

CONTACT WITH MOON ACHIEVED BY RADAR IN TEST BY THE ARMY

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Signal Sent From Laboratory
in Jersey Is Reflected Back
2.4 Seconds Later

VAST POSSIBILITIES SEEN

Mapping of Planets, Defense
Against Bombs in Cosmic
Space Are Suggested

By JACK GOULD

The first man-made contact with the moon was achieved on Jan. 10 when the Army Signal Corps beamed a radar signal on it and 2.4 seconds later received an echo reflected by the celestial body, it was announced yesterday. The signal, covering a round-trip distance of an estimated 450,000 miles, was sent out from the Evans Signal Laboratories at Belmar, N. J.

Applications almost beyond immediate comprehension were foreseen as a result of the electronic achievement. New and far more accurate study of the universe, perhaps ultimately resulting in the detailed topographical mapping of distant planets, was anticipated. Detection of enemy missiles flying through cosmic space also was expected to be possible from the new definitive proof that radio waves could penetrate beyond the earth's ionosphere.

The sound that the moon sent back to the earth took the form of a 180-cycle note, or somewhat higher in pitch than the hum to be heard on a home radio receiver when a station is not tuned in. It lasted half a second. The Army also recorded the echo visually on an oscilloscope. There the epic-making peep appeared as a series of jagged, saw-tooth lines.

Army Announces Feat

The official announcement that a radio signal had been bounced off the moon was made by Maj. Gen. George L. Van Deusen, Chief of the Engineering and Technical Service, Office of the Chief Signal Officer, at the annual dinner of the Institute of Radio Engineers at the Hotel Astor.

The first word to reach the public, however, came several hours earlier under circumstances anything but formal. A group of reporters crowded into a small upstairs reception room in the hotel and a quiet, 39-year-old officer, Lieut. Col. J. H. DeWitt, who supervised the experiment, announced what had been done.

As the men who had finally "reached the moon," Colonel DeWitt and his four chief associates in the venture were modest in the extreme. Only upon the reporters' insistence was there any revelation of biographical material on the quintet.

Colonel DeWitt, a former broadcast engineer in Nashville, Tenn., and a "ham" (amateur) radio operator, acknowledged that the results were the climax of his peacetime hobby to put a signal up to the moon. He said he failed in an attempt in 1940.

Jacob Mofsenon, 32, a graduate of City College, who entered the Signal Corps in April, 1942 was even more hesitant, but finally consented to tell his peacetime occupation.

"I was a diamond dealer," he said, with a laugh.

The other principal participants were Dr. E. K. Stodola, 31, a graduate of Cooper Union, who was in charge of research; Dr. Harold Webb, 36, a former teacher of physics and mathematics at West Liberty College, West Liberty, Va., and Herbert Kauffman, 31, who had worked in radio in New Orleans.

Two Conducted First Test

Dr. Webb and Mr. Kauffman were actually the only two at the radar receiving equipment when the first echo came back from the moon, but said they had betrayed no particular emotion at the time over the event.

"We looked for it and got the results," Dr. Webb said.

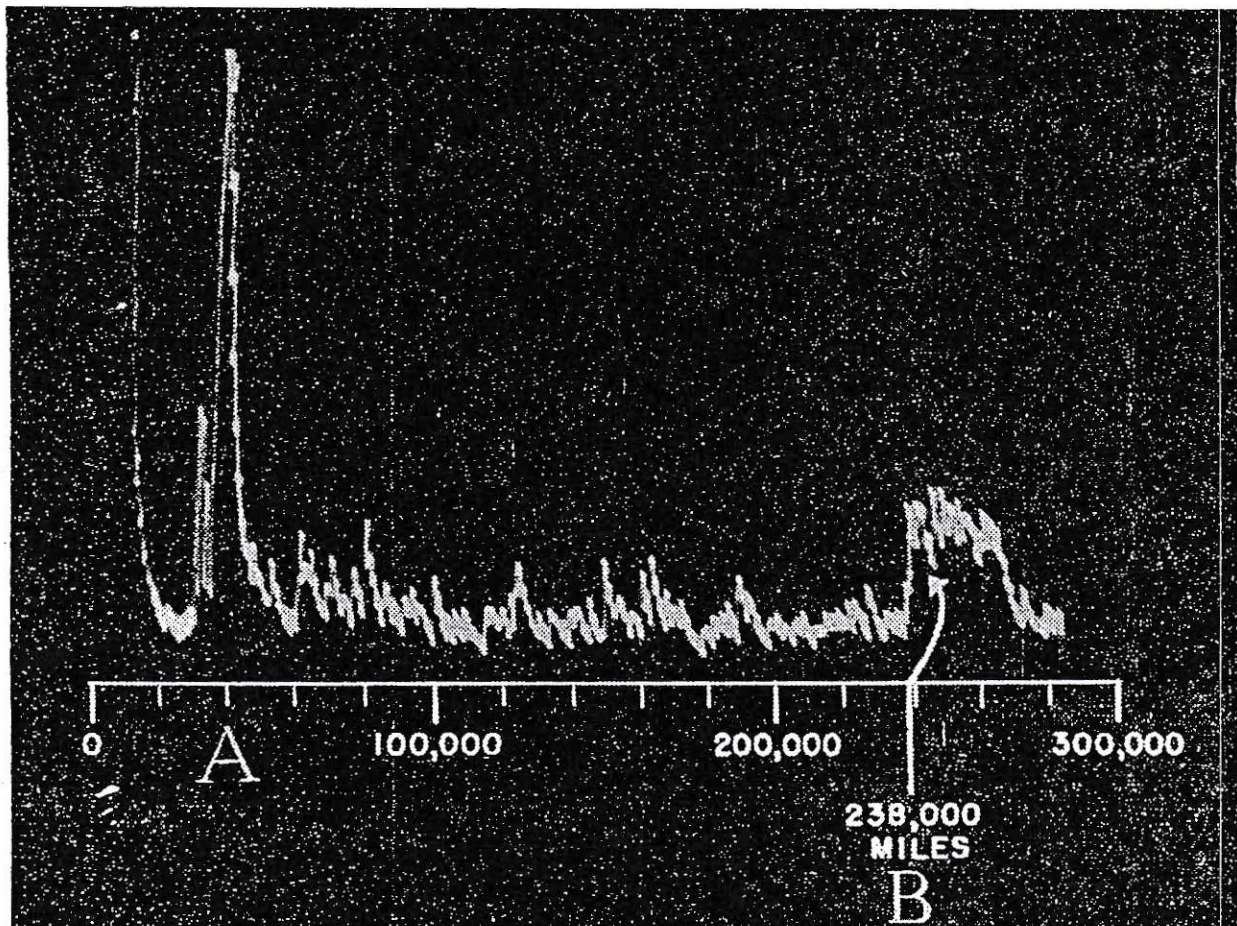
Work on reaching the moon by radar was started soon after V-J Day, according to Colonel DeWitt, and on Jan. 10 preparations had been completed for a test. On that day, he said, the moon rose at 11:48 A. M. and a few minutes

later the initial radar impulse was beamed heavenward on a frequency of 111.6 megacycles. It was at 11:58 A. M., as the scientists remembered it, that the first flick of light appeared on the oscilloscope denoting success.

The tests were continued for five days, three tests being made as the moon rose and one as it set. Tests of the moon's "receptiveness" when it was higher in its arc were not

Continued on Page 19, Column 3

AN ECHO FROM THE MOON IS RECORDED



This is the Army's visual representation of the reception of a radar signal reflected by the moon. At "A" is the strong beam sent heavenward from Belmar, N. J. At "B" and the arrow is the record of the same signal as received back from the celestial body. The jagged lines between "A" and "B" are the variations caused by local noise conditions at Belmar. The time it took the signal to make the trip from earth to moon and back was 2.4 seconds. The mean distance from the earth to the moon is 238,857 miles.

Contact With Moon Is Achieved By Radar in Army Experiments

Continued From Page 1

possible because of lack of suitable antenna equipment and some days no signal came back, apparently because of propagation characteristics within the earth's atmospheric region.

The peak power of the transmitter was three kilowatts but through use of a special antenna giving a gain of 200 its radiation effectiveness thereby being vastly increased. The strength of the signal received back from the moon was calculated at about three watts.

Colonel DeWitt emphasized the "real trick" in making contact with the moon was not so much in the transmission but in the construction of a receiver of exceptional sensitivity to pick up the feeble echo from the planet. He

the earth, and the radio reporting of astronomical data electronically computed aboard such vessels."

For the project, which Army officers informally labeled "Diane," the chief deviation from conventional radar application was in the use of a much longer pulse-repetition rate, somewhere between three and five seconds, compared with the usual pulse rate of thousands of times a second. The length of time each pulse of energy existed varied from one-tenth to one-half a second, an "enormously long interval" compared with war-time standards.

It was the factor of the rate and duration of the pulse, plus companion antenna problems, that led Colonel DeWitt and his associates to a relatively cautious approach in speculating on making contacts with Mars and Venus, as different distance ranges present new sets of problems.

estimated the sensitivity at .01 microvolts.

The radar waves traveled at the speed of light—186,000 miles a second. The mean distance between the moon and the earth is calculated at 238,857 miles, but the greatest problem for the scientists at Belmar was to allow also for the distance variation involved in the relationship between the speed of the moon and the earth's movement. The moon's speed, it was explained, varies from 750 miles faster than the earth's rotation to 750 miles slower.

Having demonstrated that a signal can reach the moon and return, Colonel DeWitt said the only problem left was the calculation of the time interval. When the echo came back in 2.4 seconds, the scientists were convinced they had achieved their aim "because there was nothing else there but the moon."

To make sure that there might be no error, a small group of scientists, not identified, visited Belmar and verified the conclusions.

"Hello" From Moon Expected

Colonel DeWitt professed a dislike for speculation of a "Buck Rogers or Jules Verne" character, but acknowledged that the Army scientists hoped to increase their transmitter's power so that it could be modulated by voice.

"We should be able to say 'hello' and hear the moon say 'hello' back," he said.

He quickly added: "I hope the moon doesn't answer, 'Good-by.'"

In connection with the announcement in New York, the War Department in Washington issued a statement on the implications of the feat. Maj. Gen. Harry C. Ingles, Chief Signal Officer of the Army, noted that it could have "valuable peacetime as well as wartime applications, although it is impossible at this stage to predict with certainty what these will be."

"One obvious possibility is the radio control of long-range jet or rocket-controlled missiles, circling the earth above the stratosphere," the War Department continued. "The German V-2 missiles already are believed to have reached an altitude of sixty miles."

"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 which encircles the earth and stratosphere. The several layers of the ionosphere start about thirty-six miles above the surface of the earth and extend to approximately 250 miles."

"On this basis, the V-2 projectiles already have risen above the lower ionosphere levels, and it is now known that radio waves can completely penetrate the ionosphere."

"The new technique will also be valuable for studying the effects

Termed "Interesting Tool" CAMBRIDGE, Mass., Jan. 24

(U.P.)—Dr. Harlow Shapley, director of the Harvard College Observatory, described the Army's radar contact with the moon tonight as "an interesting tool in exploring the solar system" and predicted that more startling war-born developments would be revealed within the next few years.

"I believe radar contact with the moon is extremely helpful," he said, "because it will aid us in the study of meteoric material in the vicinity of the earth. I don't think it will ever help us to find another planet."

Indicating that the radar experiments had been known to scientists for at least two years, Dr. Shapley said the importance of this advance was not at all comparable to the atomic bomb. However, he said astronomers were working on other discoveries made during the war, and he predicted they would be far more startling than the radar contact when they were announced.

of the ionosphere upon radio waves. Scientists already have learned that low and medium frequency waves are reflected by the ionosphere, and these reflections form the 'skywaves' used for long-distance broadcasting. The ionized layers also sometimes distort and bend radio waves, much as a prism distorts light waves.

"Another valuable application may be the provision of new astronomical information. Not only may it be possible to construct detailed topographical maps of distant planets with the aid of radar data, but scientists may be able to determine the composition and atmospheric characteristics of other celestial bodies by this means.

"A less likely application of the new technique will be the possibility of radio control from the earth's surface of 'space ships' venturing thousands of miles from