Text

NAVIGATIONAL AIDS

Radio beacons are used to help a pilot navigate along airways and to help controllers keep accurate track of his progress in relation to other traffic when no radar is available. They also provide holding in a particular area, locating an aerodrome, or may be used as a fix for a let-down procedure in bad weather. Certain other aids are used for long range navigation and landing approaches.

1. Non - Directional Beacon (NDB)

This most basic of all aids is still used in less developed areas to mark air routes, its useful range being up to 100 miles. It remains the most common approach and landing aid, sometimes referred to as a Locator Beacon, with a range of about 15 miles in this application. The NDB consists of a radio transmitter in the medium frequency band which sends out a continuous steady signal in all directions. A callsign of two or three letters in Morse code is superimposed at regular intervals as a check that the desired beacon has been selected.

The Automatic Direction Finder (ADF), or radio compass, fitted in an aircraft, when tuned to the appropriate frequency, indicates the relative position of the transmission source by a needle on the Radio Magnetic Indicator (RMI). Unfortunately, NDBs suffer greatly from interference. Their signals can be deflected by high ground and coastal refraction and, if there is a thunderstorm in the area, the needle may point to its most active cell. Still, NDBs have one advantage. This advantage is that their signals follow the curvature of the earth, so if the aircraft is within the power range of the station, the signals can be received regardless of altitude.

2. VHF Omnidirectional Range (VOR)

For the last 40 years VOR has been the ICAO standard international short range navaid, used both to navigate along airways and to provide an accurate approach.

It consists of a ground beacon which sends out a signal from which an airborne receiver can determine the aircraft 's bearing (or radial) from the beacon. The receiver can add 180° to the 'From' indication and instruct the pilot which way to fly ' To' the station. A 'To / From' flag on the instrument face tells the pilot in which mode it is operating. Accuracy is increased by the addition of Doppler (DVOR), by which fluctuations in frequency wave motion emitted by an object moving at speed can be calculated.

VOR's great advantages are ease of use and freedom from static interference. With two VORs an accurate fix can be obtained from radial intersections. VORs can also be used for ATIS broadcasts. Disadvantages are that the VHF signals are line-of-sight and thus can be cut off by mountains and man-made obstructions. For the same reason, a large area of coverage requires numerous expensive beacons.

3. Distance Measuring Equipment (DME)

DME gives a pilot range information from a DME facility which, in case of en route aids, is normally co-located with a VOR. DME is also coupled with Instrument Landing Systems, which makes fixed ground outer and middle marker beacons unnecessary. A special transmitter in the aircraft transmits pulses in all directions which are received at the DME ground station. As each pulse is received, an answering pulse is transmitted automatically and this is picked up in the aircraft.

As the speed of radio waves is constant, a computer in the aircraft, which measures the time interval between the transmission of the pulse and the reception of the response, is able to convert this interval into a distance and display it in nautical miles or kilometers. With more advanced equipment the 'time-to-go' to the beacon can also be displayed. Because DME measures slant range rather than ground distance, an aircraft at 30,000 ft overhead the facility will get an indication of approximately 5 nm. Combined with VOR, DME provides an extremely accurate position fix.

VOR is usually combined with DME, and they are often located at the same site. They operate on VHF and UHF respectively and are not affected by static or noise interference. The maximum range of VOR is about 200 nautical miles. By measuring his radials from more than one VOR station a pilot can check his position, as VOR gives the pilot his exact bearing to or from the station.

The function of DME, which is short for Distance Measuring Equipment, is to measure distance. The DME measures electronically the time it takes for a signal, transmitted from an aircraft interrogator, to reach the ground based station transponder and return.

This time is converted to miles and the pilot receives a continuous digital reading of how far he is from or to a station .

With many VOR/DME stations along his route, a pilot knows he is on the correct heading, knows his distance to or from a DME station and can establish his exact position.

At present the aircraft, operating international flights, are required to be equipped with TCAS (Traffic Alert and Collision Avoidance System). It consists of a mode S transponder, computer and indication system. It provides the crew with traffic information and recommend them to change level not to collide with another aircraft in the form of Traffic Alert and Resolution Advisory.

VORTAC, a navigation system, combining VOR with TACAN (Tactical air navigation) is used by crews of both military and civil aircraft. Besides, there are some long range navigation aids. They operate on low frequencies and are called LORAN, Omega and Console.