ELECTRONICS

U. S. Contacts Venus

Radio waves emitted from a Massachusetts Institute of Technology transmitter have reached Venus and returned, marking the first radar observations of any planet.

➤ RADIO SIGNALS have reached Venus twice, Massachusetts Institute of Technology radar experts reported.

Astronomers and electronic engineers throughout the world have eagerly awaited radar observations of a planet ever since the moon was detected by radar in 1946. The M.I.T. Lincoln Laboratory team, which has won the international race to bounce a signal off another planet, did so more than a year ago while Venus was about 28,000,000 miles from the earth, more than 100 times the distance to the moon.

The American experimenters used a powerful radar research installation on Millstone Hill, in Westword, Mass., and credit their success not only to its power but also to the use of a new kind of amplifier and to sophisticated new mathematical and electronic computing techniques.

The radio waves emitted from the transmitter took about five minutes to make the 56,000,000-mile round trip to Venus and back. Making certain that the signals received on earth were indisputably those which had been sent from earth took months. They were recorded on magnetic tape and examined in a high-speed electronic digital computer. Its calculations now have shown that there is less than one chance in 10,000,000 that the experimenters were deceived by nature's quirks and noises.

Venus first was contacted on Feb. 10, 1958. Two days later, the feat was repeated. Venus then was receding from the earth.

The signals sent on Feb. 12 did not return until nearly 7.5 seconds later than those that were sent on Feb. 10. The difference in the time required for the radio waves, traveling at the speed of light, to make the round trip indicated that in the two-day interval, Venus and the earth had moved 696,640 miles farther apart.

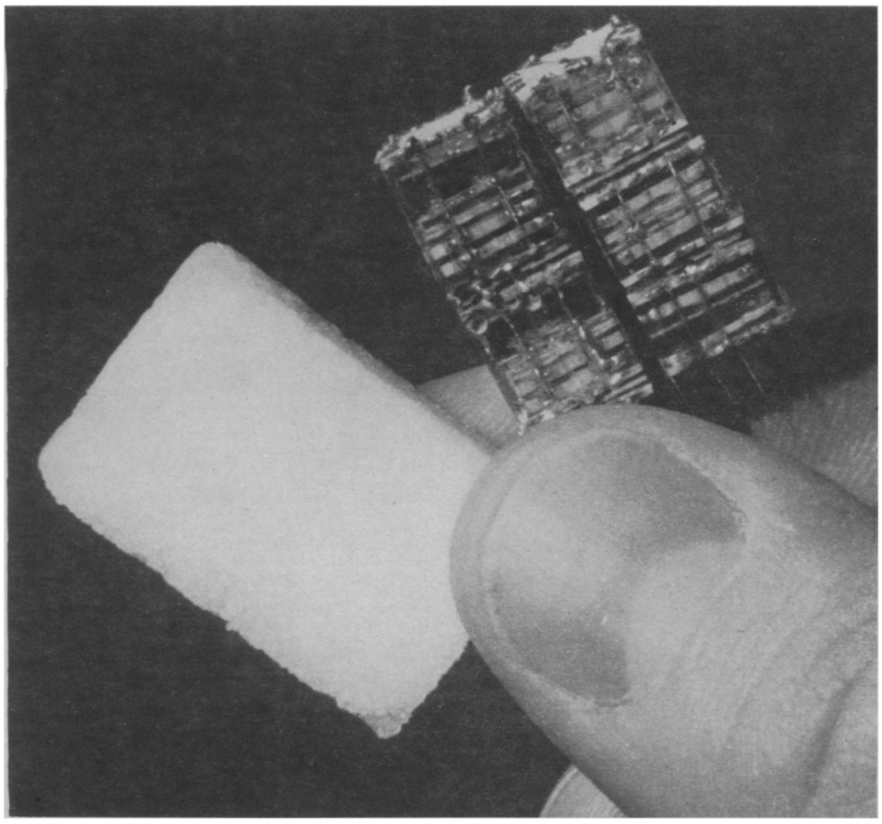
A report of the work in *Science* (March 20) points out radar now can be used to measure interplanetary distances with greater precision than was previously possible. The M.I.T. scientists' findings indicate the astronautical unit, the mean radius of the earth's orbit around the sun, commonly used to compute distances within the solar system, may be slightly shorter than was thought.

The radar used was developed for the U. S. Air Force, primarily for the study of problems in ballistic missile defense. The new amplifier used with it was a solid-state maser, a device which introduces very little noise. The increase in sensitivity which the maser gave the apparatus was equivalent to a four-fold increase in the power of the transmitter. The researchers pioneered in using this device, which has since been used elsewhere to extend the range of radio telescopes.

Despite the high power of the transmitter, and the added sensitivity achieved with the maser, the signals returned from Venus were so weak that new techniques were required to detect them with certainty. Recordings of what was received were searched by the electronic computer for the particular train of pulses that had been transmitted.

The Lincoln Laboratory team was led by Drs. Robert Price and Paul E. Green Jr., and included Thomas J. Goblick Jr., Robert H. Kingston Jr., Leon G. Kraft Jr., Gordon H. Pettengill, Roland Silver and William Boyd Smith.

Science News Letter, April 4, 1959



CUBE-SIZED RADIO—Micro-modules, circuit building blocks measuring only a third of an inch on each side, have gone into the development of devices such as this sugar-cube-sized radio by the U. S. Army. Tests by the Army Signal Corps and the Radio Corporation of America indicate the tiny cubes are highly dependable, long-lived and extremely rugged.

ENGINEERING

Spot-Pinpointing Device Aids Missile Guidance

➤ A DEVICE that can readily determine the position of any point on earth to within ten feet by astronomical means is expected to give more accurate guidance of long-range missiles.

Described at the Institute of Radio Engineers meeting in New York by F. J. Alterman of General Mills, Inc., the device consists of a computer and an optical star-observing instrument.

The computer trains the star gazer in the anticipated direction of a known star. When the earth's rotation causes the star to enter the field of vision of the star gazer, a photoelectric device signals the computer, which then notes the exact time by means of an electronic clock, and checks the position of the star gazer with the help of a gyro compass.

After a suitable number of stars have been similarly observed, the computer determines the location of the observation site to within one-tenth of a second of arc, or about ten feet.

Guidance accuracy will be increased by reducing uncertainties as to the precise locations of the missile launching site and points along its flight path.

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