BAT RADAR

By JOHN ERIC HILL

(Drawing by G. Frederick Mason)

IN the post-war world, pilots of commercial airplanes will have radio instruments that will determine accurately the position of obstacles and their distances from the plane, as well as the altitude of flight and the physical conformation of the surface of the earth below. These radio detection devices, or radar instruments, function as well in fog and bad weather as they do in clear weather.

The public has been given enough information on radar to understand the general principles involved: Radio impulses are beamed out into space, and when any solid object is encountered, an "echo" rebounds. This echo is received by a detector which indicates the direction from which it comes and the time required for its return. . Since radio impulses travel with the speed of light, approfflimately

327 yards per microsecond (a millionth of a second), it is possible to compute accurately the distance the beam has travelled, half of which is the distance of the object.

Bats, the only mammals that can truly fly, use a similar method for avoiding obstacles in their darting flight. Instead of radio impulses, they emit a series of intense cries, pitched too high to be heard by the human ear, and they are guided by the echoes that their sensitive ears are tuned to hear. For generations, the ability of bats to make their way through the inky darkness of winding caves puzzled naturalists. More than 150 years ago an Italian scientist blinded bats and found they could fly as skillfully as ever. While their sight is far keener than usually believed ("blind as a bat" is one of our false proverbial sayings), these experiments proved that they did not depend on their eyes. Some years later an investigator found that if the ears were plugged, the flying skill of a bat was greatly impaired. This discovery was forgotten for many years, and naturalists almost without exception accepted an untried theory that special senses in the skin of the wings were responsible for the ability of bats to fly without hitting things.

In recent years,* however, bats and their flight were studied anew. A number of experiments showed that they had extremely keen hearing, especially for high-pitched sounds. With sensitive recording devices it was discovered that bats give forth a series of strong sounds, pitched far above the limit of our hearing—45,000 to 50,000 vibrations per second, as compared with our limit of about 20,000.

A soundproof room was divided by a hanging screen of metal wires, set about a foot apart. Bats were temporarily blinded and then made to fly through the wire barrier. Blind bats were as successful as normal bats in this test, confirming the old experiments. But when the bats were gagged so they could not make their sound, or when their ears were plugged so they could not hear it, they had great difficulties. They would not fly without much urging, and when they were forced to fly they went slowly, as if uncertain of themselves, bumping into the wires and even the walls again and again, unable to adjust to the unusual situation.

Blind persons make a similar use of echoes to avoid obstacles. The tapping of a blind man's cane along the sidewalk and the resulting echoes have been widely used for generations as a guide when sight could no longer serve. Studies of the problems of "echolocation" as this method has been called, are now in progress, and improvements in technique may be expected which will add greatly to the well-being of sightless persons.

—(*Courtesy of Journal of the American Museum of Natural History*, 1945, p. 315.)

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*Griffin and Galambos, *Journ. Exper. Zool.*, LXXXVI (1941), 481-506; *Sci. Monthly*, LVI (1943), 155-162.

THE NOBEL PRIZE AWARDS

PROFESSOR W. PAULI (Switzerland), Princeton University, has been awarded the Nobel Prize for Physics for 1944.

The 1944 prize for Chemistry has been won by PROFESSOR OTTO-HAHN (Germany). The 1945 prize goes to PROFESSOR ARTURI VIRTMEN (Finland).

The 1945 prize for Medicine has been awarded jointly to SIR ALEXANDER FLEMING, SIR HOWARD FLOREY and DR. E. B. CHAIN for their contributions to penicillin.

The International Red Cross, Geneva, receives the Peace Prize for 1944 while MR. CORDELL HULL wins the Peace Prize for 1945.