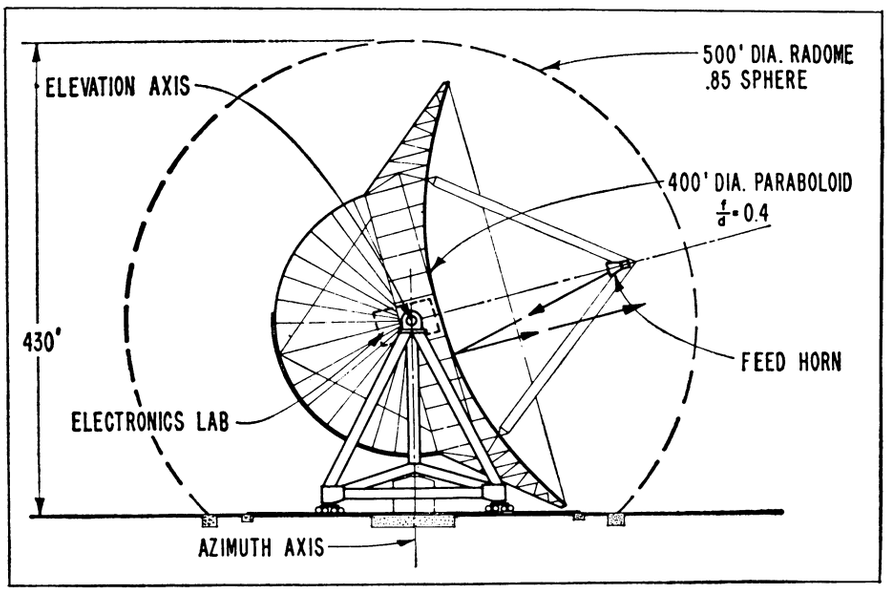
Radio Telescope of 'Near' Future



CAMROC

Dish in a dome: one version as proposed by the CAMROC group.

A new generation of radio telescopes is on the drawing boards. A major obstacle to previous progress in building large antennas to tune in on radio waves from the heavens can now be hurdled. Thanks to calculations on a computer, astronomers have found they can economically build large instruments by enclosing their dish in a dome.

Almost since radio astronomy came of age 20 years ago, astronomers have been seeking larger, more flexible and more sensitive ears to turn skyward.

In radio astronomy, the size of the dish-shaped antenna used to catch faint emissions from distant sources is as critical to the sensitivity and flexibility of a telescope as is the mirror in an optical reflector.

But, largely because of construction problems, radio astronomers have had to get along for years with nothing larger than the 250-foot dishes at the National Radio Observatory, in West Virginia, and another 250-footer at Jodrell Bank in England.

There are bigger radio 'scopes, like the one in Puerto Rico, the dish of which is a great bowl hollowed out of the earth.

But it is a 300- to 600-foot, mounted and fully steerable dish, the astronomers believe, that will give them the boost optical astronomy gained with completion of the 200-foot reflector atop Mt. Palomar in California.

Puzzling sources in the heavens, such as unusual galaxies, sources of prodigious outpourings of radio waves, are among the objects on which astronomers hope to train the large antenna when it is built.

Another urgent task for which the huge antenna would be particularly suited is the analysis of hydrogen and helium, as well as the hydroxyl radical and possibly other elements or compounds in interstellar space. The radio waves are broadcast by both neutral hydrogen and helium atoms when they change from one highly excited state to another. The antenna would also be used to search for deuterium in space.

Now, because of the computer and the dome, radio astronomers believe they can build a steerable dish of the size they want. Earlier efforts to build radio telescopes in this size range came a cropper on the weight needed to withstand wind and other forces at work in the open.

A committee set up jointly by four institutions in Cambridge, Mass., is now taking a searching look at the feasibility of building this next generation of steerable radio telescopes. The group is known as CAMROC, an acronym for Cambridge Radio Observatory Committee. Its 11 members represent Harvard University, Massachusetts Institute of Technology, the Smithsonian Astrophysical Observatory and MIT's Lincoln Laboratory.

Their preliminary studies, scheduled for completion within six months, have shown that it is economically feasible to build a telescope some 400 feet in diameter if the huge dish is sheltered by a plastic dome. The estimated cost of a 400-foot antenna inside a dome would be about $25 million, only one-third that of an equivalent structure built to withstand winds and other weather elements without protection.

Housing radio telescopes in a dome does not interfere with receiving either radio waves broadcast by many heavenly objects or the radar signals bounced back from earth-circling satellites, the moon or planets. Recent discoveries made by tuning in on radar and radio waves from near and far space have emphasized the need for very large antennas.

Radio waves are as much as a million times longer than optical radiation. The instruments to detect them must, therefore, be large. Although an array of small antennas, or massive and immovable bowls, can be used to achieve this effect, only a fully steerable dish has the desired versatility, and the added advantage that it can be used to do several experiments at the same time at different wavelengths.

CAMROC, by using computers in design studies, found that the estimated cost of a 400-foot antenna could be cut by one-third from the level originally calculated. The committee's feasibility studies have been funded partly by the participating institutions and partly by the Government through the National Science Foundation.

CAMROC is now preparing a formal report outlining its findings concerning the technical aspects of constructing a large steerable radio telescope. Indications are that the main difficulty will not be technical but obtaining the funds.

Although CAMROC would like to see the facility built in the Northeast, its design studies have been sufficiently broad so that the giant antenna could be built anywhere in the United States, and competition for such an antenna is apt to be keen.

The weather-protecting dome in which the proposed 400-foot antenna would be housed would be similar to the plastic bubbles surrounding the radar antennas on the DEW line, the lightweight geodesic domes invented by Buckminster Fuller. The Distant Early Warning radars signal when an orbiting or flying object, such as an intercontinental ballistic missile, approaches northern Canada.