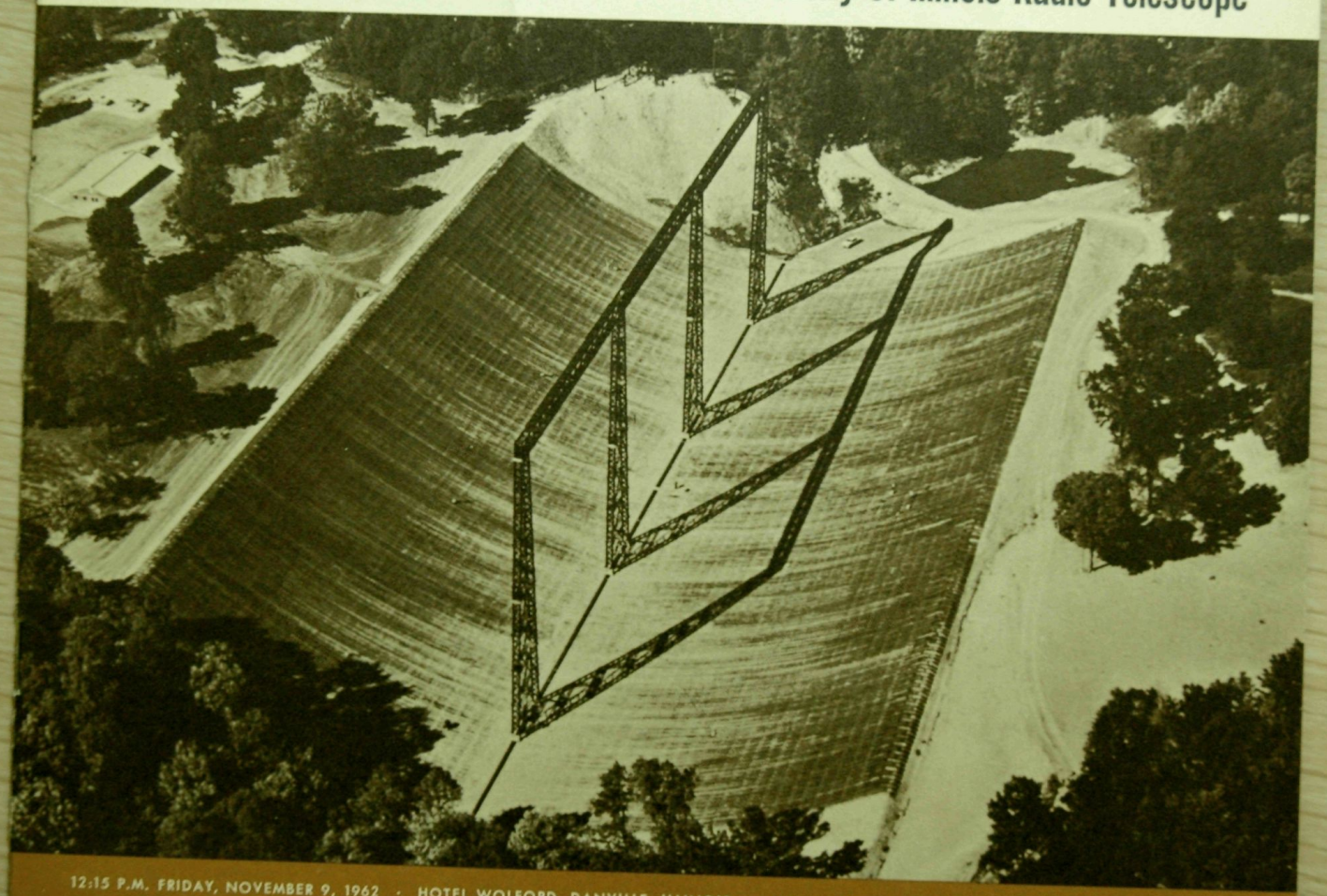
Program for the Formal Dedication of the University of Illinois Radio Telescope



12:15 P.M. FRIDAY, NOVEMBER 9, 1962 · HOTEL WOLFORD, DANVILLE, ILLINOIS · SPONSORED BY THE DANVILLE CHAMBER OF COMMERCE

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A Measure of Distinction

Like a diamond under scrutiny of an expert, a university is appraised by the many facets of its operation, the nature of its performance, and the brilliance of its reflection in the life of man. Unlike the diamond — because a university is its people — an educational institution has a spirit and a character.

The spirit of the University of Illinois is intellectual inquisitiveness, the search for knowledge and truth. Its character is defined by the zeal for learning which motivates the people who are involved in its work.

All universities have their measures of distinction. One which marks the University of Illinois is its tradition of readiness to deal with the challenges of new ventures in man's conquest of the world.

This willingness to explore the unexplored and the University's capacity to furnish talent capable of undertaking such assignments constituted the backdrop for construction at Illinois of what is at present the world's largest radio telescope.

Financed by a grant from the Office of Naval Research with a supplemental sum from the National Science Foundation, electrical engineers and astronomers from the University have built near Danville a parabolic radio mirror to concentrate signals from space on receiving elements supported by towers stretching far into the sky.

Here scientists will study signals from radio sources which may be billions of light years away. Here they will seek and ultimately come to understand more about these signals, their significance to the universe and to those who inhabit our world.

The new telescope is but one measure of the distinction of the University of Illinois; but it is symbolic of why this institution has assumed national leadership on many fronts — in engineering, chemistry, architecture, solid state physics, agriculture, and in many other disciplines. It suggests the reasons for the University's record as a producer of teachers, scholars, and professional leaders. It is an index to the quality of the University's services to the people of the State and Nation. It clearly demonstrates why a university is best described as an investment in human progress.

David D. Henry, *President*
University of Illinois

Dedication Program

Vermilion River Observatory and University of Illinois Radio Telescope
12:15 p.m. Friday, November 9, 1962, Hotel Wolford, Danville, Illinois

Sponsored by the Danville Chamber of Commerce

INVOCATION . . . . . The REVEREND C. B. MOTSETT
St. Paul's Roman Catholic Church, Danville

INTRODUCTION OF GUESTS . . . . . KENNETH R. BENTLEY
President, Danville Chamber of Commerce

"A WELCOME TO THE UNIVERSITY OF ILLINOIS" . . . . . Mr. BENTLEY

RESPONSE . . . . . PRESIDENT DAVID D. HENRY
University of Illinois

GREETINGS FROM THE STATE OF ILLINOIS . . . . . HON. SAMUEL H. SHAPIRO
Lieutenant Governor of Illinois

GREETINGS FROM THE BOARD OF TRUSTEES . . . . . HOWARD W. CLEMENT
President, University of Illinois Board of Trustees

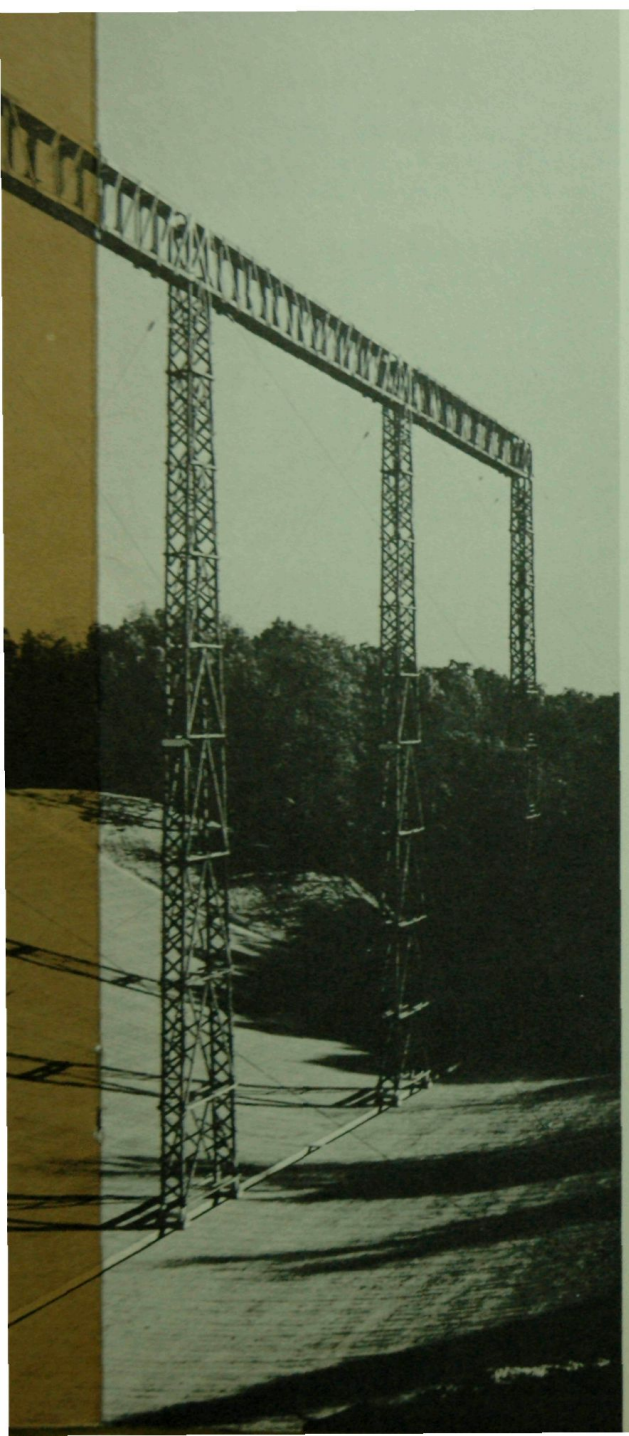
GREETINGS FROM THE OFFICE OF NAVAL RESEARCH . . . . . CAPTAIN J. M. BALLINGER, USN
Deputy and Assistant Chief, Office of Naval Research, Department of the Navy

"THE VERMILION RIVER OBSERVATORY" . . . . PROFESSOR GEORGE C. McVITTIE
Head of the Department of Astronomy, University of Illinois

"RADIO ASTRONOMY AND THE RADIO TELESCOPE" . . . . . PROFESSOR GEORGE W. SWENSON, JR.
Department of Electrical Engineering and Department of Astronomy
University of Illinois

ANNOUNCEMENTS . . . . . Mr. BENTLEY

TOUR OF OBSERVATORY AND RADIO TELESCOPE



The Radio Telescope

The idea of a radio telescope for the University of Illinois originated in 1954 with Professor G. C. McVittie, head, Department of Astronomy, and Professor E. C. Jordan, now head, Department of Electrical Engineering. They discussed building a large instrument, suitable for research, at a point close enough to Urbana-Champaign so that it could also be used for the training of students. In Professor George W. Swenson, Jr., they found an electronics expert who would devote five or six years to the task. Appointed to a joint post in astronomy and electrical engineering in 1956, Professor Swenson became the project engineer. Professor McVittie has acted as project director and the electrical engineering department has contributed the help of its antenna laboratory. The Office of Naval Research agreed to finance the undertaking. The National Science Foundation also contributed to the financing, and the University has provided funds for site purchase and various site improvements.

Professor Swenson planned the telescope after conferring with radio astronomers in America and abroad, visiting Australia and England, and benefiting from the advice of leaders in the science. He evolved a compromise between sensitivity, resolution, and economic feasibility. A frequency of 611 megacycles was chosen. Considerations of practicality and economy led to the decision to forego extensive mechanical motions of telescope components and to construct a fixed parabolic-cylinder reflector, having a focal line precisely north-south, with an array of antennas along the focal line. The phase of each antenna is adjustable, and this provides a means by which the beam can be aimed in the north-south direction. Rotation of the earth moves the beam from east to west.

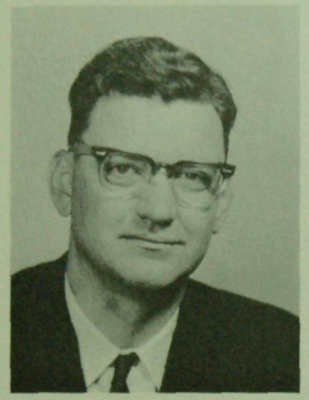
To dig a hole of the requisite size in flat country would have required moving 150,000 cubic yards of earth and posed a difficult drainage problem. The obvious solution was to utilize a natural depression in the ground to save on earth moving and to provide ready-made drainage. Such a site was found in a ravine leading to the Vermilion River about 5 miles southeast of Danville. To achieve the desired contours, 50,000

cubic yards of earth were moved. The natural stream was straightened and now flows through a concrete channel along the center line of the reflector. Storage capacity for flash floods is provided by two dams upstream.

The reflector is 600 feet long and 400 feet wide. The earth surface is covered with asphalt liner, a material similar to very thick roofing felt. The reflector itself consists of 2-by-2-inch galvanized wire mesh, stapled to the asphalt liner and with successive rolls crimped to one another so that each half of the reflector forms a continuous electrical surface, accurate to within 1 inch of a perfect parabolic cylinder. This radio mirror concentrates incoming signals onto a line 153 feet above the bottom of the reflector.

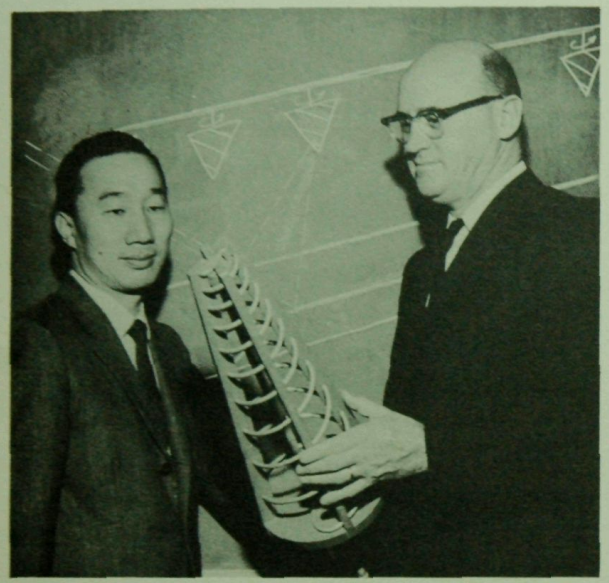
Here 276 antennas are attached to the underside of a wooden truss 425 feet long, 10 feet high, 4 feet wide. The truss is carried on four wooden towers which are self-supporting in the north-south direction and guyed east and west. Wood was selected so as to minimize the elec-

GEORGE C. McVITTIE, PH.D., PROFESSOR OF ASTRONOMY, HEAD OF DEPARTMENT.



GEORGE W. SWENSON, JR., PH.D., PROFESSOR OF ELECTRICAL ENGINEERING, RESEARCH PROFESSOR OF ASTRONOMY.

YUEN T. LO (
NEERING, DEP
AND JOHN D
ENGINEERING



YUEN T. LO (LEFT), PH.D., ASSOCIATE PROFESSOR OF ELECTRICAL ENGINEERING, DEPARTMENTS OF ELECTRICAL ENGINEERING AND ASTRONOMY, AND JOHN D. DYSON, PH.D., ASSOCIATE PROFESSOR OF ELECTRICAL ENGINEERING, WITH LOGARITHMIC SPIRAL ANTENNA.

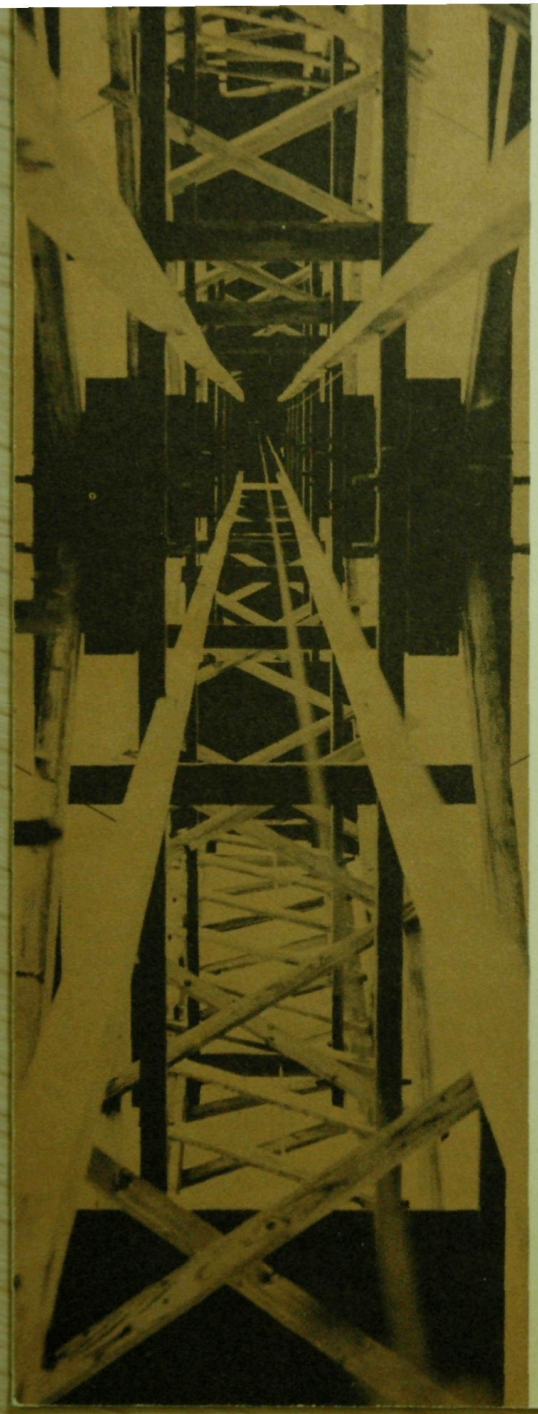
trical interference that metal towers would have produced. When it was found that many bolts were necessarily about one wave length long, they were also made of wood instead of metal.

The logarithmic spiral antennas were developed in the University's antenna laboratory by Professor J. D. Dyson, and the array was designed by Professor Y. T. Lo of that laboratory. By combining variable spacing and variable coupling of the antennas to the receiver, a well-concentrated main beam 15 minutes of an arc wide is obtained. This means that the telescope is largely free of one of the main troubles that afflict radio telescopes, namely, that they record in more than one direction at once. A specially designed low-loss transmission line connects the antennas with the receiver.

The receiver utilizes a low-noise amplifier loaned by the Zenith Radio Corporation. The amplifier is followed by a radiometer designed by the National Radio Astronomy Observatory. A semiconductor switch connects the receiver in rapid alternation with the antennas and with a standard source of electrical noise, to measure the difference between these sources. This difference is recorded on a graphic recorder — eventually the recording will also be done on a punched paper tape for processing in a digital computer.

The first observational program of the telescope will be a survey of radio sources in the accessible part of the northern sky — the part which crosses the north-south line between 10 and 70 degrees above the southern horizon. To do this, each antenna is mechanically turned once a day to aim the beam which will then sweep the heavens as the earth rotates. Allowing for overlap between successive scans and possible re-runs necessitated by man-made radio interference, the task is expected to take five years.

Existing catalogues of radio sources have been made at frequencies lower than 611 megacycles. There are discordances between these catalogues which a new survey with a new narrow-beam instrument may be expected to explain. A conclusion that can be drawn from the existing catalogues is that radio sources must have been more numerous in the past than they are now. It is as if radio sources are short-lived and die out, a process difficult to account for. The new catalogue may confirm this conclusion, but if it does not it will undoubtedly help to show how the idea has arisen. In either case, important conclusions as to the nature of the expanding universe will be achieved.



Location Five miles southeast of Danville, Illinois; 35 miles east of Urbana-Champaign, Illinois.

Cost $871,650, including $741,000 from Office of Naval Research, $25,900 from National Science Foundation, $104,750 from University funds.

Director Professor George C. McVittie, head, University of Illinois, Department of Astronomy.

Designer Professor George W. Swenson, Jr., Department of Astronomy and Department of Electrical Engineering, project engineer, with contributions from Professors John D. Dyson and Yuen T. Lo, Department of Electrical Engineering.

Consulting engineers Hanson, Collins, and Rice, Springfield, Illinois.

Contractors Chism and Miller, Inc., Springfield, Illinois, jointly with W. B. Clements Company, Wellington, Illinois.

Telescope reflector 600 feet long, 400 feet wide, created by shaping a natural ravine into a parabolic cylinder. Earth surface is covered with sheets of asphalt liner to prevent erosion. Reflecting surface consists of wire mesh screen lying on asphalt liner; screen reflects incoming signals onto 276 antennas placed along the focal line. This line is 153 feet above lowest part of surface. Antennas are fastened to underside of wooden truss carried on four wooden towers. Truss is 425 feet long.

Radio receiver Operates on frequency of 611 megacycles.

Operation By mechanical rotation of the antennas, beam can be directed to any point from 10 to 70 degrees above south horizon point; for east-west movement the telescope depends on the rotation of the earth.