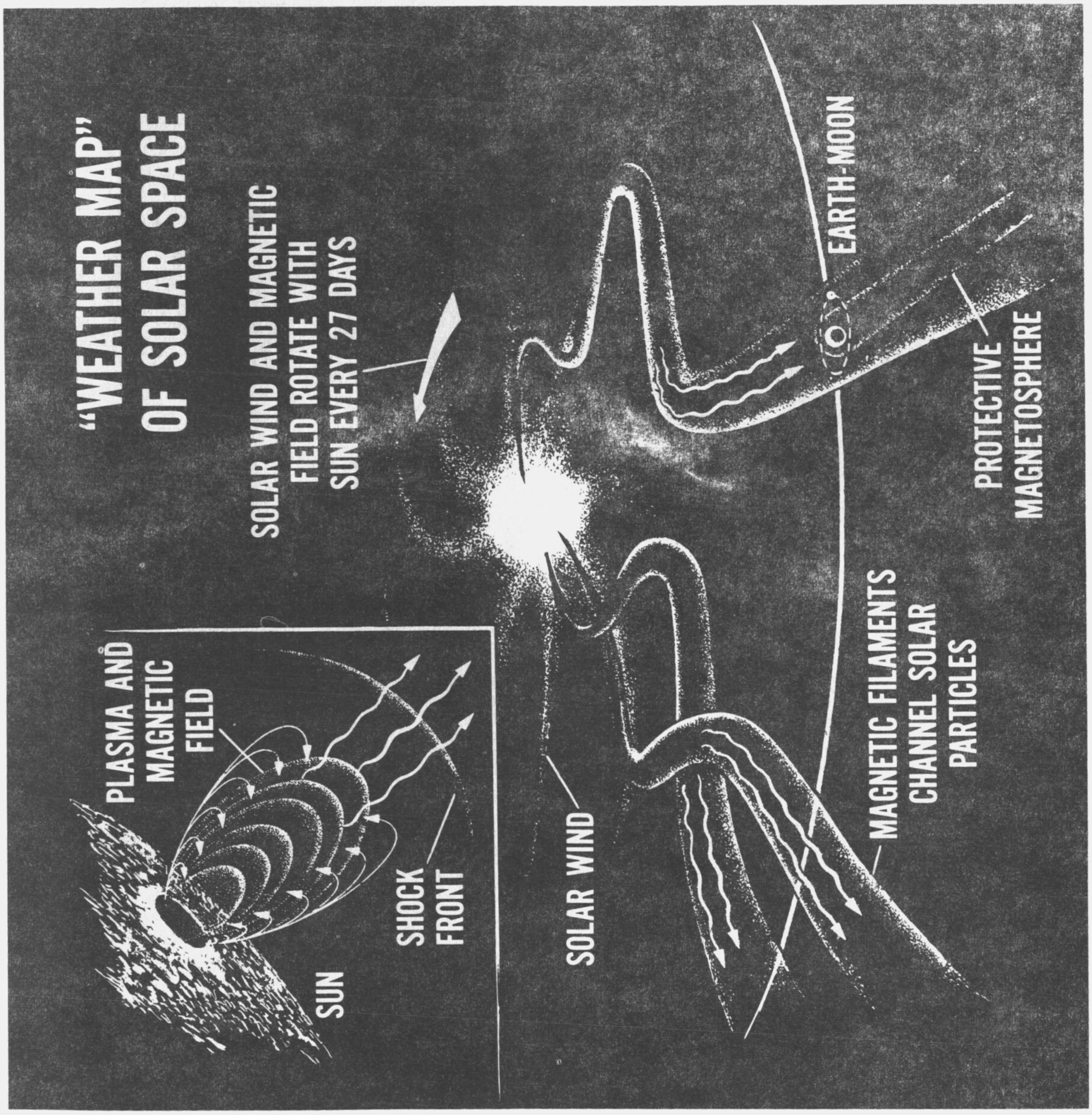

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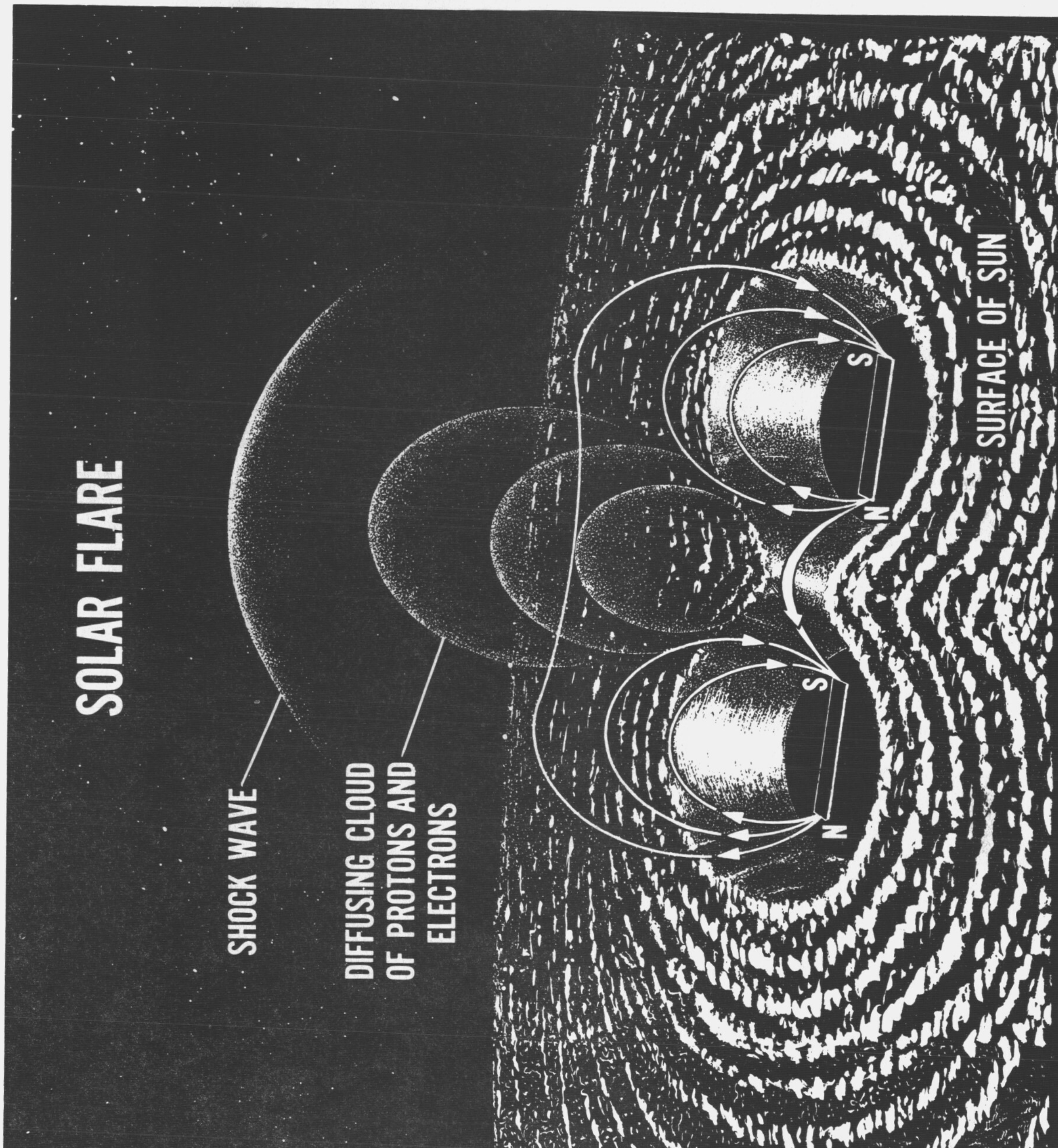

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On April 13, 1969 solar disturbances, picked up by Pioneer spacecraft three days earlier, resulted in shutting down almost all radio communications for almost a week in the arctic regions.

Based on evidence recorded by Pioneer 7 on April 22, a geomagnetic storm was forecast for April 28. It began within three hours of the time predicted. Such predictions are expected to be much improved when the processes in the interplanetary medium are better understood.

The million-mile-an-hour solar wind, which constantly blows out from the Sun, is threaded with curving magnetic filaments rooted in the Sun, carrying massive streams of high-energy particles. At the Earth they have a diameter of about two million miles. New particles constantly sweep past Earth in co-rotation with the Sun's 27-day rotation.

Very-high-energy solar storm particles from solar flares can cover the 93 million miles from Sun to Earth in as little as 20 minutes.

Scientific results obtained through research conducted with the most recently launched Pioneers include:

1) Measurements by high-resolution solar wind, electric field, and magnetometer instruments on Pioneers 8 and 9 have provided new information on the functions of the magnetosphere (the protective magnetic envelope which shields the Earth from high energy solar particle radiation).

2) Diffuse solar plasma regions appear to have an attraction of their own, which could account for the drawing out of the Earth's magnetic tail to several million miles, a phenomenon still not adequately explained.

3) Cosmic dust populations have been measured by coincidence-type instruments (to detect meteorites on impact) on Pioneer 8 and 9. Spatial density of micrometeorites is considered low enough to pose no hazard to missions in this region of space.

4) Several years of precision radar tracking of the four Pioneer spacecraft now in solar orbit have helped experimenters establish the most reliable value to date for the Earth-Moon mass ratio (accurate to 1 part in 8000), as well as for the Sun-Earth mass ratio (accurate to 1 part in 400,000).

5) Pioneer 6 passed behind the Sun last November. The effects of passage through the solar corona on its radio signal were measured, providing data on changes in the electrical and magnetic characteristics of the corona.

Scientific experiments on Pioneer-E include a high-resolution magnetometer, instruments to measure the solar wind, solar and galactic cosmic ray particles, electron densities, electric fields and cosmic dust.

A continuing celestial mechanics experiment based on tracking data from Pioneer spacecraft is refining measurements of Sun-Earth distances and planetary orbits. In addition, it is acquiring additional data regarding the theory of general relativity.

The Pioneer program is directed by NASA's Office of Space Science and Applications. Project management is by NASA's Ames Research Center, Mountain View, Calif. The Delta launch vehicle is managed by Goddard Space Flight Center, Greenbelt, Md., and is launched by Kennedy Space Center, Fla.

Communications and tracking will be by NASA's Deep Space Network (DSN), operated for NASA by the Jet Propulsion Laboratory, Pasadena, Calif.

The Pioneer spacecraft are built by TRW Systems Group, Redondo Beach, Calif. The Delta rocket is built by McDonnell Douglas Corp. at Santa Monica, Calif.

END OF GENERAL RELEASE; BACKGROUND INFORMATION FOLLOWS

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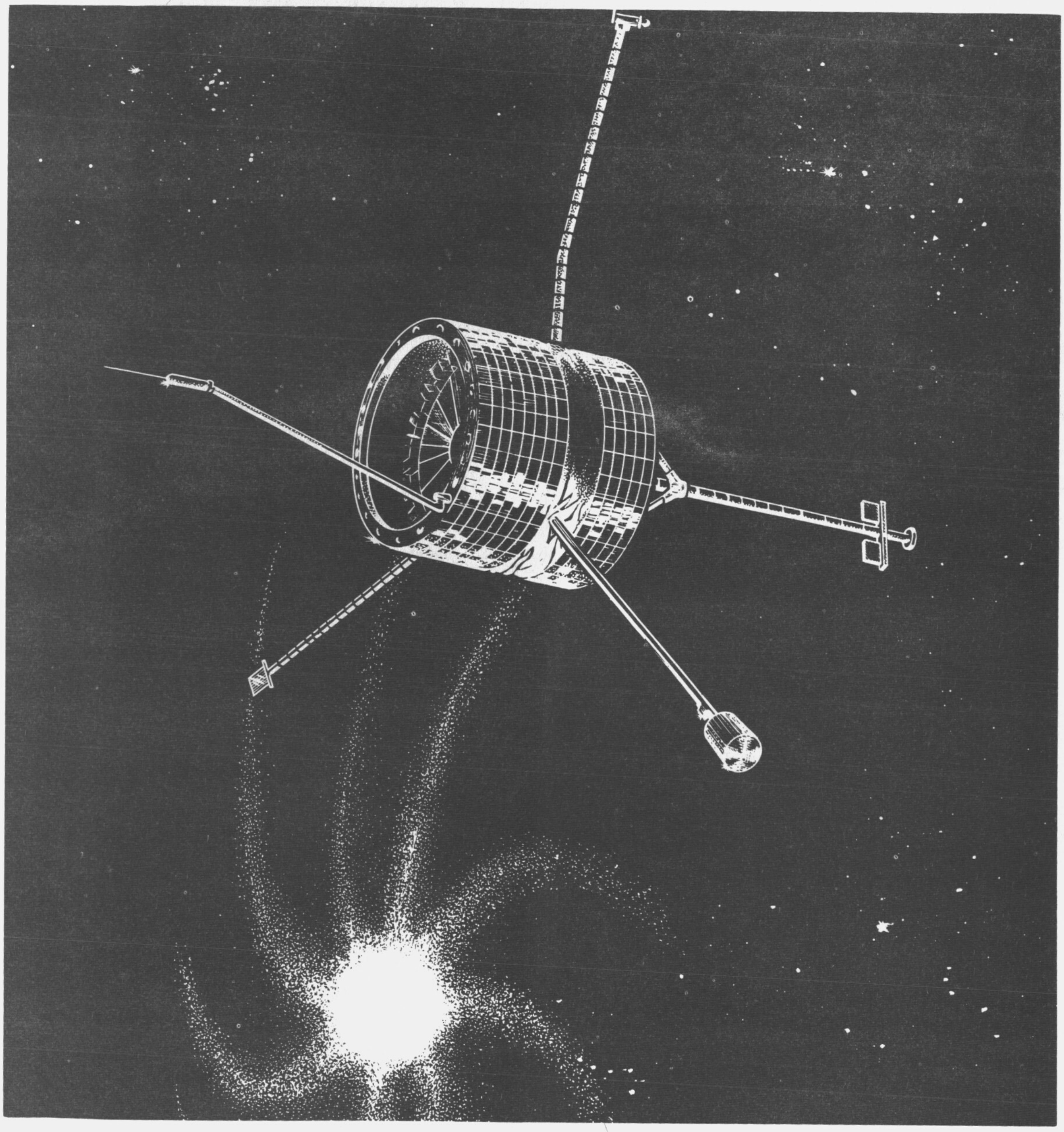

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PIONEER E SPACECRAFT

Overall Configuration

The Pioneers are designed as rugged, high-performance spacecraft. They have proved able to return large amounts of data on flights of several years over distances of many millions of miles.

All spacecraft systems have been chosen for simplicity and reliability. Maneuvering, for example, is handled by a single cold-gas jet.

Pioneer E weighs 148 pounds and carries 40 pounds of scientific experiments. Attitude of the Pioneers is extremely stable. Average drift for each six months in space has been about one degree.

The spacecraft is a drum-shaped container, 35 inches high and 37 inches in diameter. Its sides are covered with solar cells, and divided by a narrow circular band containing apertures for four experiments and four orientation Sun sensors. A fifth Sun sensor provides the experiments with a directional reference to the Sun's position.

At 120-degree intervals around the sides of the spacecraft are three five-foot four-inch booms, deployed horizontally in flight by the spin of the spacecraft.

Within the spacecraft, a circular platform carries most of the equipment. Below the platform, a pressure sphere carries the gas for the orientation system.

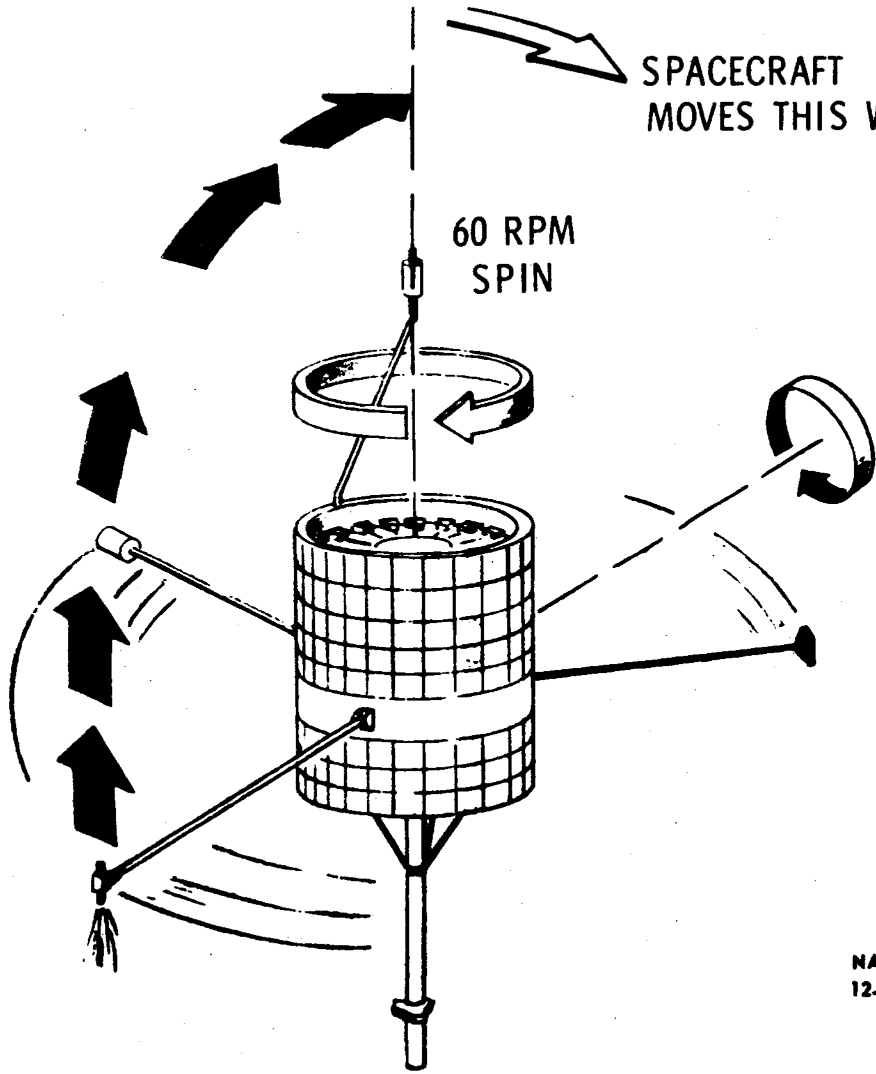
The spacecraft structure, made principally of aluminum, is lightweight and its cylindrical shape is inherently strong. There are more than 56,000 parts in Pioneer, including its scientific instruments.

Communication System

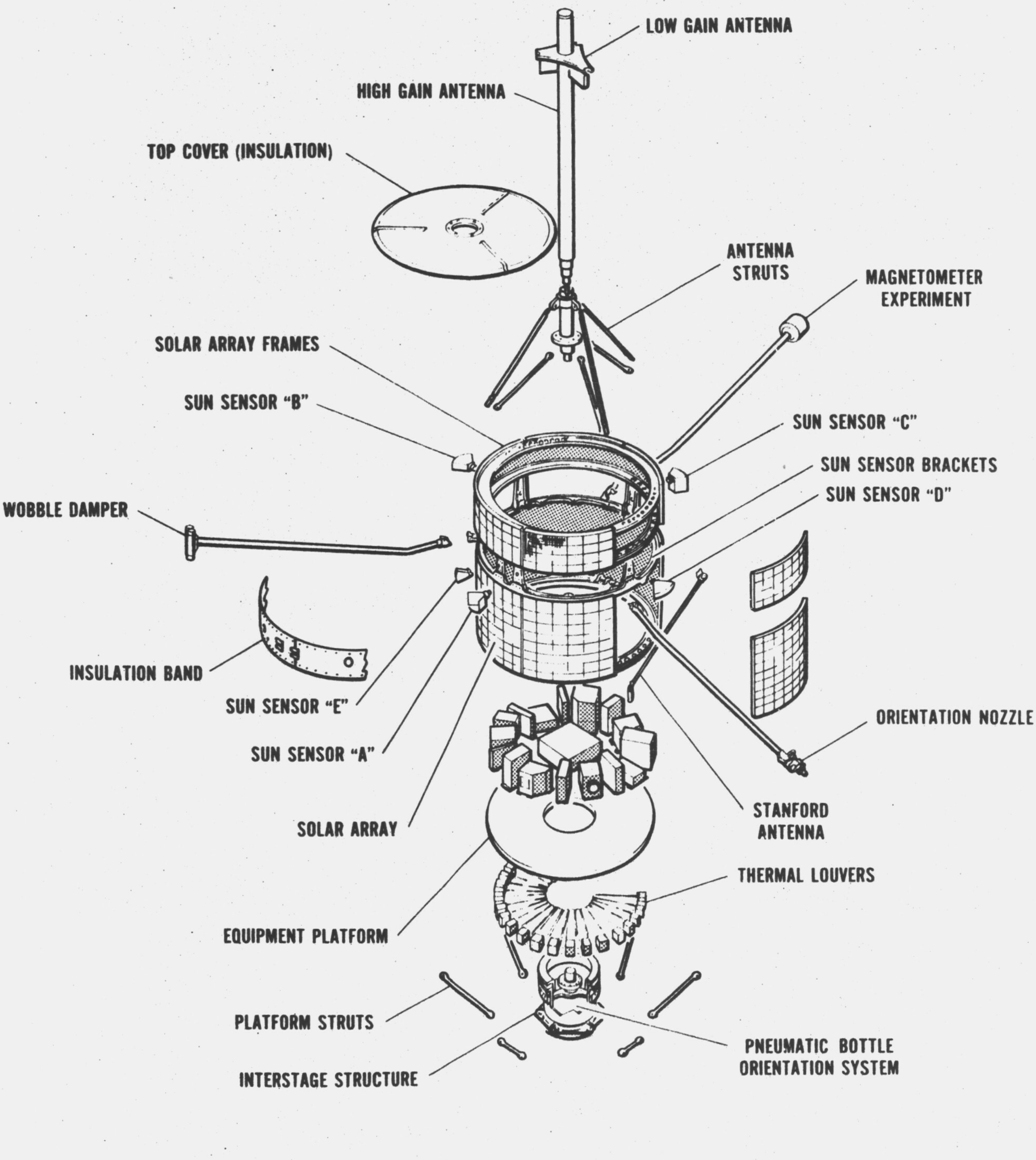
The 35-pound Pioneer communications, timing, and data handling system has performed well aboard Pioneers 6, 7, 8 and 9. It has returned some 18 billion data bits to Earth of 3,400 measurements. Pioneers 6, 7, 8 and 9 have received 25,000 commands from the ground.

The system maintains two-way S-band communication at about 2,200 megahertz.

PIONEER ORIENTATION MANEUVERING



PIONEER E SPACECRAFT COMPONENTS



Commands are sent to Pioneer from DSN antennas in binary (1,0) code. These commands are received by spacecraft antennas and routed to one of two radio receivers. They then go to one of two command decoders. Once decoded, commands are routed by the command distribution unit to a spacecraft system or experiment for execution.

To send information back to Earth, the spacecraft transmitter driver puts coded data on the basic S-band carrier and routes it to one of the two spacecraft traveling wave tubes, which amplifies the signal to about eight watts.

The Pioneers have the greatest data-return capacity of any interplanetary spacecraft because they match the most efficient rate of data return with the distance from the Earth. They return data at 512, 256, 64, 16, and 8 bits per second.

The convolutional coding system increases by 40 per cent the maximum distance from Earth at which it is possible to use any given bit rate. An encoder is synchronized with the spacecraft digital telemetry unit. Data from this unit are processed into a coded bit stream for transmission to the ground.

The ground station computers are programmed to process the coded data bit stream and, by using the coding information, can correct errors caused by the transmission link. The final data output has such a low error rate that the maximum distance at which a bit rate is usable is increased by 40 per cent over the uncoded system.

The spacecraft memory can store samples of data obtained during periods of up to 19 hours for later transmission to Earth.

Attitude Control

The Pioneers use the gyroscopic effects of their 60-rpm rotation to maintain a stable attitude.

Changes in attitude are achieved by turning the spacecraft about a selected axis through many brief thrusts from the nitrogen gas jet at the end of one boom. Force from this gas jet must be applied perpendicular to the desired direction of motion because the spinning craft precesses like a gyroscope.

- more -

Thrusts applied at one point on the circle of spacecraft rotation are timed by a sensor which sees the Sun once each spacecraft revolution.

Because the many thrusts at one point produce wobbling rotation, wobble is eliminated by flexibility of all three booms and by a damper consisting of two small balls in two cylinders at the end of one boom.

Pioneer E must have its spin axis perpendicular to both Sun-spacecraft line and Earth-spacecraft line, so that solar cells are illuminated efficiently, and the narrow beam antenna focuses on the Earth.

Sun orientation is automatic. One Sun-sensor sees the Sun for 80 degrees above the plane of spacecraft rotation; a second sees the Sun for 80 degrees below this plane. Proper orientation is achieved when the spacecraft turns until both see the Sun.

For Earth orientation, ground commands rotate the spacecraft around the spacecraft-Sun line, until its high-gain antenna acquires the Earth.

Power Systems

Pioneer E's 10,368 silicon crystal, n-on-p solar cells provide the spacecraft its 60-watt power needs.

Auxiliary power during launch, before solar cells begin to function, is provided by a rechargeable silver-zinc battery with a capacity of about two hours.

Temperature Control

Temperature is controlled by managing heat produced by spacecraft equipment and by heat-reflective coatings on the spacecraft exterior. Twenty louvers under the spacecraft equipment platform, actuated by bi-metallic springs, open and close automatically to release heat.

Magnetic Field

The magnetic field of the Pioneers is extremely low, 1/10 gamma (1/500,000 the Earth's field). Engineers achieved this low magnetism by using non-magnetic materials, new fabrication and inspection techniques, and design innovations.

SCIENTIFIC INVESTIGATIONS

Interplanetary space is hundreds of times less dense than the best vacuums achieved on Earth. Nevertheless, particles and fields radiated from solar disturbances propagate through it. They cause the auroras and feed the Van Allen radiation belts. Solar radiation provides the Earth its basic energy source.

Phenomena being explored by Pioneer spacecraft in interplanetary space include:

Particles -- Electrons and hydrogen, helium and other nuclei carrying an electric charge which make up the "solar wind"; cosmic rays from Sun or galaxy which are extremely energetic (fast-moving) charged nuclei of many elements; cosmic dust and meteoroids.

Radiation -- The entire electromagnetic spectrum such as light, radio and X-rays.

Fields -- Magnetic, electric and gravitational.

Scientists now believe, based to a substantial degree on Pioneer discoveries, that these ingredients are interrelated as follows:

Description of Solar Space

The solar wind originates when the solar surface heated by the thermonuclear reaction in the Sun's center, throws off ionized gases into space. Positive nuclei and negative electrons are ejected into space from the Sun's 2,000,000 degree F. corona, perhaps heated by local shock waves. The particles reach a speed of around one million miles-per-hour as solar gravity weakens.

The magnetic field on the Sun's surface is the total result of a mass of small bi-polar fields. This complex twisted field is carried by the solar wind far beyond the Earth's orbit. The field is further bent as numerous solar wind "beams" (masses of gas on separate paths) collide and change direction.

In the Sun's corona, the magnetic field divides into major radial sectors (commonly from two to seven), each with a single field direction the reverse of its neighbor.

These large sectors, extending far beyond the Earth, are believed to be created by surface regions which send out high-speed streams of solar wind for months. When a region dies, its sector disappears, and new regions produce new sectors.

Local disturbances on the Sun throw out masses of solar wind particles and high energy particles (solar cosmic rays). During disturbances, magnetic field strength in local solar regions can rise from 100 to 1,000 times the normal of 100,000 gamma. (Earth's surface field is 50,000 gamma; interplanetary field, five gamma).

Lower-energy solar cosmic ray particles cover the 93 million miles to the Earth in one to two hours. Higher-energy particles arrive in as little as 20 minutes. They break out of the twisted interplanetary field but follow its general radial direction. They travel in long curves crossing the Earth-Sun line at an angle of about 45 degress.

The flow of lower energy cosmic rays often lasts many hours. The Sun appears to "store" them near its surface. The particles frequently are injected onto a number of different magnetic filaments, and particles from the same solar disturbance may reach the Earth in entirely separate, twisted streams.

Solar wind streams spiraling out from disturbed regions on the Sun collide with slower wind masses, creating relatively dense shock areas. These radial shock fronts behave like vanes of a centrifugal pump, pushing galactic cosmic rays out of the inner solar system.

Very intense waves, much like sound waves, form during solar storms, especially at boundaries between fast and slow-moving segments of the solar wind. These waves accelerate and alter solar wind flow.

The solar wind now is believed to extend out to between 900 million and nine billion miles. Where it ends is the margin of the interplanetary field and the boundary between interplanetary and interstellar space. Slight variations in direction of galactic cosmic ray particles may be due to passage through this boundary.

The North-South magnetic field of the Sun is the sum of many local fields. It seems to disappear at the peak of each 11-year solar cycle and the to reappear with North and South poles reversed.

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PIONEER E SCIENTIFIC INSTRUMENTS AND ASSOCIATED INVESTIGATIONS

Instrument	Wt. (lb.)	Power (watts)	Investigators
Three-Axis Magnetometer	6.66	5.2	C.P. Sonnett* D.S. Colburn Ames Res. Center
Cosmic-Ray Telescope	7.89	2.74	W.R. Webber* Univ. of Minn.
Radio Propagation Detector	5.05	1.35	V.R. Eshleman* A.M. Peterson Stanford Univ. R.L. Leadabrand H.T. Howard R. Long Stan. Res. Inst.
Electric Field Detector	0.80	0.43	F.L. Scarf* G.M. Cook I. Green TRW Systems
Quadrispherical Plasma Analyzer	5.91	3.10	J.H. Wolfe* D.D. McKibbin Ames Res. Center
Cosmic-Ray Anistropy Detector	5.56	1.78	K.G. McCraken* Univ. of Adelaide R.T. Bukata S.W. Cent. for Adv. Studies W.C. Bartley Nat. Acad. of Sci. U.R. Rao U. of Ahmedabad, India
Cosmic Dust Detector	4.26	0.41	O.E. Berg* GSFC
Celestial Mechanics	--	--	J.D. Anderson* JPL

*Principal Investigators

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EXPERIMENTS

A list of the scientific experiments with essential characteristics of the instruments and names of the experimenters is given in the table (page 14) and described in detail below:

Three-Axis Magnetometer

This experiment continuously measures the rapidly-varying strength and direction of the interplanetary magnetic field simultaneously in three axes.

The experiment sensor is mounted on a five-foot boom to isolate it from the spacecraft's minor magnetic field.

It measures the field over a range of ±50 gamma with a very fine resolution of .1 gamma. It contains three mutually perpendicular fluxgate sensors. A thermal-electric motor rotates two of the sensors 90 degrees on command, interchanging them to measure possible sensor drift. The instrument's precision is due in part to a digital signal processor, which eliminates effects of spacecraft spin, and to digital filters, which process the three field components to eliminate sampling errors. It measures up to 3.5 vectors per second.

Quadrispherical Plasma Analyzer

This experiment measures particles in the solar wind -- quantities, directions, energies, and temperatures.

The instrument employs two parallel curved plates. A voltage across the plates is varied to select particles to be measured. Particles then pass between the plates and land on a collector. Horizontal directions are measured by noting the direction the probe looks out from the spinning spacecraft; vertical direction by three collector plates which look out over an arc of 160 degrees. The experiment measures electron energies from 14 to 1000 electron volts, and positive ions from 200 to 15,000 electron volts. It can measure 50,000 to 100 million particles per sq. cm. per second with accuracies better than 1 degree in direction and 1 per cent in velocity.

Radio Propagation Detector

This experiment determines total electron content between Pioneer and the Earth. The 150-foot dish antenna at Stanford University sends radio signals to a special receiver on the spacecraft.

The receiver can hear the Stanford signal from as far away as 280 million miles. Experimenters send low and high frequency signals to the spacecraft. The greater slowing of the low frequencies by electrons in space allows measurements of electron density.

Electric Field Detector

This instrument measures the electric components of low frequency radio waves and waves created by density variations in the solar wind. Unequal concentrations of positive ions and negative electrons have electric fields between them. The instrument uses an alternating current electrometer to measure the fields as shown by small voltage changes in the Stanford antenna on the spacecraft.

Cosmic Ray Anisotropy Detector

This instrument finds arrival direction, mass, and energy (speed) of solar and galactic cosmic ray particles.

It consists of a crystal scintillator which produces flashes of light of varying intensity, depending on the energy, direction and type of cosmic ray particle which strikes its crystal lattice. The instrument detects particles arriving from eight directions in the plane of the Earth's orbit, and from below and above the spacecraft. The energy range measured is from three million to 360 million electron volts.

Cosmic Ray Telescope

This instrument measures numbers, energy, direction, charge, and distribution through space of nuclei of atoms from one million to one billion electron volts. It employs two solid-state, surface-barrier detectors, three solid-state lithium-drift detectors, one detector with a synthetic sapphire window to a photomultiplier tube, and one with a plastic guard cup monitored by photomultipliers.

Selection of one of five detector combinations to be monitored is by ground command. Resolution is better than any such instrument to date. The relative abundance of elements in cosmic rays aids scientists in developing theories about their origin.

Cosmic Dust Detector

The instrument measures the momentum, energy, and distribution in interplanetary space of minute meteoroids. It determines the velocity, mass, and flux of particles from 50 millionths to less than a trillionth gram at speeds up to 900,000 mph.

Two sets of thin-film panels front a piezoelectric crystal microphone mounted on an impact plate. These elements measure particle flight time between front and rear films, determine direction by comparing front and rear penetration points, and measure impact on the plate.

Celestial Mechanics Experiment

The purpose of this experiment is to determine better: the Astronomical Unit (Earth-Sun distance), shape and orientation of the planet orbits, and to test the theory of general relativity. The Pioneer spacecraft provide useful data for this because of their long-duration solar orbits, spin stabilization with negligible non-gravity effects, and different solar orbits for each Pioneer.

The experiment will use the DSN precision radar tracking data and large digital computers.

DELTA LAUNCH VEHICLE

The Pioneer-E mission will mark the 73rd flight of a Delta launch vehicle since 1960. Of the previous 72 launchings, 66 were successful.

Delta is managed for NASA's Office of Space Science and Applications by the Goddard Space Flight Center. The McDonnell Douglas Corp. is Delta prime contractor.

Following are the general characteristics of the three stage vehicle for the Pioneer-E mission:

Total Height: 106 feet (including shroud)
Total Weight: 200,000 pounds
Maximum Diameter (first stage): 8 feet
First Stage Thrust (average): 325,000 pounds

First Stage (Liquid only): Modified Air Force Thor, produced by McDonnell Douglas Corp.; engines by Rocketdyne Division of North American Rockwell.

Height:	75 feet
Diameter:	8 feet
Propellants:	RJ-1 kerosene for the fuel and liquid oxygen (LOX) for the oxidizer.
Thrust:	172,000 pounds
Weight:	186,000 pounds
Burning Time:	3 min. 41 sec.

Strap-on Solids: Three Castor-II solid propellant rockets produced by the Thiokol Chemical Corp.

Height:	20 feet
Diameter:	2.6 feet
Propellants:	Solid
Thrust:	153,000 pounds (51,000 each)
Weight:	29,600 pounds (9866 each)
Burning Time:	39 sec.

Second Stage: Produced by the McDonnell Douglas Corp., utilizing the Aerojet General Corp., propulsion system; major contractors for the autopilot include Minneapolis-Honeywell, Inc., Texas Instruments, Inc., and Electro-solids Corp.

Height:	13 feet
Diameter:	4 feet 7 inches
Propellants:	Liquid-&-Unsymmetrical Dimethyl Hydrazine (UDMH) for the fuel and Inhibited Red Fuming Nitric Acid (IRFNA) for the oxidizer.
Thrust:	7,800 pounds
Weight:	13,000 pounds
Burning Time:	6 min. 19 sec.

Third Stage: United Aircraft FW-4 solid motor.

Height:	5 feet
Diameter:	20 inches
Propellants:	Solid
Thrust:	6,000 pounds
Weight:	700 pounds
Burning Time:	32 sec.

NOMINAL DELTA FLIGHT EVENTS FOR PIONEER-E MISSION

Event	Time	Surface Range (Statute Miles)	Altitude (Statute Miles)	Velocity (Miles Per Hour)
Solid Motor Burnout	39 Sec.	1,763 feet	3 Miles	1,259 mph
Solid Motor Separation	1 Min. 10 Sec.	2 Miles	10 Miles	1,527 mph
Main Engine Cutoff (MECO)	3 Min. 41 Sec.	127 Miles	91 Miles	10,026 mph
Second Stage Ignition	3 Min. 47 Sec.	139 Miles	98 Miles	10,006 mph
Shroud Separation	3 Min. 50 Sec.	147 Miles	101 Miles	10,017 mph
Second Engine Cutoff (SECO)	10 Min. 6 Sec.	1,239 Miles	345 Miles	16,963 mph
Third Stage Ignition	32 Min. 1 Sec.	1,812 Miles	342 Miles	16,978 mph
Third Stage Burnout	32 Min. 33 Sec.	6,775 Miles	342 Miles	24,030 mph
Spacecraft Separation:				
TEst TRaining (TETR-C) Satellite	32 Min. 49 Sec.			
Pioneer-E	33 Min. 21 Sec.			

TEST AND TRAINING SATELLITE (TETR-C)

Its purpose is to provide crew training and engineering tests of NASA's Manned Space Flight Network (MSFN).

The TETR-C carries a payload consisting of an S-Band transponder which transmits and receives signals simulating the Apollo spacecraft. It will provide an active target useful for training the personnel and testing the equipment of MSFN.

Designated TETR 3, in orbit, the 45-pound, magnetic-stabilized spacecraft will be mounted in the rear of the second stage. The satellite will be ejected rearward at three feet per second about one minute after third-stage ignition. The planned orbit is circular, 300 nautical miles above the Earth, with an inclination of 33 degrees to the Equator and an orbital period of 96 minutes. Estimated lifetime is 20 months.

By means of this satellite MSFN personnel will be able to receive realistic training in the checkout of the Unified S-Band system used on Apollo, mission simulations, practice in teaching procedures, and development and verification of new procedures. It will also be used to perform MSFN engineering and operational tests on the S-Band problem areas.

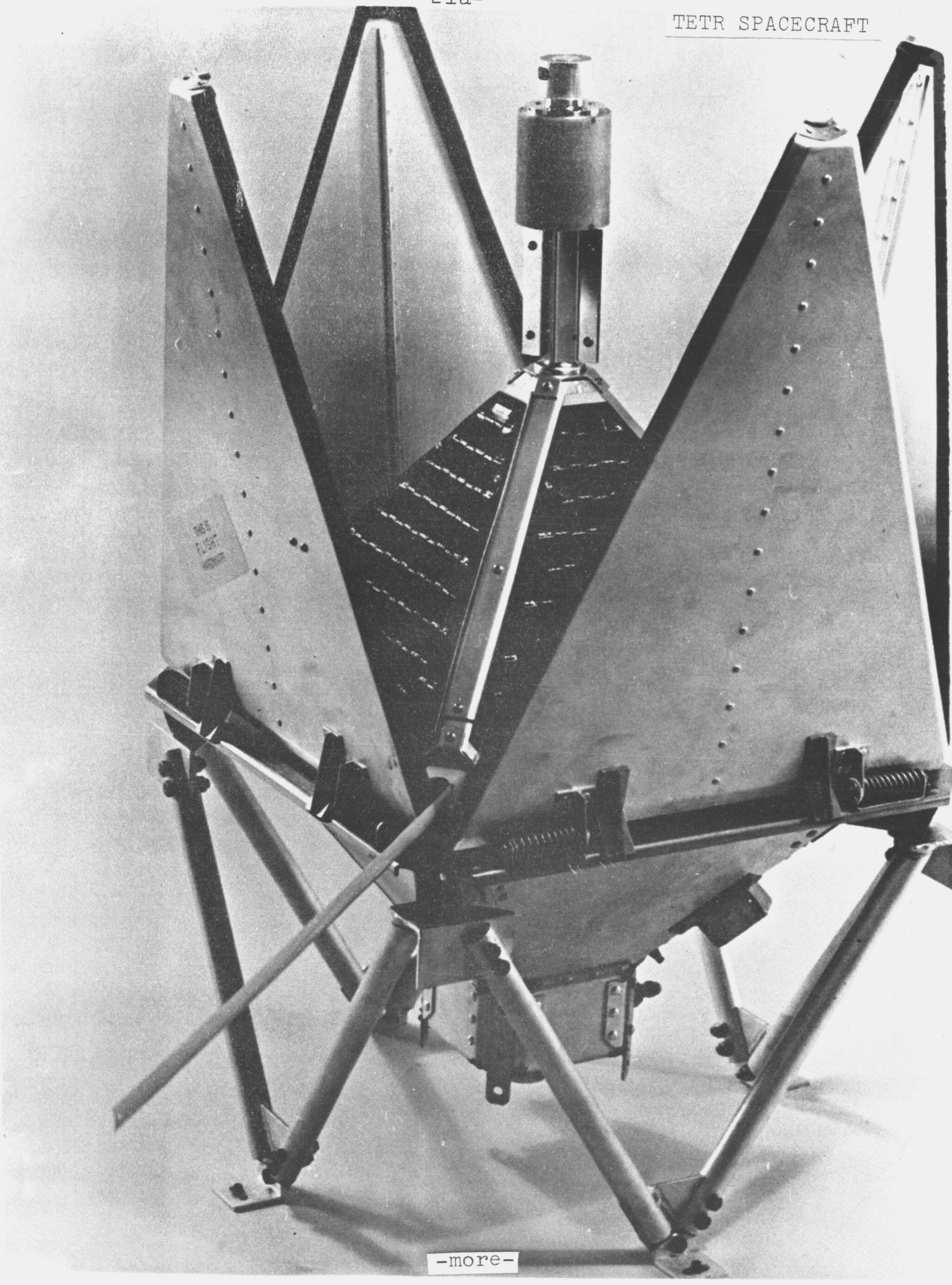
The spacecraft is octahedron-shaped (bottom to bottom pyramids), 11 inches on each side. The basic configuration provides mounting support for both externally-and internally-located components.

The top apex supports an S-Band antenna with mast. At two opposite apexes in the center plane are mounted the VHF transmitter antenna sections. The bottom apex has a fitting for mounting and ejecting the spacecraft from its canister. The VHF command telemetry antenna section is located near the bottom apex.

Electrical power for sub-systems is generated through solar cell panels on the eight faces of the spacecraft. The battery pack, with an average capacity of 6-ampere hours, provides power for the S-Band transmission and operation while the satellite is in darkness. The battery is recharged in 20 to 30 hours. The battery pack can provide continuous full power for operation of the spacecraft for approximately 3.2 hours.

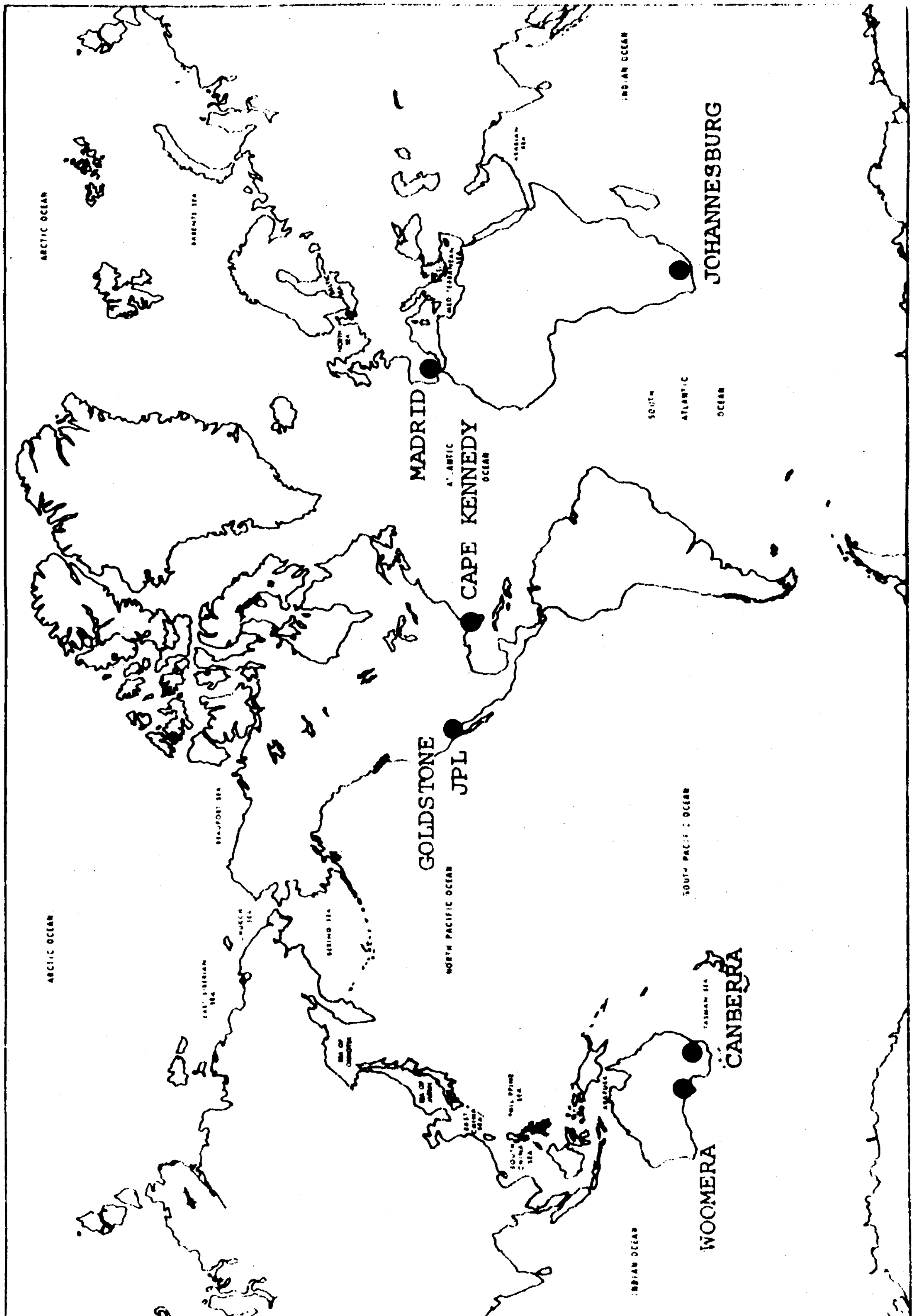
The Manned Space Flight Network is operated independent of the Deep Space Network which will support the Pioneer E. MSFN stations are located at Antigua and Ascension islands; Canberra and Carnarvon, Australia; Bermuda; Grand Bahama Island; Tananarive, Madagascar; Guaymas, Mexico; Madrid and Canary Islands, Spain; Corpus Christi, Tex.; Goldstone, Cal.; Guam; and Kokee Park, Hawaii.

TETR SPACECRAFT



The TETR program is directed by the Network Support Implementation Division, Office of Tracking and Data Acquisition. Project management is under the Goddard Space Flight Center, Greenbelt, Md. The TETR spacecraft are designed and built by TRW's Space Vehicles Division, Redondo Beach, Calif.

DEEP SPACE NETWORK LOCATIONS



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Aug. 1, 1969

DEEP SPACE NETWORK

To provide precision tracking, command and communication with Pioneer E for a prolonged period, the solar probe will be supported by an expanded global Deep Space Network (DSN) of 85-foot diameter antennas.

Pioneer E will be tracked by the normal complement of DSN stations: Echo station at Goldstone, Cal.; Tidbinbilla, near Canberra, Australia; and Cebreros, near Madrid, Spain. In addition, Johannesburg, South Africa, will support the injection phase and the first two days of the flight.

Supplementing these stations with nearly continuous precision tracking for the first 30 days will be other DSN units at Robledo, near Madrid; Woomera, Australia; and the Pioneer station at Goldstone, together with stations of the Manned Space Flight Network (MSFN) at Goldstone, Madrid, and Honeysuckle Creek, near Canberra. The supplementary support will be required of all stations at least part-time for many months in the future as the mission progresses.

If the spacecraft functions long enough, tracking will be performed for a total of three to five years. Special command encoders and other equipment have been installed at selected stations for the Pioneer E flight.

The DSN Space Flight Operations Facility at the Jet Propulsion Laboratory, Pasadena, Cal., will command the Pioneer E mission for the first few days. Then the base of command will shift to the Ames Research Center, Mountain View, Cal.

Completed tapes of recorded data will be mailed from each station to the Pasadena facility for checking, thence to Ames for processing into separate recordings and distribution to experimenters, contractors and project personnel for their detailed analysis and study.

The essential deep-space tracking role will begin as the launch phase of the Pioneer E flight ends with launch stage separation. The Johannesburg station will track through separation and injection and afterward until the spacecraft is acquired by Canberra, about 50 minutes after liftoff. The nearby MSFN unit at Honeysuckle Creek will provide backup support.

While this mission progresses, the network will continue to track Pioneers 6, 7, 8 and 9, which were launched in the period since December 1965. Their major tracking support will come from the 210-foot diameter antenna of the Mars station at Goldstone. The 210 will command and receive data from the four Pioneers as they travel around the Sun, or some 200 million miles.

Capable of 6.5 times the sensitivity of the 85-foot antennas, or one-tenth of one-trillionth of one-trillionth of a watt, the 210 serves to assure the capability and useful life of all the Pioneers as long as their operating systems last.

The networks of NASA's Office of Tracking and Data Acquisition are managed and operated at major field centers. The Deep Space Network is under control of JPL, the MSFN of NASA's Goddard Space Flight Center, Greenbelt, Md. Goddard also operates NASCOM, the NASA global communications network.

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Spacecraft Subcontractors

Eagle Picher Joplin, Mo.	Batteries
Texas Instruments, Inc. Dallas, Tex.	Solar Cells
Optical Coating Labs, Inc. Santa Rose, Calif.	Solar Cell Cover Glasses
Rantec Calabasas, Calif.	Diplexer and Bandpass Filter
Hughes Aircraft Co. Los Angeles, Calif.	Traveling Wave Tubes
Electronic Memories, Inc. Hawthorne, Calif.	Data Storage Unit
Vitro Electronics Silver Spring, Md.	Telemetry Receiver
Solid State Products, Inc. Salem, Mass.	Photo Silicon Control Rectifiers
Western Semiconductors Santa Ana, Calif.	Photo Silicon Control Rectifiers
Sterer Engineering & Manufacturing Los Angeles, Calif.	Pressure Regulator and Relief Valve
Weston Hydraulics Van Nuys, Calif.	Pneumatic Solenoid Valve
Quantitron Los Angeles, Calif.	Coaxial Switch

Scientific Instrument Contractors

Philco-Ford Corp. Palo Alto, Calif.	Magnetometer
Marshall Laboratories Torrance, Calif.	Plasma Probe, SCAS Cosmic Ray Instrument, Cosmic Dust Detector
Stanford Research Institute Menlo Park, Calif.	Radio Propagation Detector
Honeywell Radiation Center Lexington, Mass	Univ. of Minn. Cosmic Ray Instrument
TRW Systems	Electric Field Detector

In addition, more than 100 other firms are contributing to the Pioneer Project.

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