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GROUND BASE COMUNICATION NAVIGATION SERVILANCE PROGRAM FOR AIROSPACE

***Ankit Kumar Yadav, Sunil Kumar**
*Dronacharya Group of Institutions, Greater Noida, India
Dronacharya Group of Institutions, Greater Noida, India

ABSTRACT
The mission of the ground-based communication navigation and surveillance is to ensure national airspace system (NAS) ground-based CNS system solutions are implemented in the most efficient and effective manner to satisfy customer needs. In addition, the group provides a liaison to the CNS services leadership team and serves as the program integrator with regional and HQ organizations. Themain objective CNS is to procure ground- based communication navigation surveillance systems and equipment in order to meet new requirements and support existing systems. There are various equipments which is used as a communication navigationalsurveillance equipments such as (HF) High frequency radio, (VHF) very high frequency radiofor communication and (VOR) very high frequency Omni-directional range,(ILS) instrument landing system,(LPDME) low power distance measuring equipment, (DME) distance measuring equipment for navigation and RADAR, (GPS) global positioning system for surveillance These equipments are usually very important for communication safety landing and take–off or finding location of flight in aerospace.

INTRODUCTION
The Airports Authority Of India (Aai) Under The Ministry Of Civil Aviation Is Responsible For Communication Control And Management Of The Indian Air Space. Installation And Maintenance Of Various Communication ,Navigation & Surveillance Aids Design ,Development ,Operation & Maintenance Of Passenger Terminals & Cargo Terminals rescue & Fire Services.

Communication
In order to meet future challenges, the target of the aviation community is to modernize the communications technologies by creating a **global and interoperable system**, for both civil and military aircraft. Communication is the exchange of voice and data information between the pilot and air traffic controllers or flight information centers.Wave propagation is a way of communication where as we use VHF (very high frequency) and HF (high frequency) equipment.

HF radio use
The high frequency band is very popular with amateur radio operators, who can take advantage of direct, long-distance (often inter-continental) communications and the "thrill factor" resulting from making contacts in variable conditions. International shortwave broadcasting utilizes this set of frequencies, as well as a seemingly declining number of "utility" users (marine, aviation, military, and diplomatic interests), who have, in recent years, been swayed over to less volatile means of communication (for example, via satellites), but may maintain HF stations after switch-over for back-up purposes. However, the development of Automatic Link Establishment technology based on MIL-STD-188-141A and MIL-STD-188-141B for automated connectivity and frequency selection, along with the high costs of satellite usage, have led to a renaissance in HF usage among these communities.

VHF radio use
VHF propagation characteristics are ideal for short-distance terrestrial communication, with a range generally somewhat farther than line-of-sight from the transmitter (see formula below). Unlike high frequencies (HF), the ionosphere does not usually reflect VHF radio and thus transmissions are restricted to the local area (and don't interfere with transmissions thousands of kilometres away). VHF is also less affected by atmospheric noise and interference from electrical equipment than lower frequencies. Whilst it is more easily blocked by land features than HF and lower frequencies, it is less affected by buildings and other less substantial objects than UHF frequencies.

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Navigation

Navigation applications are essentially used to maximize the capacity of airspace by facilitating flows of traffic between airports and maximizing safe and efficient access to airports.Navigation element of CNS Systems Is meant toprovide accurate, reliable and seamless position determination capability to aircraft it includes all those instruments which are used for air craft guidanance.

ILS (instrument landing system)

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:

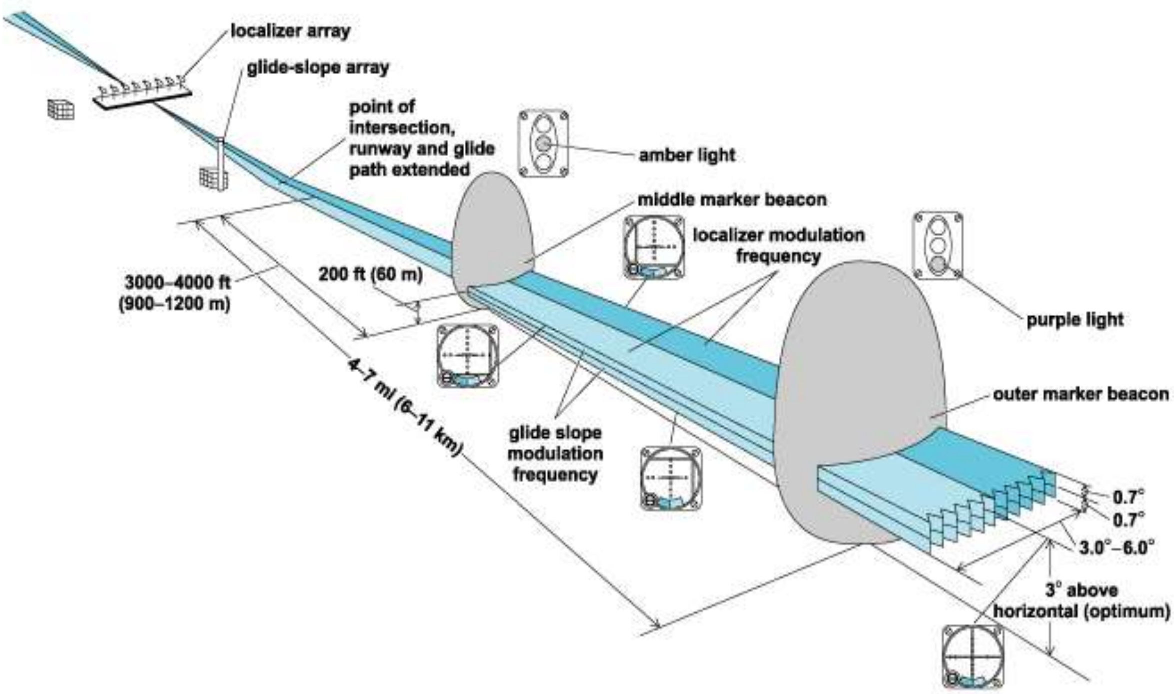

Fig.02 position of equipments

There are three main elements in the complete ILS:

1. A localiser radio beam to furnish directional guidance to and along the runway
2. A glide path radio beam to furnish vertical guidance at the correct descent angle to the runway touchdown point
3. Fan markers (outer marker and middle marker). In some cases DME has been authorised for use when markers are not available or cannot be installed.

GROUND EQUIPMENTS: -

LOCALISER

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 centerline. 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

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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 [1].

1. 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.

Fig.03 Localizer

GLIDE PATH

The transmitter buildings and glide path aerial are in close proximity and are usually located approximately 25–380 meters from the approach end and 120–210 meters to the side of the runway centerline. The field pattern radiated by the glide path equipment is illustrated, with the on path line set at an angle of 2½ to 3° from the touchdown point on the runway. The glide path 'width' as it is interpreted by the travel of the glide path needle on the aircraft cross pointer indicator from a full 'fly-up' indication to a 'fly-down' indication, varies from 1° to 1.5°. There is no sector colouridentification associated with the glide path. The transmitters are duplicated, with an automatic change-over facility from primary to secondary equipment in the event of failure or malfunction**.**

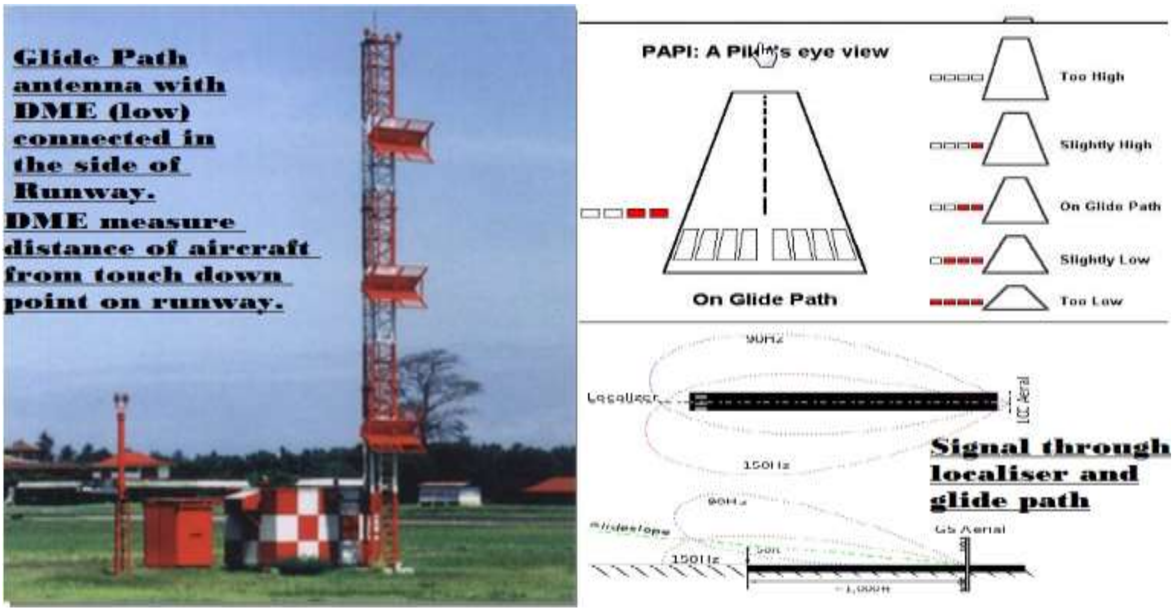

Fig.04 Glide path operations

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MARKER BEACON

On some installations, marker beacons operating at a carrier frequency of 75 MHz are provided. When the transmission from a marker beacon is received it activates an indicator on the pilot's instrument panel and the tone of the beacon is audible to the pilot. The distance from the runway at which this indication should be received is published in the documentation for that approach, together with the height at which the aircraft should be if correctly established on the ILS. This provides a check on the correct function of the glide slope.

Outer marker

The purpose of this beacon is to provide height, distance, and equipment functioning checks to aircraft on intermediate and final approach.

Middle marker

The middle marker should be located so as to indicate, in low visibility conditions, the missed approach point, and the point that visual contact with the runway is imminent, ideally at a distance of approximately 3,500 ft (1,100 m) from the threshold.

Inner marker

The inner marker, when installed, shall be located so as to indicate in low visibility conditions the imminence of arrival at the runway threshold. This is typically the position of an aircraft on the ILS as it reaches Category II minima, ideally at a distance of approximately 1,000 ft (300 m) from the threshold.

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 sitting 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].

Fig.05 (VOR)

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(DME) distance measuring instrument

Distance measuring equipment (DME) provides pilots with a slant range measurement of distance to the runway in nautical miles. DMEs are augmenting or replacing markers in many installations. The DME provides more accurate and continuous monitoring of correct progress on the ILS glide slope to the pilot, and does not require an installation outside the airport boundary. When used in conjunction with an ILS, the DME is often sited midway between the reciprocal runways thresholds with the internal delay modified so that one unit can provide distance information to either runway threshold. For approaches where a DME is specified in lieu of marker beacons, DME required is noted on the Instrument Approach Procedure and the aircraft must have at least one operating DME unit to begin the approach.

Surveillance

The objective of the surveillance infrastructure is to enable a safe, efficient and cost-effective air navigation service. As a key player in the Single European Sky, EUROCONTROL is committed to enhancing global interoperability. The surveillance systems can be divided into two main types:- Dependent surveillance and Independent surveillance.

For Detection of objects we use: -

RADAR

Radar is an object-detection system that uses radio waves to determine the range, altitude, direction, or speed of objects. It can be used to detect aircraft, ships, spacecraft, guided missiles, motor vehicles, weather formations, and terrain. The radar dish (or antenna) transmits pulses of radio waves or microwaves that bounce off any object in their path. The object returns a tiny part of the wave's energy to a dish or antenna that is usually located at the same site as the transmitter.

Radar was secretly developed by several nations before and during World War II. The term RADAR was coined in 1940 by the United States Navy as an acronym for **Ra**dio**D**etection**andR**anging. The term radar has since entered English and other languages as a common noun, losing all capitalization.

The modern uses of radar are highly diverse, including air and terrestrial traffic control, radar astronomy, air-defense systems, antimissile systems; marine radars to locate landmarks and other ships; aircraft anti-collision systems; ocean surveillance systems, outer space surveillance and rendezvous systems; meteorological precipitation monitoring; altimetry and flight control systems; guided missile target locating systems; and ground-penetrating radar for geological observations. High tech radar systems are associated with digital signal processing and are capable of extracting useful information from very high noise levels.

Other systems similar to radar make use of other parts of the electromagnetic spectrum. One example is "lidar", which uses ultraviolet, visible, or near infrared light from lasers rather than radio waves.

Application of RADAR

1. In aviation, aircraft are equipped with radar devices that warn of aircraft or other obstacles in or approaching their path, display weather information, and give accurate altitude readings. The first commercial device fitted to aircraft was a 1938 Bell Lab unit on some United Air Lines aircraft.[23] Such aircraft can land in fog at airports equipped with radar-assisted ground-controlled approach systems in which the plane's flight is observed on radar screens while operators radio landing directions to the pilot.

2.Marine radars are used to measure the bearing and distance of ships to prevent collision with other ships, to navigate, and to fix their position at sea when within range of shore or other fixed references such as islands, buoys, and lightships. In port or in harbor, vessel traffic service radar systems are used to monitor and regulate ship movements in busy waters.

3. Meteorologists use radar to monitor precipitation and wind. It has become the primary tool for short-term weather forecasting and watching for severe weather such as thunderstorms, tornadoes, winter storms, precipitation types, etc. Geologists use specialized ground-penetrating radars to map the composition of Earth's crust.

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GPS NAVIGATION SYSTEM

A **GPS navigation device** is a device that accurately calculates geographical location by receiving information from GPS satellites. Initially it was used by the United States military, but now most receivers are in automobiles and smart phones.The Global Positioning System (GPS) is a satellite-based navigation system made up of a network of a minimum of 24, but currently 30, satellites placed into orbit by the U.S. Department of Defense.[1] Military action was the original intent for GPS, but in the 1980s, the U.S. government decided to allow the GPS program to be used by civilians. The satellite data is free and works anywhere in the world.

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 AA

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12) 703-518-9923