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NEW DISHES FOR CALTECH'S RADIO OBSERVATORY

The Owens Valley Radio Observatory is on the way to becoming the world's most powerful and flexible system for the study of radio sources beyond our galaxy

A new 130-foot radio telescope for Caltech's Owens Valley Radio Observatory is now under construction, made possible by a $1,645,000 grant from the National Science Foundation. The new installation, scheduled for completion in mid-1966, is the first of several antennas planned to augment the twin 90-foot dishes which have been in operation at the observatory since 1958.

In a ten-year development program for ground-based astronomy in the United States, the Panel on Astronomical Facilities of the National Academy of Sciences recently recommended that a total of eight large antennas be built at the Owens Valley Radio Observatory.

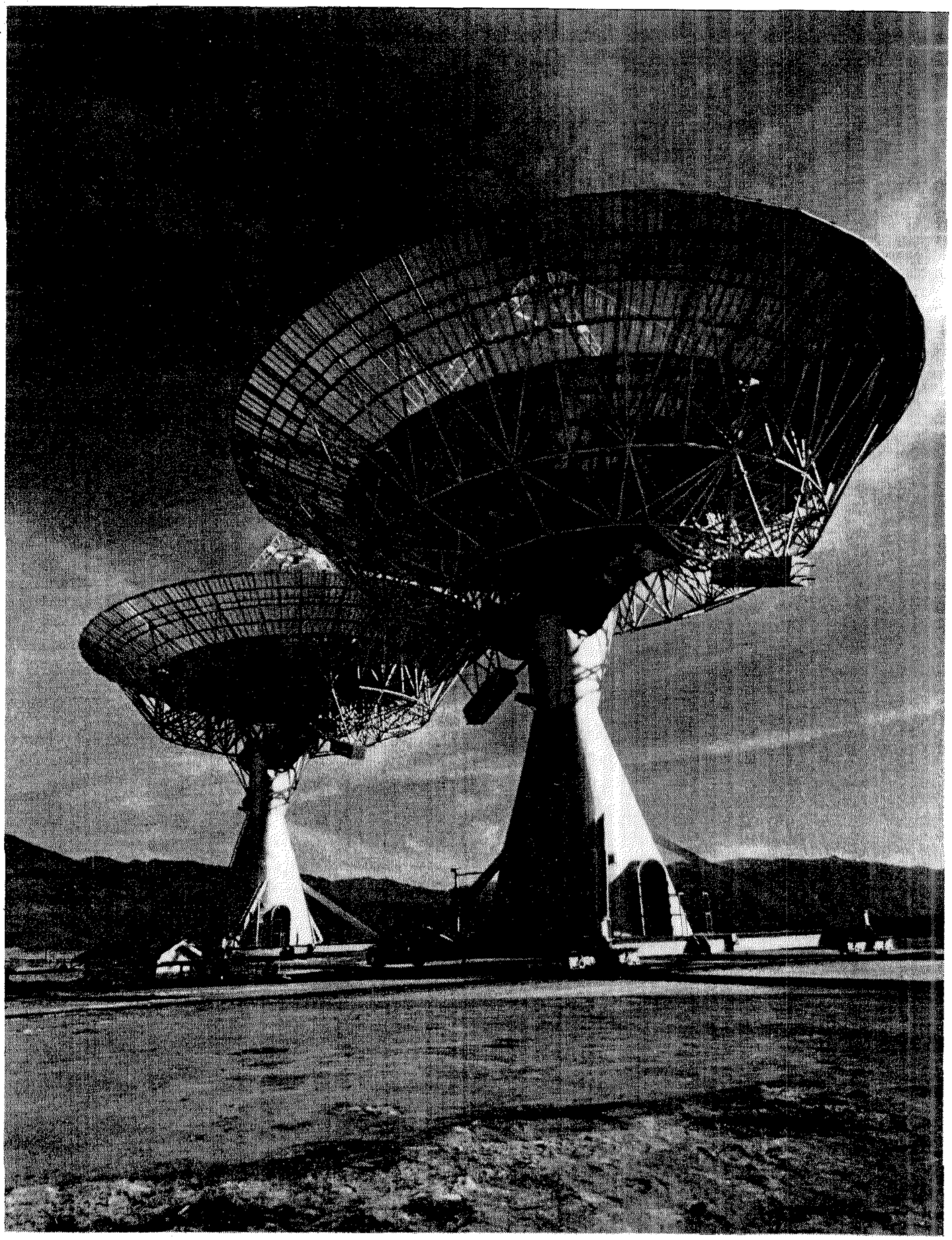
This will be the world's most powerful and flexible system for the study of objects beyond our galaxy that radiate energy in the radio frequencies. It will be 50 times as sensitive as the present system, capable of investigating a great range of problems, from the surfaces, atmospheres, and temperatures of planets, to the size and shape of the universe.

Westinghouse Electric Corporation will construct the new dish on a recently acquired 640-acre site adjoining the present 300-acre property located 250 miles north of Pasadena in the Owens Valley. Situated between the Sierra Nevada and White Mountain ranges, the observatory is ideally protected from man-made radio and television signals.

The additional land is needed for extension of the rail lines on which the radio telescopes, mounted on heavy wheeled pedestals, are moved. The two existing rail lines, on which the two 90-foot dishes move, form an "L" 1,600 feet long in a north-south direction and the same distance east and west. With the new dishes, the rail system will form an inverted "T" whose stem ultimately will extend for three miles north and south and whose east-west crosspiece will be 7,500 feet long.

On these rails the dishes may be moved into a variety of patterns. They can be used singly or ganged together as a phased array. Linked electronically as a single observing unit, the dishes become, through interferometry, the equivalent of a much larger dish than it would be possible to build.

"With the new dishes we can greatly expand our major research program," says Gordon J. Stanley, research associate in radio astronomy and director of the observatory. "We will be able to observe many more radio sources and to more accurately define their sizes and shapes, and to map more definitively the different intensities of emissions within a single source.

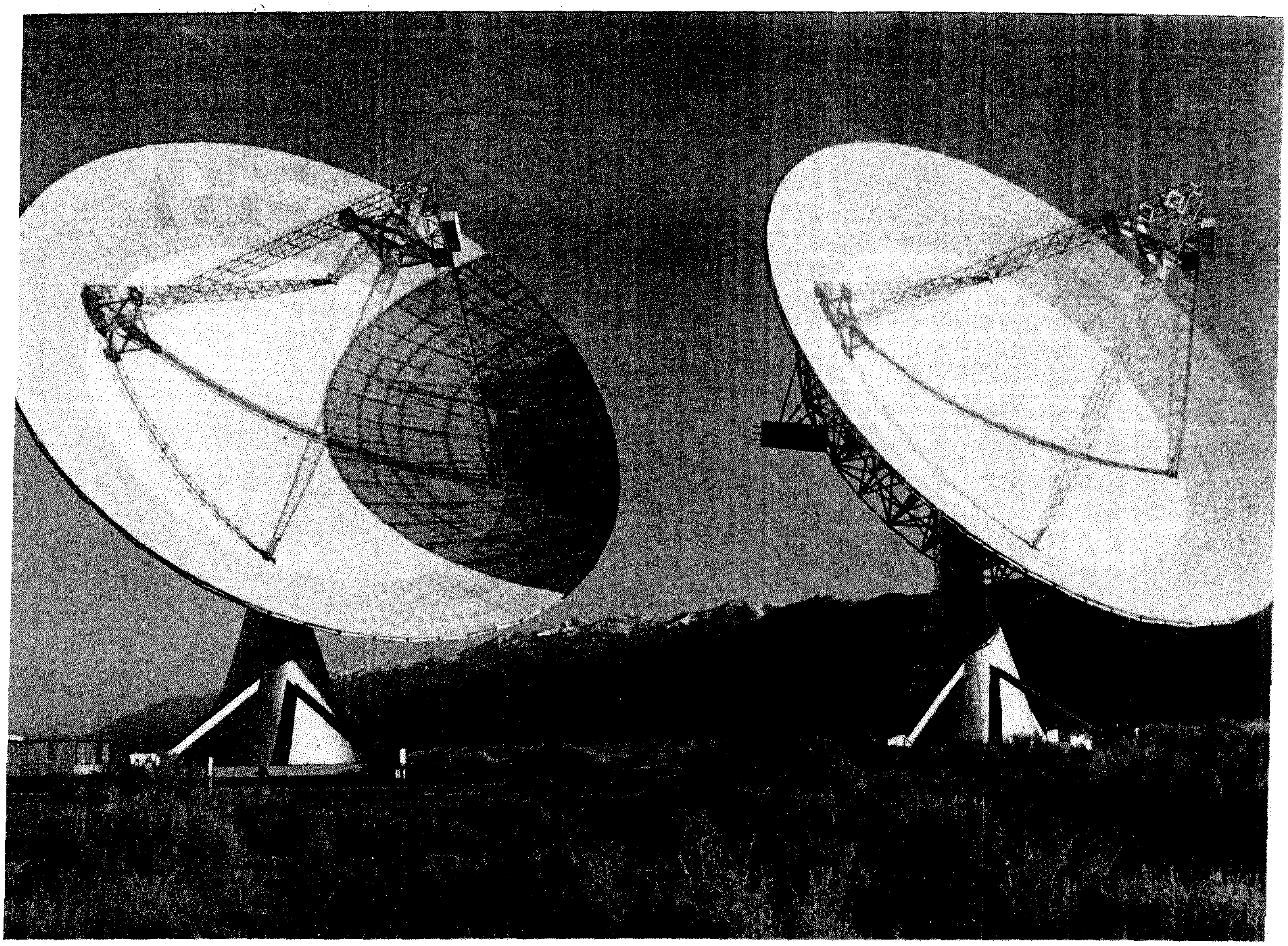


A new 130-foot antenna will supplement the 90-foot dishes now in operation at Owens Valley.

"We would like to be able to resolve several thousand radio sources and to study in greater detail more very distant ones. With our new ability to resolve and identify radio sources, it will be possible to tackle the cosmological problem of general relativity – that of the size and shape of the universe."

Bruce Rule, Caltech's chief engineer and a consultant for major radio and optical observatories throughout the world, is mainly responsible for the design of both the new and old antennas. The engineering problems that had to be overcome in designing the new antennas involved maintaining the accuracy of the 14,000 square feet of aluminum parabolic reflecting surface on each dish to within one-sixteenth to one-eighth of an inch under all conditions of gravity, motion, wind loading, and temperature extremes.

The shape of each dish will remain precise in



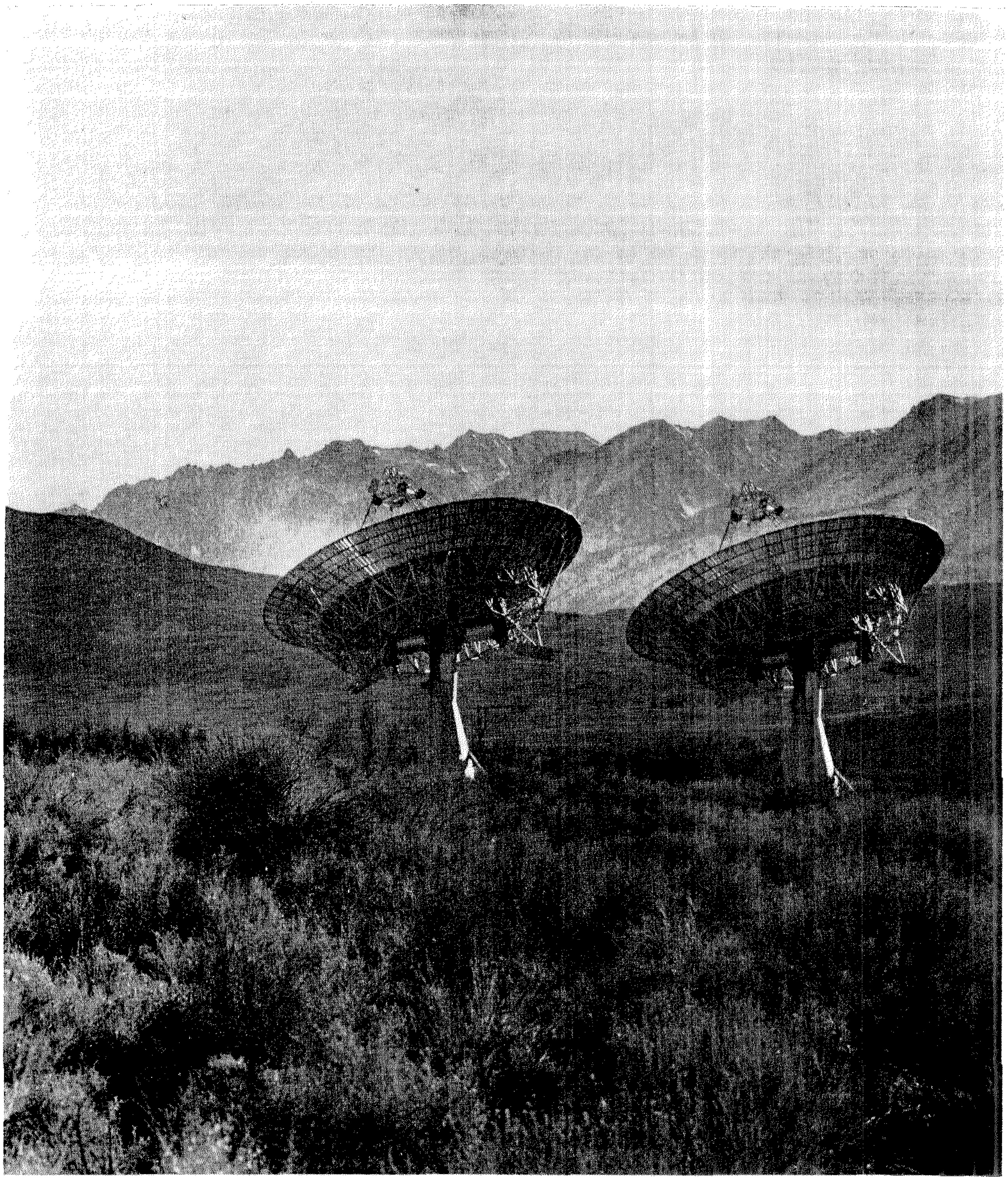
Radio waves from space are reflected from the surface of the dishes to receivers at the apex of 52-foot booms.

winds up to 20 miles an hour. In winds up to 35 miles an hour the shape will be less perfect, but will allow for some observations to be made. Each dish is designed to survive winds up to 90 miles an hour while locked, facing straight up.

The aluminum surfacing is in the form of panels which will have 936 adjustments per dish. The inner 60 percent of the surface will be solid aluminum sheets, while the outer 40 percent will be perforated to allow the wind to go through it. The parabolic surface of the dish will catch and reflect radio waves to a receiver mounted in front of the dish. The receiver will be at the apex of a quadripod of booms extending 65 feet from the surface. The recording equipment is in the pedestal, so that each dish may be used separately or linked electronically with the control and instrument building, where incoming signals are visually recorded.

The work of the observatory's new 130-foot antenna will be a part of the continuing program in collaboration with the Hale 200-inch optical telescope on Palomar Mountain in identifying extremely distant objects, such as the quasi-stellar radio sources. This program has already increased the number of extragalactic radio sources identified with optical objects to about a hundred, and has made it possible to suggest the physical processes and energies involved in these radio sources.

"An additional dish area is needed," according to Stanley, "to obtain a more detailed picture of the hydrogen clouds within our galaxy and to make planetary observations. We want to learn whether or not the earth and Jupiter are the only planets with radiation belts and magnetic fields. We also will be able to extend our polarization work for detecting and mapping magnetic fields."



The twin radio telescopes in use since 1958 have been important in the discovery of quasi-stellar radio sources.

The operation of the Owens Valley Radio Observatory is sponsored by the Office of Naval Research. The observatory has already made many contributions to the young science of radio astronomy. It played a leading role in the discovery of quasi-stellar radio sources, and of radio sources beyond our galaxy. It determined that most radio sources outside our galaxy come in pairs, which led to the concept of their explosive nature. It has mapped the arms of our galaxy and determined its polarity and it has discovered Jupiter's Van Allen radiation belt.