ELECTRONICS

Escaped Radio Waves

They are constantly being sent beyond the atmosphere that surrounds our earth, but have only recently been reflected back to us.

➤ RADIO WAVES are constantly being sent beyond the atmosphere that surrounds our earth, but only recently have any of these "escaped" impulses been reflected back to us.

The SOS of a ship in peril on the sea, the messages with which far-away adventurers at the ends of the world keep in reassuring touch with those at home, and the globe-encircling signals of radio amateurs and professionals are all made possible by reflection from ionized layers, consisting of electrified particles, many, many miles above the tallest transmitting tower.

When a transmitting station sends out a series of radio signals, the energy goes in two ways, which may be described as the ground wave and the sky wave. The ground wave travels along the surface of the earth, gradually becoming less powerful as it spreads out over a greater area and as energy is absorbed from it.

Meanwhile, the sky wave travels upward until it reaches the ionized layer of the atmosphere and then is reflected back in much the same manner that light is reflected from a mirror. A receiving station located only a short distance from the transmitting station will pick up the signal first from the ground wave, and then after an interval as an "echo" from the sky wave.

A clue to the height of the ionized layer is given by clocking the time needed for a wave, which is assumed to travel with the speed of light, to hit the ionized layer and be reflected back. Reflection of waves from the ionosphere was in a sense the first radar.

Whether radio waves will be reflected by the lower ionized layer about 40 or 50 miles up, or whether they will penetrate it and continue up to some greater height and be reflected by one or another of the higher layers, depends upon the frequency or wavelength of the impulse. The greater the frequency or the smaller the wavelength, the higher will the radio impulse penetrate into the ionosphere and the longer will be the time interval before the echo returns. There is, however, no echo for some extremely small waves, which pass beyond all the layers and escape into space.

The maximum frequency which will be reflected by each layer, called the critical frequency for that layer, varies with the time of day, season of the year, longitude and latitude, and also with solar activity as shown in the sunspots.

In experiment stations throughout the world radio experts many times each day send into the upper atmosphere a wide range of radio waves to find the critical frequencies of the different layers. This information is used to suggest the best frequency for short-wave broadcasts.

To date, none of these short radio waves, escaping through the ionized layers surrounding the earth, have been known to hit a body in space and be reflected back to us. It took radar waves, specially beamed to the moon, to escape through the earth's atmosphere and return. Although scientists have long suspected that short radio waves did penetrate beyond the ionosphere, it was the moon that gave us our first definite proof.

Science News Letter, February 2, 1946

ELECTRONICS

"Blind Navigation" Possibility of Future

➤ SHIPS AND AIRPLANES of the future may use "blind navigation" to know where they are, regardless of the weather, by using radar to take their "sights" on heavenly objects.

Discovery that the layer in the atmosphere that ordinarily reflects radio waves back to earth, can be penetrated by radiation of 112 megacycles, makes it possible to pick up any heavenly body within range of the radar impulses.

A rotating antenna sweeping across the heavens could locate a planet in a way similar to that used during the war to pick up enemy ships, planes and submarines. The height and direction at which the planet is found would tell the navigator exactly what his position is on the surface of the earth.

When used for spotting of ships or other objects on the surface of the earth, the range of radar is limited by the horizon. Radar, like your eyes, can "look" only in a straight line and so cannot see around the curve of the horizon except by reflection. Putting the antenna on the top of a tall tower helps to see farther just as sending a lookout to the top of the ship's mast helps him to see farther.

But the horizon does not limit range when you are sending your radar message to the heavens. The only thing that limits range is the strength of the impulses. You could use radar to sight on the farthest star provided your antenna were sensitive enough to pick up the faint echo that comes back.

For "blind navigation" through dense clouds it would be necessary to work with a wavelength that will penetrate thick layers of moisture. Some wavelengths are screened off by heavy clouds. However, it should be possible to find a wavelength that will go through them. There may also be an engineering problem involved in making the necessary sending and receiving apparatus compact and light enough to be carried on a ship or a plane.

The navigator who makes use of radar will have to learn to take his bearings from objects he has not been using in the past. The bright stars used in ordinary navigation are extremely distant, and it would take years or centuries for the echo to come back. For radar navigation, it would be better to sight on the moon, the sun or the planets, which are only seconds distant, as radar-waves fly.

Science News Letter, February 2, 1946

AERONAUTICS

High-Flying Data Win Octave Chanute Award

➤ THE OCTAVE Chanute award for 1945 was presented at the victory dinner on Jan. 28 of the Institute of the Aeronautical Sciences in New York, to Robert T. Lamson and A. Elliott Merrill for obtaining at great personal hazard data contributing to the design of high-altitude military aircraft. Specifically, their flight research contributed to the success of high-altitude, daylight precision bombing with B-17 airplanes in Europe.

The award is in honor of Octave Chanute, an engineer who gave assistance to the Wright Brothers in their early work.

Science News Letter, February 2, 1946

Starfish are a pest in commercial oyster beds; one has been known to eat more than 50 oysters in six days.