ELECTRONICS

# Microwave Radar

## Largely a wartime development, it is responsible for equipment that licked Hitler and the Japs. Is of much higher frequency than that of prewar days.

➤ MICROWAVE radar, that is, radar working on much higher frequency than used in prewar days, is responsible for most of the radar equipment that finally brought the Germans and the Japs to their knees. The possibility of the use of high frequency radar was one of the earliest problems tackled by Radiation Laboratory, at the Massachusetts Institute of Technology, after its establishment in November 1940. Most of the radar used by the armed forces had its origin in this laboratory.

Radiation Laboratory is a child of the National Defense Research Committee, whose head, Dr. Vannevar Bush, set up in 1940 a special section to develop enemy detection devices of all sorts and appointed President Karl T. Compton of MIT as the head of the section. Dr. Compton allotted space for the section scientists at the Institute.

At that time, radar was well known to all the major nations and was in active war use. But it was longer-wave radar. Dr. Compton therefore appointed a committee to explore the possibilities of microwave, or very short wave, radar. Later, when developments had matured, a total of approximately 3,800 scientists and others worked on radar at this laboratory.

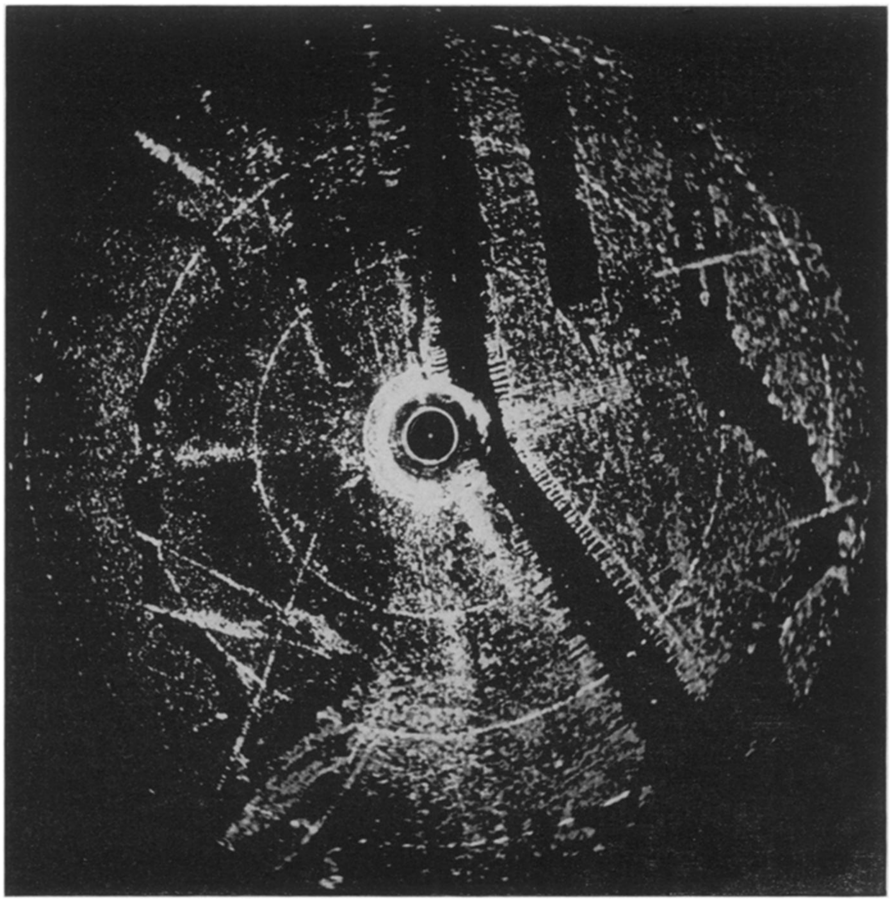
The laboratory staff had begun its exploration of microwave radar before a British mission came to this country in 1940, bringing with it a very high frequency development, called the magnetron, that was capable of generating microwaves of a power theretofore unknown. The mission left the equipment and one of their representatives at the Radiation Laboratory. It was then that the committee decided that the problem was important enough, and promising enough, to require a laboratory of its own and a large staff to work on the problem.

The success of the early warning radar system which can shoulder the burden of spotting dozens of enemy planes within a radius of many miles, and of other radar equipment, is due to the employment of these magnetron and improved microwave appliances.

The waves used are so short that they cannot be carried by ordinary wires and antennae. Instead, they are carried inside a rectangular pipe, or waveguide, from a powerful magnetron to the antenna. Here they are focused by parabolic reflectors, like light waves in a searchlight, and are concentrated into a very sharp beam.

The shape and size of the antenna makes the beam very narrow, giving a very high angular resolution. A large modulator furnishes the transmitter with pulses or bursts of power. These pulses are not measured in seconds, but in terms of millionths of seconds. Any plane within the range of these pulses will reflect them, much diminished, to the antenna and waveguide. There they pass into the receiver, where they are greatly amplified.

The receiver converts the pulses into "video" signals, which can be seen in the indicator on a cathode ray oscilloscope as bright spots of light. Range can be obtained by measuring the time required for the pulse to echo back to the receiver.



*THIS IS NEW YORK!—This microwave Radar Scope photograph of the city was taken from a B-17 with new high definition apparatus which was designed for use against Japan and would have provided radar identification of important military objectives. The outline of Manhattan Island clearly shows the Hudson river with its shipping docks. The Metropolitan Museum can be seen jutting out into Central Park. On the New Jersey side of the Hackensack river is clearly visible. At the time the photograph was taken the plane was directly over the spot in the center of the circle. Distance is indicated by the concentric circles used for navigation and bombing.*

Science Service, Inc. is collaborating with JSTOR to digitize, preserve, and extend access to The Science News-Letter. www.jstor.org

The Radiation Laboratory succeeded in producing wavelengths even shorter than those produced by the English magnetron. As a result many additional uses of radar were developed. In the summer of 1942, the Laboratory's "sea-search" radar, installed in American and British planes, was patroling the Atlantic ocean. Production sets resulting from it are credited with 50% of the U-boat kills in the Atlantic.

Bombing through overcast by means of radar played a very important part in the destruction of Nazi war essentials. Winter weather over the European continent made necessary the development of some method of putting the bombs on their targets other than by visual means. Radar made blind bombing possible. Both American and British work with radar bombing contributed to the successful radar blind bombing equipment.

In the fall of 1943, about 12 B-17 airplanes equipped with the new radar equipment were sent to England. These planes were to be used as lead aircraft for combat formations, and it was planned that the formation would drop their bombs as directed by them. Trained men from Radiation Laboratory accompanied these radar-equipped planes. Additional blind bombing equipment, much improved, was developed and constructed. It became known as the "Mickey" and proved to be a valuable navigation instrument as well as a blind bombing device.

In principle the "Mickey" set operates like the conventional radar. A pulse of radio energy is sent out from the antenna and at the same time, an electronic sweep starts out from the center of a cathode ray tube. This trace goes out radially, and in the direction in which the antenna points at the moment. Some of the energy pulses are reflected back, amplified, and put on the cathode ray tube. The result is a map of the area beneath the plane.

Ground control approach equipment developed at the Radiation Laboratory will probably have extensive uses in commercial flying to assist planes to runways during overcast and very low ceiling. Early in 1943 the equipment passed exhaustive tests and was accepted by the armed services. It includes two complete radar systems. With one, the operators search the zone surrounding the airport, directing the approaching plane into the sector scanned by the second system. Practically continuous information on the plane's position is thus secured which enables the final controller to guide the pilot down the glidepath by radio. The planes need no special equipment except their ordinary radio equipment.

*Science News Letter, September 15, 1945*

GENERAL SCIENCE

# Expedition Planned

## A group of scientists representing the American Museum of Natural History will go to Nyasaland, South Africa, as the first expedition abroad since 1941.

➤ AN EXPEDITION to Nyasaland, South Africa, is planned by the American Museum of Natural History for next April. The museum's first large-scale expedition abroad since 1941 will be led by Arthur S. Vernay, trustee of the museum, who has sponsored numerous expeditions to remote parts of the world for the past 25 years to collect material for exhibition and research.

Southern Nyasaland is one of the few remaining parts of Africa that has not been thoroughly studied by scientists. Mount Mlanje, in the wild and mountainous country south of Lake Nyasa, is a point of especial interest. Specimens of both mammal and plant life will be collected.

Mr. Vernay will be accompanied by Dr. Harold E. Anthony, chairman and curator of the department of mammals; Leonard Brass, botanist; and Capt. Guy Shortridge, director of the Kaffrarian Museum of King William's Town, South Africa.

Although the country abounds in elephant, buffalo, antelope, lion, leopard and other game, the expedition is mainly interested in collecting shrews, mice, squirrels and other varieties of small animals for a complete picture of the mammalian life of this region.

The native plants of Nyasaland are little known, so both dried and pressed plants and living botanical specimens will be collected. This material will go to the New York Botanical Gardens, which is cooperating in the project.

Part of the collections to be made by the Nyasaland expedition will be added to the South African collections of the Kaffrarian Museum, of which Captain Shortridge is director.

The expedition will be in the field for five months, working during the dry season, from May to October of 1946.

*Science News Letter, September 15, 1945*

Over 5,500,000 *grapefruit trees* were in production in Florida, Texas, Arizona and California in 1942, with approximately 44% of the acreage in Florida.

**SCIENCE NEWS LETTER**

*Vol. 48* SEPTEMBER 15, 1945 *No. 11*

**The weekly Summary of Current Science, published every Saturday by SCIENCE SERVICE, Inc., 1719 N St. N. W., Washington 6, D. C. NOrth 2255. Edited by WATSON DAVIS.**

Subscriptions—$5.00 a year; two years, $8.00; 15 cents a copy. Back numbers more than six months old, if still available, 25 cents. Monthly Overseas Edition: By first class mail to members of the U. S. armed forces, $1.25 a year. To others outside continental U. S. and Canada by first class mail where letter postage is 3 cents, $1.25; where letter postage is 5 cents $1.50; by airmail, $1.00 plus 12 times the half-ounce airmail rates from U. S. to destination.
Copyright, 1945, by Science Service, Inc. Republication of any portion of SCIENCE NEWS LETTER is strictly prohibited. Newspapers, magazines and other publications are invited to avail themselves of the numerous syndicate services issued by Science Service.
Entered as second class matter at the post-office at Washington, D. C., under the Act of March 3, 1879. Established in mimeographed form March 18, 1922. Title registered as trademark, U. S. and Canadian Patent Offices. Indexed in Readers' Guide to Periodical Literature, Abridged Guide, and the Engineering Index.

The New York Museum of Science and Industry has elected SCIENCE NEWS LETTER as its official publication to be received by its members.

Member Audit Bureau of Circulation. Advertising Representatives: Howland and Howland, Inc., 393 7th Ave., N.Y.C., PEnnsylvania 6-5566 and 360 N. Michigan Ave., Chicago, STAte 4439.

SCIENCE SERVICE

The Institution for the Popularization of Science organized 1921 as a non-profit corporation.
***Board of Trustees**—Nominated by the American Association for the Advancement of Science:* Edwin G. Conklin, American Philosophical Society: Otis W. Caldwell, Boyce Thompson Institute for Plant Research; Henry B. Ward, University of Illinois. *Nominated by the National Academy of Sciences:* Harlow Shapley, Harvard College Observatory; Warren H. Lewis, Wistar Institute; R. A. Millikan, California Institute of Technology. *Nominated by the National Research Council:* C. G. Abbot, Smithsonian Institution; Hugh S. Taylor, Princeton University; Ross G. Harrison, Yale University. *Nominated by the Journalistic Profession:* A. H. Kirchhofer, Buffalo Evening News; Neil H. Swanson, Executive Editor, Sun Papers; O. W. Riegel, Washington and Lee School of Journalism. *Nominated by the E. W. Scripps Estate:* Max B. Cook, Scripps Howard Newspapers; H. L. Smithton, Executive Agent of E. W. Scripps Trust; Frank R. Ford, Evansville Press.

***Officers**—President:* Harlow Shapley. *Vice President and Chairman of Executive Committee:* C. G. Abbot. *Treasurer:* Frank R. Ford. *Secretary:* Watson Davis.

***Staff**—Director:* Watson Davis. *Writers:* Frank Thone, Jane Stafford, Marjorie Van de Water, A. C. Monahan, Martha G. Morrow. *Science Clubs of America:* Joseph H. Kraus, Margaret E. Patterson. *Photography:* Fremont Davis. *Sales and Advertising:* Hallie Jenkins. *Production:* Dorothy Reynolds.