GEOPHYSICS

Seeing Earth Satellites

Many people will be able to see the tiny artificial satellites to be launched by the United States during the International Geophysical Year.

See Front Cover

By ANN EWING

➤ THERE WILL be a great straining of eyes to spot the tiny artificial satellite to be shot spaceward by the United States in about a year.

This minute, man-made "moon" will be the first of at least six sent whirling around the earth at about 18,000 miles per hour, in a path that varies in altitude from 200 to 1,500 miles.

Anyone south of a line across the continent from Philadelphia to a point about 150 miles north of San Francisco with sharp eyes, a pair of binoculars or an instrument easily made of parts costing about $20 should be able to see the earth satellite at dusk or dawn if the weather is good.

However, joining the hardy bands of amateur astronomers and other interested persons who will contribute to the scientific information learned by tracking the satellite will require plenty of patience and fortitude.

Paths the satellite is expected to take will be made as widely known as possible so as many people as want to can view the earth-circling moonlet. These orbits will be computed by a giant electronic "brain" in Cambridge, Mass.

All reports on times of the satellite's passage and its position against the background of stars will be relayed immediately to the computer, which will then predict its future path.

Launching the first and later earth satellites is part of a world-wide program to explore the earth and its atmosphere being made during the 18 months starting next July 1. This cooperative venture of 55 nations, including the U.S.S.R., is called the International Geophysical Year.

Hundreds of important investigations on an international scale are slated for this period, but the most eye-catching of the experiments planned are the launchings of basketball-sized spheres to circle the earth at its outmost atmospheric fringe.

Many scientists foresee the tiny, unmanned satellites as the first step in man's eventual conquest of space.

Once a satellite is whirling around the earth, however, knowing its position is the first and most vital information needed before anything else can be learned.

Two radio and two optical programs will all help locate the satellite accurately. First reliance, however, will have to be placed on the teams of observers in the visual program.

A dress rehearsal for this program, known as MOONWATCH, is expected sometime before Jan. 15, 1957. Plans now are to have airplanes fly high over MOONWATCH stations during the twilight period one night before then. They will be at an altitude that will make their motors inaudible, with a course and speed approximately duplicating the apparent motion of a satellite.

Each plane will carry a light to match the expected brightness of the earth-circling moonlet as seen from the ground.

The proposed flights will be made only over a few stations and none of the observing teams will know whether or not the simulated satellites are due over their area.

One practice team in session, lined up in the approved fashion at a practice session held at the home of G. R. Wright, Silver Spring, Md., is shown in the photograph on the cover of this week's SCIENCE NEWS LETTER. Displayed in the foreground is a model showing how a half-circle segment of the heavens can be covered using the simply-made MOONWATCH telescope mounted nearby.

When practice turns to reality, the most important contributions made by such teams will be the first sightings as the satellite starts its earth-circling path and the last before the man-made moonlet spirals to earth.

However, if the satellite's battery-powered radio fails to work or if the power supply is exhausted before the satellite burns up in the earth's atmosphere, observations made by MOONWATCH teams will be essential for aiming the wide-eyed telescopes being set up at 12 observatories around the world.

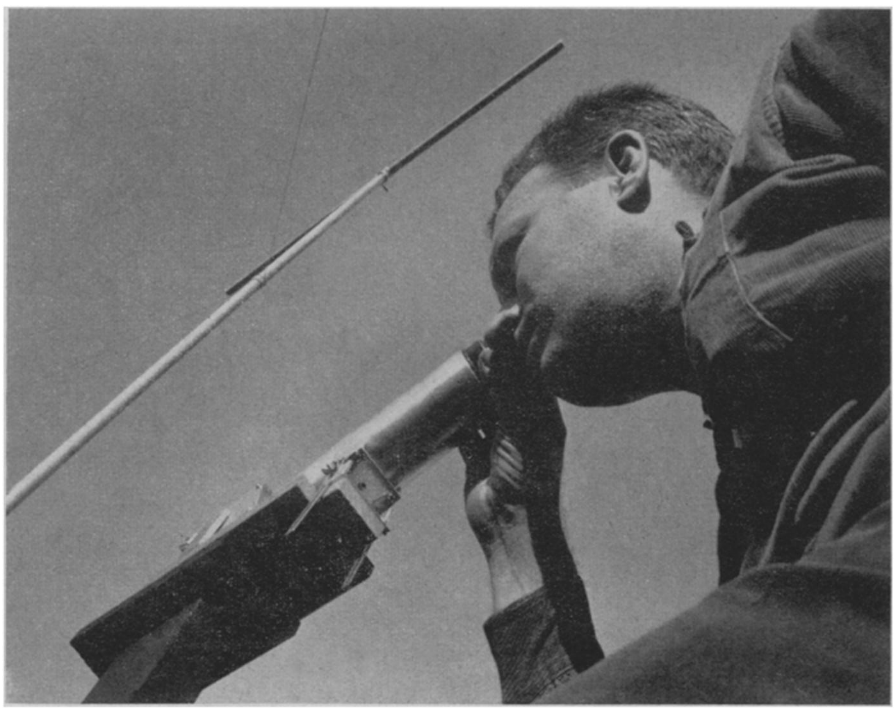
Not until the satellite's path has been plotted fairly accurately can the precise timing and tracking be started at these observatories. Nor can extremely rapid changes in path during the satellite's last hours be followed with the precise instruments.

Polish for Visibility

The satellite's skin will be highly polished to aid its visibility. Nevertheless, scientists estimate it will have a magnitude of about six, the same as the faintest star that can be seen under the best conditions.

Some idea of the observing difficulties is shown by the fact that the satellite's apparent speed will be equivalent to that of an object crossing the moon's face in only a few seconds.

Designs for constructing a MOONWATCH telescope are available from the Smithsonian Astrophysical Observatory, 60



MOONWATCH TELESCOPE—A volunteer observer, Nelson M. Griggs of Washington, D. C., here demonstrates how the telescope especially developed for spotting an earth satellite can be used with a meridian marker.

Garden Street, Cambridge 38, Mass. The optical parts used are available either as Army surplus or from standard optical houses and cost about $20.

Besides the optical observations, the satellite will be tracked by radio. It will carry a small transmitter and battery power supply. The radio signals will be received by the Minitrack system, developed by the Naval Research Laboratory.

In order to intercept the satellite's radio broadcasts at each passage at least eight Minitrack stations will form a chain along the 75th meridian, which runs north and south from New York to Chile. These ground stations will include a precision array of several antennas and a complex electronics installation requiring an operating staff of ten technicians.

The main Minitrack stations are being built by the Government at a cost of about $120,000 each. The so-called "poor man's" Minitrack, or Mark II, however, can be constructed by radio amateurs or other interested groups for anywhere from a few hundred to a few thousand dollars, depending on the equipment already on hand. Full working designs can be obtained from John T. Mengel of the Naval Research Laboratory, Washington, D. C.

The command structure for the entire satellite program is somewhat complex. At the very top is Dr. Joseph Kaplan, University of California physicist who is chairman of the U. S. National Committee for the International Geophysical Year.

Advising Dr. Kaplan is a technical panel on earth satellites headed by Dr. R. W. Porter, a General Electric Company consultant. The tracking, computing and experiments for the satellite are under the overall direction of a group headed by Dr. W. H. Pickering, director of the Jet Propulsion Laboratory, California Institute of Technology.

Responsibility for the optical tracking program has been assigned to the Smithsonian Astrophysical Observatory, of which Dr. F. L. Whipple is director. Coordinator of visual satellite observations is Dr. Armand N. Spitz, while Dr. J. Allen Hynek is in charge of the photographic work.

Handling the engineering and rocketry necessary to launch the satellites was assigned by President Eisenhower to the Department of Defense, which made it a joint project of the Army, Navy and Air Force, with the Navy as manager. The Navy, in turn, lumped this assignment with others from the IGY on telemetering and radio tracking under a program called Project Vanguard, of which Dr. John P. Hagen of the Naval Research Laboratory is director.

The Minitrack stations will be located at Blossom Point, Md., U.S.A.; Fort Stewart, Ga., U.S.A.; Batista Field, Havana, Cuba; Coolidge Field, Antigua Island; Quito, Ecuador; Lima, Peru; Antofagasta, Chile, and Peldehue Military Reservation, Santiago, Chile. The Naval Electronics Laboratory, San Diego, Calif., which is not on the 75th meridian will also have a Minitrack installation.

The Australians are considering the possibility of converting some of their radio astronomy equipment already on hand for tracking the satellite, and the IGY Committee is interested in getting other nations to set up radio tracking stations.

Optical observations with 12 especially built, wide-eyed Schmidt cameras will be made at White Sands, N. M., U.S.A.; some site in Florida, U.S.A.; the island of either Aruba or Curacoa; Quito, Ecuador (with radio observations); Antofagasta, Chile (also with radio observations); Cordoba, Argentina; Bloemfontein, South Africa; Woomera Range, Australia; Mauna Loa, T.H.; Tokyo, Japan; Dehra Dun, India, and Cadiz, Spain.