ELECTRONICS

Echoes Off The Moon

Specially designed radar was used in the contact with the moon. Pulses of high frequency were shot into space and their echoes were detected seconds later.

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➤ MAN HAS actually contacted the moon. Radio waves, according to the War Department, have gone beyond our atmosphere to the moon and been reflected back to us, travelling an estimated 477,714 miles in all.

This first contact with the moon was made on Jan. 10 by Army Signal Corps scientists at the Evans Signal Laboratory, Belmar, N. J. Specially designed radar was used which shot pulses on very high frequency energy out into space and detected their echoes seconds later. The picture on the front cover of this SCIENCE NEWS LETTER shows the antenna used by the Army Signal Corps to make the contact with the moon.

Announcement of this first proof that radio waves can penetrate beyond the earth's atmosphere was withheld until the Signal Corps was certain beyond doubt that the experiment was successful. The results achieved have been painstakingly verified. Several subsequent efforts to contact the moon have also been successful.

Radar pulses, like radio waves, travel at the speed of light—186,000 miles a second. It took about 2½ seconds for the radar pulses to speed from the station to the moon and the echoes to travel back to the station. The distance between the moon and the earth, which varies as the moon revolves and moves in its orbit around the earth and they together travel around the sun, is calculated to average about 238,857 miles.

The Signal Corps experiments are expected to have "valuable peacetime as well as wartime applications." One obvious possibility is the radio control of long-range jet—or rocket-propelled missiles, circling the earth above the stratosphere. The German V-2 missiles already are believed to have reached an altitude of 60 miles.

Radar might eventually be developed to the point where it can be used by astronomers to map the surface of the moon far more accurately than is at present possible. Radar may also help in constructing detailed topographical maps of distant planets and in definitely determining whether life, such as we know it, exists on any of them. It might conceivably be used in getting data concerning the composition and atmosphere of other celestial bodies.

The primary significance of the Signal Corps achievement is that this is the first time scientists have known with certainty that a very high-frequency radio wave sent out from the earth can penetrate the electrically charged ionosphere.

In connection with wartime applications of radar, the Signal Corps has been studying for several years the problem of reaching other celestial bodies with radar. The experiments were directed by Lt. Col. John H. Dewitt, Jr., former director of the Evans Signal Laboratory.

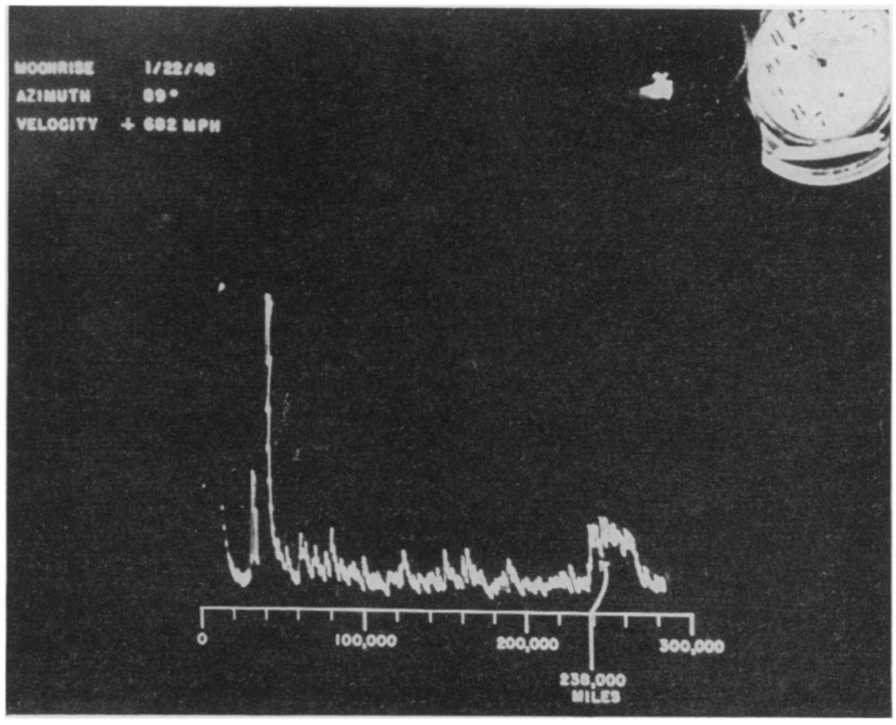
The equipment used for this experiment comprised extensive adaptations to a standard wartime Signal Corps radar, originally designed in 1937 for long-range early warning against enemy air attack.

The radar was operated at its standard frequency of 112 megacycles—its alternating-current radio waves made 112,000,000 complete cycles per second—but the pulse repetition rate and pulse width were extended beyond the usual standards. Instead of sending out several thousand spaced pulses each second the modified radar transmitted a pulse only every five seconds. The pulse width was increased from a few billionths of a second to as much as one-half second.

A specially designed high persistency oscilloscope, comparable to the "A-scope" used on wartime radars, was constructed to present visual evidence of the moon echoes. When the radar was operating, a line across the face of the tube represented the transit of the successive pulses. As each pulse left the transmitter, a tall "pip" appeared at one end of this line. A smaller pip, toward the other end of the line, represented the pulse echo received from the moon.

A double-sized antenna with 64 instead of the standard 32 dipoles on a 100-foot tower was used.

Science News Letter, February 2, 1946



RADAR SCOPE—Shows the start of the impulses toward the moon and their reflection from it. Between the start and finish of impulses is a three-second interval, with contact made after two and a half seconds. First upswing (left) of the line indicates start, while tiny pips are the result of minor interferences. Photographs by Acme.