

RADAR (Radio Detection And Ranging)

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Radar is a system that uses radio waves that can see hundreds of miles in fog, rain, snow, clouds and darkness. It can identify the range, altitude, direction, or speed of both moving and fixed objects such as aircraft, ships, motor vehicles, weather formations, and ground formation. A transmitter sends radio waves that are aimed at a target and deflected back to a receiver. Although the radio signal returned is usually very weak, radio signals can easily be amplified. Radar is used in many areas such as weather prediction, air traffic control, police detection of speeding traffic, and by the armed forces to detect incoming planes and missiles. The term RADAR was coined in 1941 as an acronym for Radio Detection And Ranging.

The concept of using radio waves to detect objects goes back as far as 1902, but the practical system we know as radar began in the late 1930s. British inventors, aided by research from other countries, developed a warning system that could detect airplanes or missiles moving toward England.

Basic Principles

The basic principle of radar can be easily demonstrated. Imagine facing the side of a mountain or large wall somewhere in the distance. You have a very accurate stopwatch and 'super hearing' to help you. If a person would shout at the top of their voice and accurately time between the voice leaving and the first echo returning, this time is recorded in a radar device. You have now become a basic radar unit.

Instead of one person screaming, a powerful radio beam is sent out. When this burst of radio energy strikes a solid object, at least part of that sound wave will be reflected back to the transmitter. The transmitter and receiver on a basic radar unit are mounted close together, much like your mouth and ears. By calculating the speed of the radio waves and the time it takes for the signal to bounce off the object and hit the receiver, a radar operator can gauge the distance between themselves and the object.

Doppler Radar

A Doppler radar is one that produces a speed measurement as one of its outputs. Early Doppler radars were CW, and it quickly led to the development of Frequency Modulated (FM-CW) radar, which sweeps the transmitter frequency to encode and determine range.

Distance Measurement

One way to measure the distance to an object is to send a short pulse of radio signal and measure the time it takes for the reflection to return. Since radio waves travel at the speed of light (186,000 miles per second or 300,000,000 meters per second), accurate distance measurement requires high-performance electronics.

Radar can be used to:

- Locate and track artificial satellites and spacecraft thousands of miles from the earth.
- It can help to navigate ships, land planes safely in a fog, and guide space astronauts.
- It can help scientists to explore distant planets.

Speed Measurement

Speed is the change in distance of an object with respect to time. The radar is useful in counting the number of vehicles on city streets and highways so this information can be used to adjust traffic signals during rush hours or bad weather.

Radar assists police in controlling traffic and speeding motorists to make travel safer for everyone. Police use small radar sets, placed by the side of a road or held by hand, to measure the speed of passing cars. When a speeding car goes by, the radar operator radios ahead to a waiting car that picks up the speeder.

Space Exploration

Radar plays an important part in tracking artificial satellites, space probes, and spacecraft. Astronauts landing on the moon used radar to tell them how high they were and how far they were from the moon surface.

Missile Detection Systems

In the late 1930s, a network of radar stations built along the coast of England gave them early warning of incoming attacks of German planes and missiles during World War II. Today Radar systems are used to aim a gun or missile so that it will hit a target as small as a baseball as far away as 1,100 miles.

Air Traffic Control and Navigation

Radar sets are widely used at airports so airplanes avoid collisions in the air and can land safely when the weather is bad and pilots cannot see the land. The ground controller can talk to the pilot by radio giving him instructions on the course to follow for a safe landing.

Weather-Sensing Radar systems

Radar is used in weather forecasting by locating storms systems that may take days to reach the area you live in. Radar systems are used to get echoes from raindrops, snowflakes, weather fronts, and cloud formations. They can find the location of weather conditions such as hurricanes, blizzards, tornadoes, and tropical storms and as a result warn people to take safety precautions before they are expected to affect their area.

Camera Phone

A camera phone is a mobile phone that has a camera built into that allows a person to share pictures and video over the Internet with someone who has a device to receive them. Camera Phones of today do not use connecting cables but share their pictures instantly and automatically by a carrier network (Internet).