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News Release

GRADUATE RESEARCH CENTER OF THE SOUTHWEST

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RELEASE

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-- JOINT RELEASE BY AGREEMENT AMONG AGENCIES CONCERNED --

DALLAS, Texas --
HOBART, Tasmania --

Five Australian and American scientific organizations have joined in plans to build and install a super-neutron monitor station at Wilkes, Antarctica.

The international group includes the National Science Foundation, Washington, D.C., the Graduate Research Center of the Southwest at Dallas, the University of Tasmania, at Hobart; the Australian National Antarctic Research Expedition, and the Department of External Affairs, Commonwealth of Australia.

Purpose of the Antarctic station is to obtain better information on the Sun's influence over intensities and energies of cosmic rays. Cosmic rays are high-energy particles that bombard the Earth continuously from outer space. Some are known to come from the Sun itself; the bulk of cosmic rays come from other sources, but stream into Solar system patterns pushed across interplanetary space by the Sun's energies.

True sources of cosmic rays appear to lie both within the galaxy that includes the tiny (by comparison) Solar system -- a star and nine planets within the orbit of Pluto -- and outside that galaxy, at distances measured in billions of light years. Explosions of super-stars may be a major source.

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The penetrating power of cosmic rays must be considered in every design of a space vehicle and every program of space experiments, particularly those involving manned flight.

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National Science Foundation Grant

The National Science Foundation, in the United States, has made a $ ----X---- supporting grant for construction of the Wilkes station. The grant was made by NSF's Antarctic Research Division, which is headed by Dr. Thomas F. Jones.

Scientists at the Graduate Research Center of the Southwest, Dallas, will be joined by investigators from the University of Tasmania for the equipment-building phase. The work will be done at the Center, where two super-neutron monitors have been built. One is installed at the GRCSW, while the other is operating at Fort Churchill, Canada, in the sub-Arctic.

Transportation and installation of the new station will be accomplished by an Australian team including the Tasmanian physicists and scientific personnel of the Austrlian Antarctic Research Expedition (ANARE).

Wilkes, originally built by the United States as a base for the International Geophysical Year 1957-58, is now operated by the fifth agency, the Department of External Affairs, Commonwealth of Australia.

The Wilkes site, accessible only during the southern hemisphere summer, will be prepared late in 1965. The schedule calls for station operation by March, 1966. Its operators, scientists from the ANARE, will each spend one year in isolation at Wilkes, over a probable five years.

The station will be linked to Tasmania, Australia's south island, by radio teletype; cosmic ray data will be gathered at the University of Tasmania, which is presently operating a network of small neutron monitors. These stations, built for the IGY, are at Morrison, Hobart, Brisbane, and

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Lae, New Guinea. Another small monitor is at Wilkes; it will be replaced by the new station.

Data will also be exchanged between the Graduate Research Center of the Southwest and the University of Tasmania.

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Background, Purposes of Monitor Stations

The Earth is a satellite of a star (the Sun) that has severe "fits". These outbursts come in cycles. Generally, they move up and down a scale of severity in 11 years. There are shorter cycles of events, covering 27-day periods and daily variations. All Solar radiation changes affect the energy fields of the Solar system and Earth, and can be observed by counting cosmic rays and cataloging their intensities.

One special interest, in the 1960's, is in possible forecasting of Solar flares. These major events make space risky for potential travelers. They are equal to gigantic hydrogen bomb explosions in the Sun's atmosphere. Clouds of very high-energy particles (measured in billions of electron volts) are pushed out faster than sound speeds by these eruptions.

The particles are mainly protons, the nuclei of hydrogen atoms; but heavier atomic nuclei are present, up to and including iron. There are also electrons and their positively-charged images, or positrons.

Unaltered cosmic rays, called primaries, are the big projectiles found in interplanetary space. The Earth's blanketing atmosphere and magnetic field keep most of the primaries from reaching the surface. There are possible exceptions. Most primaries smash into atoms of the Earth's high atmosphere, and produce showers of secondary particles.

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The primaries can be "sensed" and cataloged by ground instruments that count secondary arrivals at the surface.

This is the function of a super-neutron monitor station. Its largest component is a bank of six plastic-cased counter tubes, each nine feet long. Each tube is also enclosed in thick lead rings. Each bank of six tubes and rings is further boxed in plastic. Three banks of six tubes each are generally used in a station. The tubes themselves are made in Canada -- to add another international aspect.

When a secondary particle -- caused by a primary collision with atoms in the high atmosphere -- strikes through the boxing into the lead, many neutrons are formed. Both the plastic boxing and tube cases are moderators. The boxing slows up secondary particles, and the tube cases slow up the neutrons. Thermalized neutrons are the input to the tube itself.

With no electrical charge of their own, the neutrons represent "tags" to identify atomic disintegrations in the high atmosphere. Thus, they identify primary cosmic ray arrivals.

Inside the proportional counter tubes, a reaction takes place between a gas (boron trifluoride) and the neutrons. For each ionizing reaction, a large pulse of electrical current is produced on a collector wire through the center of the tube.

Electronics circuits count the pulses, store the counting record in a small computer system for a short period, and then transmit the count to recorders, on demand. Data may be printed by a robot typewriter, or recorded on punched tape. Usually, the station produces both a typed record and a data recording suitable for direct large-scale computer use.

Date, time, and atmospheric conditions (temperature and pressure) are also noted at each automatic observation. Stations are usually programmed to record at five-minute intervals. In case a cosmic ray count goes high, as it

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does during a solar flare, the stations can switch automatically to faster reporting programs and sound alarms calling observers to duty.

Why go to the ends of the Earth to install a super-neutron monitor? For the same reason sports viewers try to get seats at the center of the stadium, at ringside, or on the finish line. The most narrow cone of vision can cover the best action.

Neutron monitors can be made telescopic if they are located at the bottom of the atmosphere, and in or near the cones of the Earth's magnetic field. The field turns in like the top of an apple in the Arctic and Antarctic, toward the magnetic poles. The best seating -- or siting -- for a neutron monitor intended to count primary cosmic ray progeny is at sea level and in a high latitude. The monitor's view becomes limited to a smaller range of directions in space.

Super-neutron monitors can count 600,000 particles an hour. Actually, they were designed to supplement space probe and balloon lift experiments during the International Years of the Quiet Sun 1964-65, when Solar flare activity was at a minimum. But their high-counting capabilities were also an outgrowth of needs shown in the IGY 1957-58. Then, Solar flares came thick and fast; it was hard to separate effects of one from the next. Most stations built for the IGY were almost literally swamped by the Sun's outbursts.

In the IQSY observations, neutron monitor observations have been proved faithful records of galactic cosmic ray intensities in the vicinity of the Earth. Space probe and balloon experiments have furnished the proofs.

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University of Tasmania scientists for the Antarctic station project are Dr. A. G. Fenton, Reader in Physics, and Dr. K. B. Fenton, Senior

Lecturer in Physics; Prof. Kenneth G. McCracken is principal investigator in cosmic ray research at the Graduate Research Center of the Southwest.

Professor McCracken is a doctoral graduate of the University of Tasmania. He came to the GRCSW from the Massachusetts Institute of Technology.

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