Overview of Distance Measuring Equipment (DME)

DME (which stands for Distance Measuring Equipment) is an international, standardized navigation system. DME allows an aircraft to automatically measure its physical line of sight distance (in nautical miles) from a selected ground-based beacon. DME systems are used throughout the world by all airliners, most military aircraft, and a large number of general-aviation aircraft. The range of service is most often up to 300 land miles (480 km). System accuracy is usually 0.1 nautical miles (185 m) but precision equipment, intended for use during landing, has accuracy up to 100 ft (30 m).

The airborne equipment, called an interrogator, transmits pulses of 1 kW peak power on 1 of 126 frequencies. These frequencies are in the 1025–1150-MHz band and are spaced 1 MHz apart. Each pulse has a duration of 3.5 μs and is paired with another, spaced 12 μs or 36 μs later (i.e. “delayed” by either 12 or 36 μs). The combination of frequencies and pulse spacing therefore provides 252 operating channels in the system.

The beacon equipment on the ground is called a transponder. It receives these pulses, delays them by 50 μs, and then retransmits them, usually with a power of 1 kW, on 252 frequencies lying between 962 and 1213 MHz. The pulse-pair spacing is 12 μs on those frequencies not used by the interrogator (X), and 36 μs on those frequencies shared with the interrogator (Y). The transponder transmission is called the reply. The frequency difference between interrogation and reply is always 63 MHz. This arrangement allows each transmitter frequency to act as the local oscillator for its associated receiver, the intermediate frequency of which is 63 MHz.

For landing purposes, some transponders have powers as low as 100 W. In the aircraft the replies to its own interrogations are recognized by their phase coherence with their own transmissions, and by the elapsed time measured between transmissions and reception (minus the 50-μs transponder delay), usually by means of a crystal clock. This elapsed time is about 12.36 μs for each nautical mile, and the measured distance is displayed in the cockpit on a digital meter, which is usually calibrated in nautical miles and tenths of nautical miles.