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GROUND BASED NAVIGATION PROGRAM FOR AEROSPACE

Vivek Kumar
Electrical and Electronic engineering student from 'Dronacharya College of Engineering', Gr. Noida, U.P., INDIA

ABSTRACT
The mission of the ground-based nav-aids is to ensure national airspace system (NAS) ground-based navigation solutions are implemented in the most efficient and effective manner to satisfy customer needs. In addition, the group provides a liaison to the navigation services leadership team and serves as the program integrator with regional and HQ organizations. The objective of ground-based nav-aids is to procure ground- based navigation systems and equipment in order to meet new requirements and support existing systems. There are various equipments which is used as a navigational equipments such as (VOR) very high frequency omnidirectional range,(ILS) instrument landing system,(LPDME) low power distance measuring equipment. These equipments are usually very important for safety landing and take–off of airspace.

INTRODUCTION

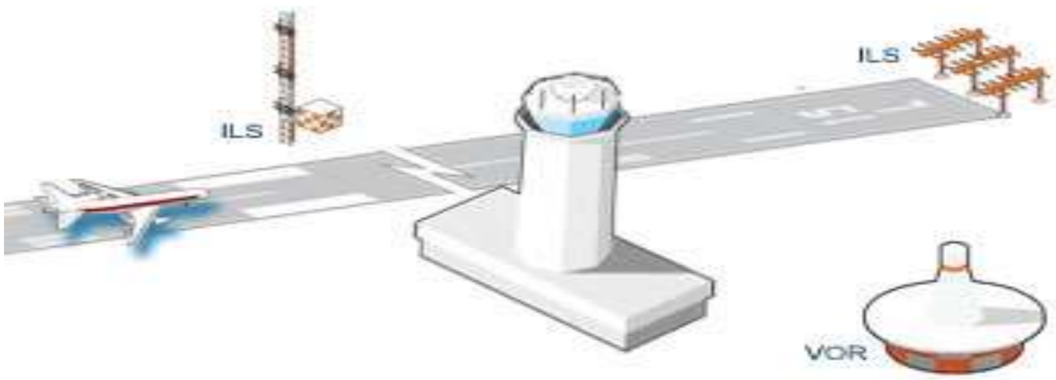

Fig.01 Runway and navigational equipment.

Now i introduce and describe navigational equipments one by one let's we first introduce :

- **Instrument Landing System(ILS):**

The ILS has been the mainstay of landing navigation aids for well over 50 years. The modernized versions used by the airport authority of India(AAI) it provide precision with vertical and horizontal navigation guidance information during take-off and landing. The attractiveness of ILS lies in the economy of its avionics costs and its wide international acceptance. Technology advances over the years have yielded great improvement in accuracy, dependability, and maintainability[1]. The function of an ILS is to provide the PILOT or AUTOPILOT of a landing aircraft with the guidance to and along the surface of the runway. This guidance must be of very high integrity to ensure that each landing has a very high probability of success. The ILS consists of:

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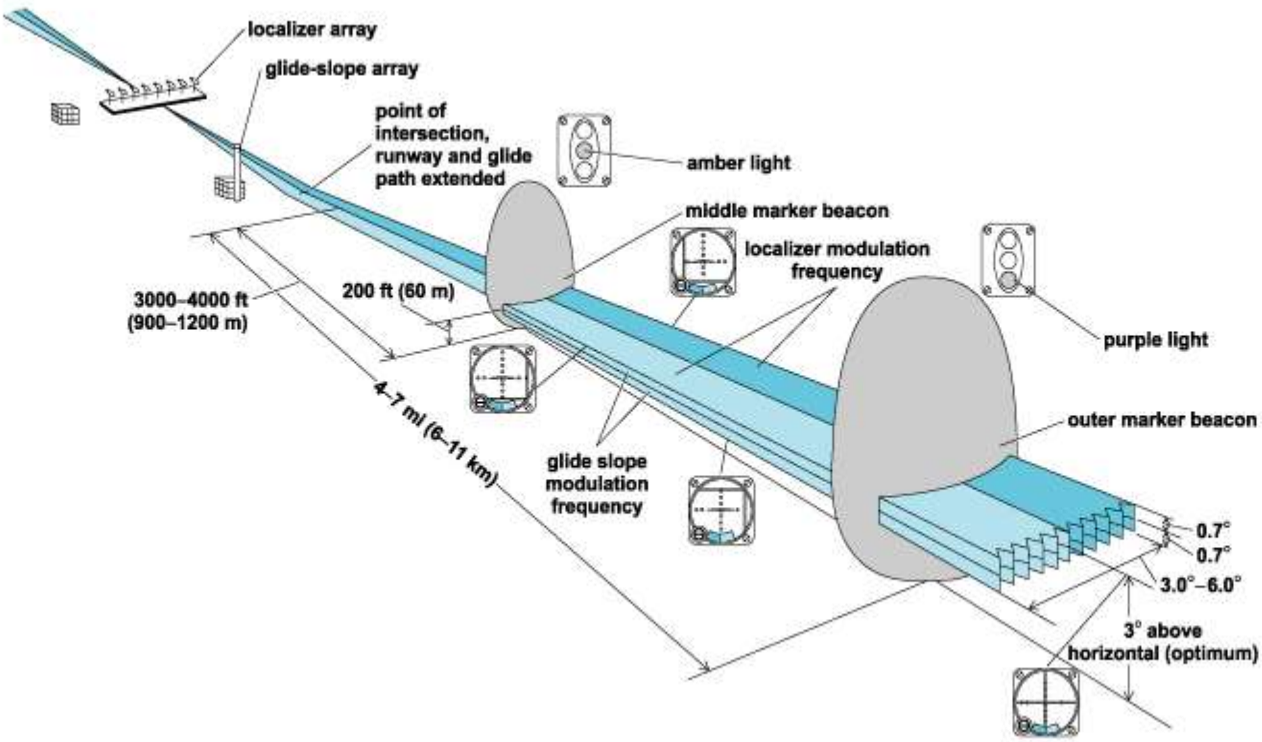

Fig.02 position of equipment

- ILS has three type of systems :-

1. LOCALIZER
2. GLIDE PATH ANTENNA
3. MARKER

The GBNG supports all ground-based ILS systems in the National Airspace System (NAS) and will continue procuring and deploying new/replacement ILS for the foreseeable future. It is expected that ILS will eventually be replaced with some variant of a GPS system in the future (see WAAS and GBAS). Presently the FAA has a contract with Thales Air Traffic Management (TATM) Corporation to procure the existing NAS-deployable Mark 20A ILS system on a requirements contract.

LOCALIZER

[1] The Localizer generates and radiates signals to provide final approach azimuth navigation information to landing aircraft. The antenna sends a VHF carrier signal with 90-Hz and 150-Hz sideband signals that the aircraft instruments determine as left and right of the centreline. The aircraft interprets the signal and displays them on the cockpit indicator guiding the pilot until the runway is in sight.

In a similar manner as the Localizer signal (just turned 90 degrees on axis), the Glide Slope sends a UHF carrier signal with the same two 90-Hz and 150-Hz sideband frequencies that aircraft instruments determine as above or below the desired glide path. This is approximately 3 degrees to the horizon which gives the aircraft a descent rate of approximately 500 feet per minute.

An ILS precision approach and landing requires several components. For properly ILS-equipped aircraft certified for the category of service utilized, the ground-based ILS systems are the electronic processing and antenna components. The runway requires proper lights and markings along with an approach lighting system. Other components may be required such as Runway Visual Range (RVR) and Marker Beacons or LPDME. Note that the more precise the approach is (lower weather minimums/visibility) the more ancillary components may be required.

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Fig.03 Localizer

GLIDEPATH ANTENNA

The glide path component of ILS. Provides vertical guidance to the pilot during the approach. Glide path is located 750 to 1,250 feet (ft) down the runway from the threshold (shown above), offset 400 to 600 ft from the runway centre line [2].

It provides a plane align with the glide path of runway for providing elevation guidance to landing aircraft. An antenna array is sited to one side of the runway touchdown zone. Freq. band: 328-336MHz, Range: 10Nm. Glide path provides slope angle 3 degree to landing airspace.

Fig.04 Glide path

MARKER

Marker is nothing, it is different position on this basis airspace take landing on the station. Marker consists:-
i) Outer marker; (OM): The outer marker (if installed) is located 3 1/2 to 6 NM from the threshold within 250 ft of the extended runway centreline to provide the pilot with the ability to make a positive position fix on the localizer [2].

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(ii) MIDDLE MARKER (MM): The middle marker (if installed) is located approximately 0.5 to 0.8 NM from the threshold on the extended runway centreline. The middle marker crosses the glide slope at approximately 200 to 250 ft above the runway elevation [2].
Marker system is not usually operate at all airspace station except some stations.

- **VERY HIGH FREQUENCY OMNIDIRECTIONAL RANGE(VOR):**

The Very High Frequency Omni-Directional Range (VOR) is a ground-based electronic system that provides azimuth information for high and low altitude routes and airport approaches [1]. VOR function based on Doppler effect.

The VHF Omni-directional Radio Range, the abbreviations for which are VOR and Omni, enables a pilot to determine the direction of his aircraft from any position to or from a VOR beacon, and, if necessary, track to or from the beacon on a selected bearing. VOR is a Very High Frequency (VHF) navigation aid which operates, in Australia, in the 112.1 to 117.9 megacycles (mcs) frequency band. Because it is a VHF aid, its ground to air range is limited to 'line of sight' reception which is typical of VHF transmission. The range achieved is dependent, therefore, on the siting of the VOR beacon with relation to surrounding terrain, and on the height at which the aircraft is flying. As a VHF navigation aid, the VOR is static-free, and the information given by it is displayed visually on easily read and interpreted cockpit instruments. An infinite number of bearings can be obtained and they may be visualized as radiating from the beacon like spokes from the hub of a wheel. However, for practical purposes the number of bearings can be considered to be limited to 360, one degree apart, and these 360 bearings are known as radials. A Radial is identified by its magnetic bearing outbound from the VOR beacon [3].

Principle Of Operation:
The basic principle on which a VOR operates can be understood from a study of a simple analogous optical system which is illustrated at Figure 5. Assume that there are two lights located at the same position, one of which is a rotating green light which is only seen when the beam is directed at an observer, and the other a white light which is visible from all directions. The green light rotates at 10 degrees per second that is, it completes a revolution in 36 seconds, and, when it is directed to magnetic north, it trips a switch to cause the white light to flash momentarily. An observer with a stop watch can note the time interval between a white flash and the next green flash, and, knowing the angular rate of the rotating green light, can determine his bearing from the lights. For example, if the observer sees the green light 10 seconds after a white flash, then the observer is on a bearing of 100° magnetic from the lights, that is, the 100° radial. The observer's bearing to the lights is, of course, the reciprocal of 100°, viz., and 280°.

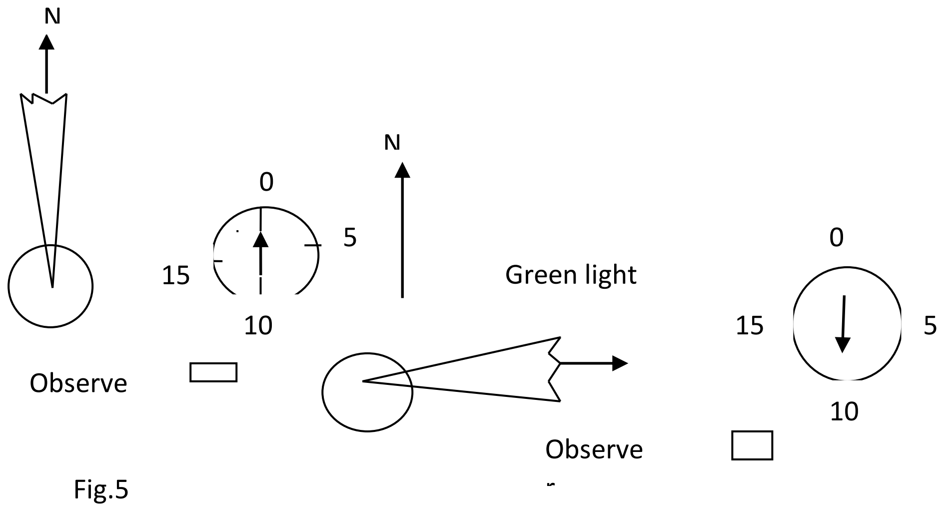

Fig.5

Instead of light signals, the VOR beacon transmits two VHF radio signals from the same facility. One of these signals, analogous to the white light, called the reference phase, is omni-directional and radiates from the station in a circular pattern. The phase of this signal is constant through 360° of azimuth. The other signal, analogous to the green light, is transmitted as a rotating field. This signal pattern rotates uniformly at 1800 r.p.m., varies in

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phase with azimuth, and is called the variable phase. Therefore, there is a different phase of this signal at each separate point around the station.

Before using a VOR indicator for the first time, it can be tested and calibrated at an airport with a VOR *test facility*, or VOT. A VOT differs from a VOR in that it replaces the variable directional signal with another omnidirectional signal, in a sense transmitting a 360° radial in all directions. The NAV receiver is tuned to the VOT frequency, then the OBS is rotated until the needle is centered. If the indicator reads within four degrees of 000 with the FROM flag visible or 180 with the TO flag visible, it is considered usable for navigation. The FAA requires testing and calibration of a VOR indicator no more than 30 days before any flight under IFR [4].
V.O.R system provides, pilot the position of aircraft w.r.t north direction from V.O.R station.Freq. band : 108 - 118 MHz, Power : 100W, Polarization : Horizontal,Range : 200Nm.

VOR Range

VOR Class= Low Altitude	1,000-18,000 feet	Range 40 nautical miles
VOR Class=High Altitude	1,000-14,500 feet	Range 40 nautical miles
VOR Class=High Altitude	14,500-60,000 feet	Range 100 nautical miles
VOR Class=High Altitude	18,000-45,000 feet	Range 130 nautical miles

Fig. 06 VOR

CONCLUSIONS

- In this fast moving world the airports are playing an important part in the field of transportation. Airports are required to take care of passengers, their luggage and other amenities as well the security of the passengers as well of itself.
- Airport management department has to play significant role in smooth and effective functioning of terminal operation.
- Airport Management discipline can be made responsible to carry out this task in coordination with other concerned department of AAI.

REFERENCES

1.https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/n avservices/gbng/.
2. http://www.aai.aero/public_notices/aaisite_test/faq_cns.jsp.
3. https://www.casa.gov.au/sites/g/files/net351/f/_assets/main/pilots/download/vor.pdf
4. https://en.wikipedia.org/wiki/VHF_omnidirectional_range
5. Thai Technics.Com