NAVIGATIONAL AIDS IN AIR TRAFFIC CONTROL

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Introduction

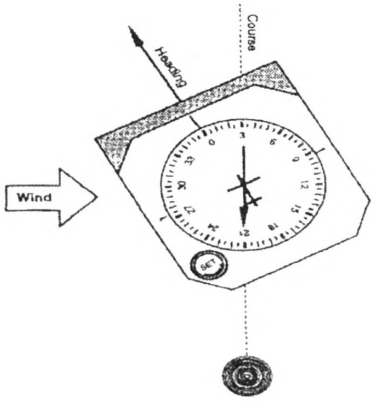
Navigation systems assist pilots in flying from one to another. These systems help both pilots and air traffic controllers determine an aircraft's position relative to the ground and to another aircraft. At high altitudes, or during bad weather, navigation systems are essential for safe aircraft flight. Navigation systems have developed from primitive ground base radio transmitters to sophisticated space- based systems. Following ground equipment guides all aircraft to its destination and is discussed in order of usage.

Non-Directional Beacon (NDB)

The commonest and one of the simplest of aids is the Non-Directional Becon. It is used to mark airways, when its useful range may be up to 150 nautical miles, and as an approach and landing aid, sometimes referred to as a locator Becon, when its range will be about 15 miles. It consists of a radio transmitter in the medium frequency band, which sends out a continuous steady note in all directions. A call sign of three letters in Morse code is superimposed at regular intervals as a check that the desired beacon has been tuned in.

The automatic Direction Finder (ADF), or radio compass, fitted in an aircraft will, when tuned to the appropriate frequency, indicate the relative position of the transmission source by means of a needle on a dial. The great disadvantage of the NDB is that it is very prone to interference. For example a thunderstorm cell in the area will often cause the cockpit needle to point to it in preference to the beacon.

Frequency range – 190to 35 kHz



Cockpit Instrument

Very High Frequency Ommi-Range (VOR)

The VHF Ommi Directional Range navigation system, VOR, was probably the most significant aviation invention other than the jet engine. With it, a pilot can simply, accurately, and without ambiguity navigate from point A to point B.

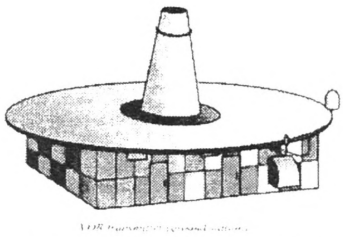
The widespread introduction of VORs began in the early 1950s and 50years latter it remains the primary navigation system in the overwhelming majority of aircraft.

The basic principal of operation of the VOR is very simple: the VOR facility transmits two signals at the same time. One signal is constant in all directions, while the other is rotated about the station. The airborne equipment receivers signals, looks (electronically) at the difference between the two signals, and interprets the result as a radial from the station.

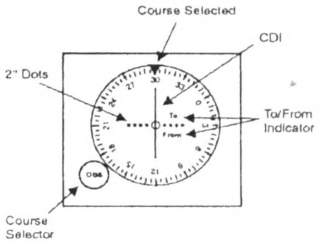
With VOR, however, course information must be manually entered into the indicator. The VOR indicator shows an aircraft heading "TO" or "FROM" the Ommi station.

Most VOR stations also have distance-measuring equipment (DME). A display indicator in the aircraft reads the signals and tells the pilot if they are on course and how far they are from the station. VOR-DME systems are limited in range to 160 miles and can only provide direct courses to or from a given station. The frequencies of the two installations are 'paired'. For example, the VOR frequency of 112.7MHz is always matched by a DME on Channel 74; a VOR on 114-9 by a selection of a particular VOR frequency automatically means that the related DME channel is selected at the same time.

Frequency range – 108.00to 117.95 MHz



Ground Based Equipment



Cockpit Instrument

Instrument Landing System (ILS)

ILS facilities are a highly accurate and dependable means of navigating to the runway in Instrument flight rule conditions. When using the ILS, the pilot determines aircraft position primarily by reference to instruments.

The ILS consists of:

- Localizer transmitter
- Glide path transmitter
- Outer markers

The ILS stations are installed in all the international airports, which support the landing aircrafts with instrument guidance under adverse weather conditions. ILS is used to provide the pilot, precision information of the aircraft direction as he lands the aircraft, it is possible, to touch the ground in the specific point. This point should be the centerline of the runway and be at the beginning of the runway. In addition, aircraft is landed at an angle of 3^0. So, the two of the landing guidance (i.e. runway centerline and 3deg. angle landing path) are provided by Localizer and Glide path respectively.

The lateral and vertical guidance is necessary for a pilot to fly a precision approach, where glide slope information is provided. A precision approach is an approved descent procedure using a navigation facility

aligned with a runway where glide slope information is given. When all components of the ILS system are available, including the approach procedure, the pilot may execute a precision approach.

Localizer

The primary component of the ILS is the localizer, which provides lateral guidance. The localizer is a VHF radio transmitter and horizontally-polarized antenna array that radiates approximately 100 watts.

Of RF power (between 108.10MHz and 111.95MHz). The transmitter and antennas are on the centerline at the opposite end of the runway from the approach threshold, as seen by the aircraft on centerline of the runway. This beamis produced by two transmitters operating on the same channel frequency but amplitude-modulated with different audio signals.

The localizer station is identified by the transmission of a four-letter identification code modulated at 1,020 Hz and also by voice identification.

Glide path

Glide path is a transmitter, which gives information of the correct angle slope in regard with the horizontal level of the straight of aircraft slide, during the landing.

The typical glide slope transmitter is usually located 750 feet from the beginning of the runway and radiates a 5-watt RF signal from a horizontally polarized antenna array at an inclined glide path angle of 2.5" to 3.00. The glide slope transmitter operates on one of 40 available channel provided by 150-kHz spacing in the UHF frequency range of 329.15MHz to 335.00 MHz

ILS Marker Beacon and Compass Locator Stations

Marke Beacons are two or three transmitters, which give information about the precision approach, as control points for the aircraft correct direction of the landing runway extension. In the above station is possible are installed and compass Locators. The outer Marker (OM) is used to indicate that an aircraft should intercept the glide path when over the transmitter. The Middle Markr is used to indicate that the aircraft is at the Decision Height (DH) for most approached, and an Inner Marker (IM) is used in approaches for the serious flights.

The Outer Marker (OM) station, located approximately 4.6 miles from the end of the runway, amplitude modulates the 75-MHz carrier at 400Hz. The OM station is identified by a 400-Hz audio tone consisting of dashes (approximately 1.5 seconds long), and by the annunciation of a "blue" indicator light on the cockpit instrument panel.

Located approximately 0.6 miles from the runway is the Middle Marker (MM) station, which amplitude-modulates its 75-MHz carrier at 1300 Hz. The MM is identified by a 1300Hz audio tone consisting of alternate dots (approximately 0.5 second long) and dashes and the annunciation of an "amber" indicator light in the cockpit.

Reference:

1). Interviewing with an air traffic controller Tharuk Hemachandra.