New 140-ft dish at Green Bank

Most steerable radio dish

After several months of operation, calibration, and shakedown, the National Radio Astronomy Observatory has dedicated its 140-ft-diameter, $13-million radiotelescope. Operating to an accuracy better than 10 seconds of arc (a dime at 400 yards), the newly completed instrument has been called the largest antenna of such precision in the world. Associated Universities, which also operates Brookhaven National Laboratory, operates the Green Bank, West Virginia, observatory under contract to the National Science Foundation.

The reflector consists of 60 panels that make a solid-surface parabola of 60-ft focal length. Design surface tolerances have been 0.03 inch for the antenna pointing straight up without wind and sun and 0.125 inch with the dish facing the horizon. The mounting is designed to allow the reflector to point at any spot in the visible sky. A polar axis will turn 110° to the west and 110° to the east from the straight-up position. Meanwhile a declination axis, which is horizontal when the antenna points to the zenith, allows a tilt of 53° to the north and 92° to the south. The polar shaft weighs 555 tons and supports an additional weight of 1725 tons.

In operation the instrument is designed to track and scan with unusual precision. The tracking motion at 15 minutes of arc per minute will have no positional deviation greater than 5 seconds of arc in a 10-min period (except that 15-mph winds might increase the deviation to 20 sec). For scanning, each axis has eight fixed rates from 10 minutes of arc per minute to 4 degrees per minute, and accuracy is 5 seconds of arc per hour in winds up to 15 mph. Scan rates can be continuously adjusted from half to twice nominal value, and any pair of rates can be used on the two axes.

A full decade has gone into planning, designing, and building the telescope. The idea was born in 1955; decision to build occurred in 1956; a design came in 1957; construction started in 1958. Fabrication of the final design began in 1962, and all components were at Green Bank, ready for assembly in the fall of 1964.

Significant discoveries started some time ago, and several programs are already fully planned for the future. Last July two observers using the antenna added confirmation to a five-year-old prediction by observing an emission line from hydrogen at 5009 Mc/sec. Discovery of this line and two others like it that were observed last year in the USSR opens new ways to explore our own galaxy (motions, densities, temperatures) and other galaxies as well. Future plans include detailed measurements of hydrogen and hydroxyl lines, intensity scans of radio sources, observations of radio frequencies from the moon and planets, and accurate determination of positions of radio sources occulted by the moon.

Brookhaven high flux reactor

Brookhaven National Laboratory's High Flux Beam Research Reactor went critical for the first time at the end of October. Under construction since September 1961, the 40-MW, heavy-water cooled and moderated HFBR is fueled with enriched uranium alloyed with aluminum and silicon and clad with wrought magnesium-silicon-aluminum alloy. The core region will have a flux of more than 1.6×10^{15} n/cm^2/sec. Altogether there are sixteen experimental facilities associated with the reactor. Nine beams are conducted through tubes beyond the shield for external experiments. External beams of thermal neutrons are produced by a heavy water reflector and beam-tube system that reduces the fast neutron background to a minimum. Inside the reactor there are four facilities for fast neutrons in the core region and three for slow neutrons in the heavy water reflector.

Among the HFBR's auxiliary components is a group of eight neutron spectrometers, all controlled by a digital computer that will also perform all computations and accumulate and process the experimental data. First experiments include studies of the structure of liquids and solids, crystal diffraction, polarized-neutron bombardment of magnetic materials, and measurement of fast-neutron cross sections with a chopper that provides beams of monoenergetic neutrons. The reactor is controlled by sixteen europium-oxide containing rods located outside the core.

The entire system is housed in a hemispherical shell of welded steel plates with an inside diameter of 176 ft. Capital cost of construction was about $12.5 million.

Capri solar telescope

On the isle of Capri, specifically at the settlement of Anacapri, a domeless solar telescope manufactured by Carl Zeiss (Oberkochen, West Germany) has been installed by the Fraunhofer Institute of Freiburg im Breisgau. The telescope is a Coudé reflector with a 35-cm aperture and 445-cm focal length. It has the form of a double tube with the two cylinders mechanically independent of each other. The inner cyclinder contains the optical components, and the outer provides protection from wind and weather. The domeless feature will permit use of the telescope at full theoretical capacity during the heat of the day. A dome acts as a heat trap and produces rising currents of shimmering air, which create an image-distorting schlieren effect. In addition, the installation is mounted 30 feet above ground to allow free air circulation around it.

The 43-mm primary image can be magnified by lens systems to 150- or

Domeless solar telescope on Capri

330-mm diameter. A rotating diaphragm in front of the mirror allows small regions of the sun to be isolated. Spectroscopy will be done with a grating autocollimation spectrograph of 20-meter focal length and 200-mm diameter, which provides enough resolving power to observe distribution of magnetic field strength across the solar surface. A special color filter on the instrument will permit more detailed study of hydrogen explosions on the sun's surface and in the corona.

You can reach Capri from Naples by vaporetto, hydrofoil, or helicopter and from Sorrento by vaporetto or water taxi.

Orbiting geophysical observatory

In spite of early difficulties with the vehicle, nineteen of the twenty experiments aboard NASA's second orbiting geophysical observatory (OGO II) were reported functioning in early November. The satellite was launched on Oct. 14 from Vandenberg Air Force Base in California and moves in a very eccentric orbit inclined at 86° to the equator. OGO II is the second of a series of seven geophysical satellites to be put into a polar orbit. When the series is complete, four vehicles will be in eccentric orbits, and three will fly near the earth.

Trouble was caused by the horizon sensor, which strayed from its fix. In correcting this, the attitude control gases were exhausted, leaving the vehicle with a slight tumbling motion that had not been planned for. This circumstance complicates data reduction but does not preclude useful results. The power supply also ran low, and contact with the satellite was intermittent at first. The power is expected to build up again, however.

Experiments aboard OGO II were supplied by eleven United States universities, one foreign university (Paris), two NASA field centers, and two other government agencies. The investigations seek information on various aspects of the following topics: mapping of the geomagnetic field with particular reference to anomalies and fluctuations induced by solar action; solar ultraviolet and x-ray emissions during low solar activity; dumping of trapped radiation and influx of solar particles into auroral regions; physics and chemistry of the neutral atmosphere; atmospheric and airglow effects of solar uv and x-ray emissions; micrometeorites near the earth; particles trapped in the geomagnetic field; very-low-frequency radio noise; solar wind interactions with magnetic fields; cosmic rays; and radio noise in space and identification of planetary and solar noise bursts.

A place to stand for Mohole

National Steel and Shipbuilding Company of San Diego has won the $30-million contract for the Project Mohole drilling platform. (Selection was made by the National Science Foundation.) Construction is scheduled to begin early next year, and it is possible that the first drillings at the primary site north of the Hawaiian Island of Maui will begin in 1968.

New building for Trieste Centre

Construction has begun on a permanent building for the International Atomic Energy Agency International Centre for Theoretical Physics. Located at Miramare, near Trieste, the new headquarters will be owned by the University of Trieste and will replace the premises on Piazza Oberdan in the center of the city that have served the centre since its inception in October 1964. To inaugurate its first year of operation, the centre held a four-week general seminar on plasma physics that attracted 21 lecturers and 64 participants. On its anniversary in October this year, a year-long study of plasma physics began, led by leaders in the field from the United States and Russia.

Comets and rockets

The recent comet Ikeya-Seki gave the first opportunity for observation of the passage of a bright sun-grazing comet with sounding rockets and high-flying aircraft. (Such comets occur once or twice a century.) The operation was a success, but the patient didn't have the disease.

When the comet was discovered, the National Aeronautics and Space Administration set up a program including two Aerobee rockets from Wallops Island and two from White Sands, visual observations from the scheduled Gemini 6 flight, the Convair 990 aircraft flying over the Pacific north of Hawaii, and ground observations. The comet was discovered on Sept. 18, but its orbit was not computed until Oct. 4. The NASA program was set to operate by Oct. 20.

Except for the Gemini 6 flight, which didn't go, everything worked as planned. The rockets got good pictures, including some high-altitude shots of the solar corona (one of the expected side-benefits). The aircraft and ground observations also were successful. Satellite tracking stations were brought into the act, and the ground communication links functioned smoothly. The comet, unfortunately, was not of the type expected, and the information was less than what was hoped for.

The program was predicated on the belief that the comet possessed a molecular tail. The rockets were set to get ultraviolet spectra and the airplane to get infrared. The comet turned out to have a tail made of dust, which rendered spectroscopy superfluous. (When this became known, the firing of the fourth rocket was cancelled.) However, when a comet with a molecular tail does come along. . . .