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News Release

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CENTER CONTRACT AMOUNT FOR DEEP-SPACE INSTRUMENTS INCREASED TO $631,060; WILL PROVIDE FIVE UNITS FOR COSMIC RAY FLIGHTS

Total amount of a two-year contract for cosmic ray anisotropy detectors has been increased to $631,060, it was announced today by the Graduate Research Center of the Southwest.

Two of the deep-space instruments will be flown in Pioneer spacecraft, with initial launch scheduled in January, 1965. The revised contract, with the National Aeronautics and Space Administration's Ames Research Center, calls for production of five detector units.

Four units were specified in an initial contract, which was funded to the extent of $100,000 as design work began in October, 1963.

The first unit, for design verification, must meet early June qualification requirements.

Industrial sub-contractors, who are producing electrical and electronic components for the Center's cosmic ray group, will receive a substantial amount of the total contract funding. Ultra-miniature electronic circuits, produced on circular panels of about the same diameter as a baseball, are being made in Dallas.

Each detector must satisfy specifications limiting total

-more-weight to 4.8 pounds. Use of the ultra-miniature components -- each panel containing elements that perform the functions of 7,260 large electronic parts -- meets both the critical weight problem and the additional specifications that call for an absolute minimum of magnetic materials.

Each Pioneer flight will carry a total of seven experiments, some of them designed for direct recording of interplanetary magnetic field strengths. Use of magnetic materials would impair these experiments.

Maximum weight allowance for the electronics in the Center's detectors is six-tenths of a pound.

Power supply for the entire detector must weight .85 pound, or less, and also must meet unusually high efficiency requirements. The small power package converts 28 volt, direct current supply from the Pioneer to 3, 12, and 1,200 volt supplies required by the detectors -- but it can draw only 1.5 watt of electrical power from the probe's primary system, which gets most of its energy from solar cells.

Sixty-five per cent of this small amount of primary power -- one-fortieth of the amount needed by an ordinary light bulb -- must be available for the detector.

* * *

Design of the detectors is being completed within the Southwest Center for Advanced Studies, the GRCSW's basic research and post-doctoral teaching division.

Principal investigators are Prof. Kenneth G. McCracken, Dr. U. Ramachandra Rao, and William C. Bartley.

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Following qualification of the first unit, delivery of a prototype detector is required in August. Three flight instruments are to be delivered in November, December, and April, 1965. Two of these will be scheduled for Pioneer flights; the third will be a back-up unit. The prototype will be used for integration with other systems in the Pioneer package, which will carry a total weight of about 25 pounds in experimental equipments.

Two sets of ground support equipment are also required in July, and a third in October.

Specific task of the Center's detector is measurement of cosmic ray intensities in four quadrants as the Pioneer rotates once each second on a 50-million mile journey across interplanetary space. Actually, the Pioneer will go on past the Sun indefinitely, but its data telemetry is not expected to be effective beyond 50 million miles from Earth.

Rocket-boosted from Cape Kennedy, the Pioneer will explore the magnetic domain of the solar system, a gigantic storehouse of cosmic rays, or energetic particles. Most of these come from the Sun, and most are entrapped in its gigantic magnetic field, as a flux.

Other particles spiral out from the Sun in a pinwheel of magnetic lines. These may flare out violently, in a "magnetic storm", but ordinarily form the supersonic solar wind, or plasma, streaming from the Sun at 300 miles a second and swirling around the Earth as if it were a stone in a swift river.

The basic purpose of cosmic ray experiments is to map the magnetic structure of the interplanetary field, using the solar system as a huge laboratory, as well as to determine numbers and kinds of cosmic particles.

The Center's experiment, and most others, will look mainly at the low-energy, galactic state of cosmic rays, a quiescent condition in which the particles may appear from many angles -- related to the detectors.

The "eye" of the detector is a cesium iodide crystal, cupped in plastic, with its opening toward space. It will peer through a central viewing band on Pioneer, which is a tubular vehicle about the size of an oil drum.

The plastic cup will weed out particles that do not come from the crystal's cone of "sight", except for a few highly-energetic primary particles that will pass through the entire vehicle without being recorded.

The detector, in conjunction with an aspect clock designed by the Center's scientists, will sort out particles in four energy categories, from 5 million electron volts to as much as 360 MEV. The aspect clock, which is basically the electronics of the detector -- and is also basically an electronic computer providing highly accurate time division, synchronized to the Pioneer's spin -- will answer the question "from what direction?" when a particle is detected.

Four energy categories, times four quadrants, result in bits of data being placed in one of 16 storage bins. The data does not actually stay in storage -- as it would in a computer memory, but is continuously being removed and transmitted by Pioneer's telemetry system.

The data produced will go into the records of the International Years of the Quiet Sun program (IQSY). This is a world-wide effort to supplement scientific information gleaned from interplanetary space during the International Geophysical Year. In the IGY, 1957-58, the Sun was within an active cycle, producing a larger number of intense particle "flares". These outbursts -- actually proving to be one of the fiercest peaks of solar activity on record, came so thick and fast that it was hard to separate the effects of one flare from the aftermath of another.

The periodic "fits" of the Sun come in 11-year cycles. After the IGY experience, it was decided that scientists needed to look again during a quieter time. More than 60 nations are taking part in the resulting IQSY program.

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