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News Release

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RELEASE ON RECEIPT

CENTER PROVIDES EXPERIMENT (COSMIC RAY ANISOTROPY DETECTOR) FOR PIONEER INTERPLANETARY RESEARCH SPACECRAFT

DALLAS --

Within the near future, an Improved Delta rocket will be launched from Cape Kennedy, carrying the first of four Pioneer spacecraft. The Pioneers are destined to become tiny planets of the Sun.

On a crowded instrument shelf at the "waistline" of the 140-pound package will be a cosmic ray anisotropy detector designed at the Graduate Research Center of the Southwest.

The experiment was proposed to the National Aeronautics and Space Administration more than two years ago by Prof. Kenneth G. McCracken of the Center's Atmospheric and Space Sciences faculty. With other instruments and experiments provided by five universities and research agencies, NASA will begin a systematic exploration of space between the Earth's nearest-neighbor planets, studying events of huge scale over long time periods.

Professor McCracken has served as a consultant to NASA on a number of occasions, assisting in selection of space experiments flown on satellites and probes, and in studying the degree to which astronauts may be adversely affected by intense doses of cosmic radiation.

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Cosmic radiation, in the most usual sense, consists of high-energy, electrically charged particles smaller than atoms, moving with velocities close to that of light. Hydrogen nuclei (protons) make up about 86 per cent of the cosmic radiation at energies greater than 1 billion electron volts. Helium nuclei contribute about 13 per cent, while heavier, totally ionized nuclei with atomic numbers up to that of iron contribute

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about 1 per cent.

The cosmic ray detectors designed for Pioneers A and B will seek data on both galactic radiation and solar cosmic rays. Galactic cosmic rays are those which have been accelerated to high velocities (high energies) in the galaxy and have then entered the solar system. Solar cosmic rays are those which have been accelerated by solar flares; that is, gigantic explosions occurring in the atmosphere of the Sun.

Cosmic rays accelerated in solar flares are a potential danger to manned flight in interplanetary space, says Professor McCracken. "The Pioneer experiments will lead to a greater understanding of the properties of cosmic radiation observed in the solar system, and this will aid in the protection of astronauts when they go to the Moon and beyond," he explains.

The Center's experiment will measure differences in the number of galactic cosmic ray particles which arrive from different directions, and determine whether the average mass and energy of particles arriving at the spacecraft varies with incoming direction.

Learning these differences will provide information about the shape of the interplanetary magnetic field, and particularly about the field in the region close to the Sun.

The "solar atmosphere" events will be recorded in a strip of space 37.2 million miles wide, as the four Pioneers circle the Sun in the same plane as the Earth's orbit.

Pioneers will be the only United States spacecraft functioning continually in interplanetary space during the years 1965-69. Within that time, the Sun is expected to become more "disturbed," says Professor McCracken. "It will be prone to produce situations of interest to the scientist, or of potential danger to the astronaut."

The Sun goes through an 11-year cycle of activity, says Professor McCracken. "After some years of quietness, it becomes disturbed, as indicated by sunspots and the occurrence of solar flares."

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Pioneer A, scheduled to leave Cape Kennedy's Complex 17, Pad A, on Improved Delta serial No. 35, will begin its flight near the time of "quiet" solar conditions. The Sun will be considerably more disturbed when Pioneer B is launched, about six months later. It will be greatly disturbed when the two later Pioneers go into orbit.

Pioneer A will be sent into an orbit which, at perihelion (point of closest approach to the Sun) will be near the orbit of Venus. Pioneer B, an identical spacecraft carrying identical experiments, will be launched into an orbit which, at aphelion (point of greatest distance from the Sun) is in the vicinity of the orbit of Mars. Pioneers C and D, with different experiments, will follow similar paths.

Data return from the Pioneers will be at least 50 million miles, and may range out to 125 million miles.

Pioneer project management is assigned to NASA's Ames Research Center, near Mountain View, California. NASA's Goddard Space Flight Center, Greenbelt, Maryland, is manager of the three-stage, 92-foot Improved Delta rocket vehicle. Communications and tracking will be handled by NASA's Deep Space Network, operated by Jet Propulsion Laboratory at Pasadena, California.

The new Pioneers bear the name of an earlier group of deep space probes. Last of these was Pioneer V, which returned data from 22.5 million miles in 1960. When Pioneer A is in successful orbit, it will be re-designated Pioneer VI.

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The Graduate Research Center's detectors on Pioneer A and B consist of crystal scintillators which produce flashes of light when traversed by a cosmic ray. The flashes are scanned for intensity, which varies according to the energy, direction, and type of cosmic particle striking the crystal. Energy range to be measured for hydrogen nuclei is from 7.5 million to 90 million electron volts, and for helium nuclei, from 130 million to 360 million electron volts.

Research Scientist William C. Bartley has supervised the two-year development of the detector, which has had to meet several tightly-limited specifications.

Electronics in the detector must provide a quarter-second time reference as Pioneer spins once a second, using the Sun as a zero marker. The logic circuits, about 600 of them, must also record cosmic particle arrivals at several different energy levels, and convert the data into telemetry information for the long radio transmission to Earth.

Integrated circuits, made by Texas Instruments Incorporated in Dallas, were used to meet stringent weight requirements. All electronics is on two multilayered circuit boards, with weight less than half a pound.

A highly-efficient power pack, about as big as a cigaret package, converts Pioneer spacecraft energy from solar cells into high voltage for the detector's light-sensing tubes. The entire power available for the detector is 1.5 watts, or about the amount used by a flashlight bulb.

One major design problem in Pioneer is magnetic cleanliness. With many of its experiments designed to measure interplanetary fields directly and indirectly, Pioneer has some 10,000 parts that have been magnetically "cleaned" to the greatest possible extent. In scientific terms, Pioneer has a magnetic field of about one-half gamma. The magnetic field of the Earth is 30,000 gamma at the Equator and 70,000 gamma at the poles.

Nickel, iron, and cobalt had to be held to a minimum by all experimenters; all these favorite electronics materials are highly magnetic. The Center's detector prototype was the first instrument submitted to meet the magnetic cleanliness specifications.

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