The Revolution of Radar

A weapon of war became a ubiquitous tool

By Virginia Hughes

In the late summer of 1940, as Nazi forces continued relentless air raids over civilians in London, British physicist "Taffy" Bowen smuggled a small box onto a U.S.-bound ship. In the box was the Royal Army's most prized weapon: radar. Prime Minister Winston Churchill had sent Bowen—and with him, all of the trusted secrets of British technology—because he needed America's help for a last-ditch attempt to choke Germany's momentum. Indeed, the contents of that box would ultimately help turn the war around.

Although the British were worried about the Germans getting the advanced radar technology contained in Bowen's box, it was a German who first discovered radar—a half-century earlier. In 1887, from the comfort of his home laboratory, German physicist Heinrich Hertz figured out that radio waves would reflect off of metals. By 1904, another German scientist, Christian Hülsmeyer, unveiled his "telemobiloscope"—a device that used radio waves to detect large metal ships up to 3 kilometers (2 miles) away.

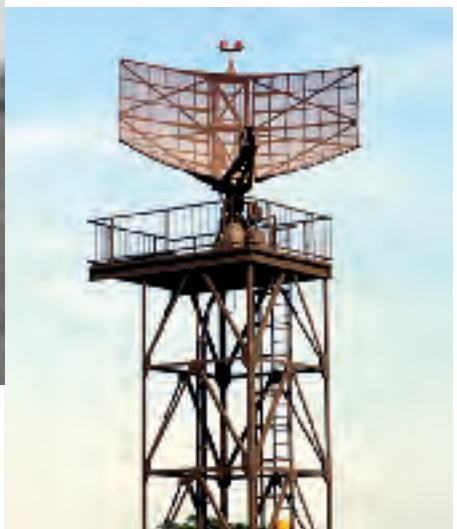
In 1915, British meteorologist Robert Watson-Watt thought that since lightning gives off radio waves, detectors could warn pilots of approaching thunderstorms. Watson-Watt figured out how to detect the signal, and then developed a rotating antenna that, by recording at what position the signal was strongest, could pinpoint the direction of the storm. And 15 years later, as more and more planes were built for radio communication, airport traffic control towers with radio wave detectors slowly began replacing flagmen in control towers. The first in the United States was built in Cleveland, Ohio in 1930. Within five years, there were 20 towers across the country.

It wasn't long before devices called radio detection finders (RDFs) were made that sent out radio pulses and then recorded how long it took for them to bounce back. The devices could calculate the distance and speed of whatever distant objects—notably, ships—were hit by the radio wave. By 1940, the eastern coastline of England was lined with 21 radar towers, all part of the country's national radar defense network, called Chain Home. The towers, though fairly conspicuous, provided early warnings of enemy plane formations across the English Channel. Still, at that point, radar technologies were not able to detect objects with much precision.

Enter Bowen's box. In it was a copper disk called a resonant cavity magnetron. At that time, radio waves were transmitted at wavelengths as long as 10 meters (33 feet). But the cavity magnetron device generated waves just 10 centimeters long (4 inches), called microwaves. When used as a detection device, this narrower beam was more accurate in pinpointing a target's location. What's more, it could detect much smaller objects, using much smaller (and thus, less noticeable) antennas.

In August 1940, Churchill ordered the first offensive air attacks on Germany. Hitler, underestimating how important it would be to knock out the Brits' radar network, instead issued retaliatory raids on London. That bombing campaign, called the Battle of Britain, was then the largest attempted by Hitler. But thanks to radar, the Royal Air Force put down two German planes for every one of its own lost. The battle was Hitler's first major defeat and a turning point for the rest of the war.

Over the next 60 years, the uses for radar multiplied. From helping to predict the weather to catching highway speeders to tracking the migration patterns of animals, radar has evolved from a weapon of war to a workhorse of modern society.



British meteorologist Robert Watson-Watt, far left, experiments with a kite and a wireless transmitter at Sunnymeads in Berkshire.