Distance-determination

The distance is determined from the running time of the high-frequency transmitted signal and the propagation c0. The actual range of a target from the radar is known as slant range. Slant range is the line of sight distance between the radar and the object illuminated. While ground range is the horizontal distance between the emitter and its target and its calculation requires knowledge of the target's elevation. Since the waves travel to a target and back, the round trip time is dividing by two in order to obtain the time the wave took to reach the target. Therefore the following formula arises for the slant range:

R = c0· t / 2 where: c0 = speed of light = 3·108 m/s

t = measured running time [s]

R = slant range antenna - aim [m] (1)

The distances are expressed in kilometers or nautical miles (1 NM = 1.852 km).

Derivation of the equation

Range is the distance from the radar site to the target measured along the line of sight.

Principle of radar

Figure 1: radar principle

v = s/t (2)

c0 = 2·R / t (3)

The factor of two in the equation comes from the observation that the radar pulse must travel to the target and back before detection, or twice the range.

$$R = c_0 \cdot t / 2 \text{ in meters} \quad (4)$$

Where $c_0 = 3 \cdot 108$ m/s, is the speed of light at which all electromagnetic waves propagate.

If the respective running time t is known, then the distance R between a target and the radar set can be calculated by using this equation.

Source: http://www.radartutorial.eu/01.basics/Distance-determination.en.html