NAVAIDS

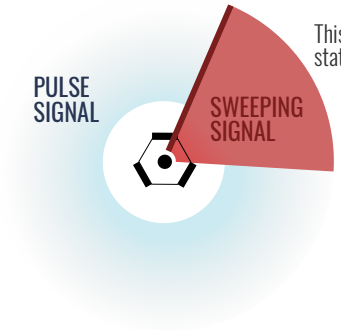
VOR

VOR
Provides azimuth information only.

VORTAC
Provides azimuth, DME and TACAN information

VOR/DME
Provides Azimuth and DME

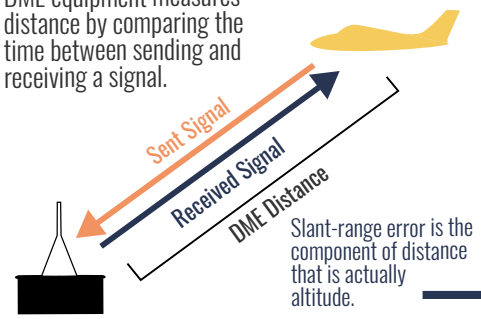
This is what a VOR station looks like.



A VOR receiver determines direction from the station (azimuth) by calculating the time difference between receiving the directional signal and the omnidirectional signal.

DME

DME equipment measures distance by comparing the time between sending and receiving a signal.

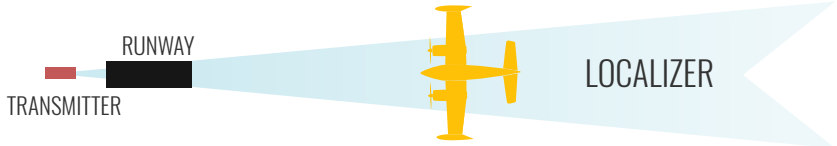


Slant-range error is the component of distance that is actually altitude.

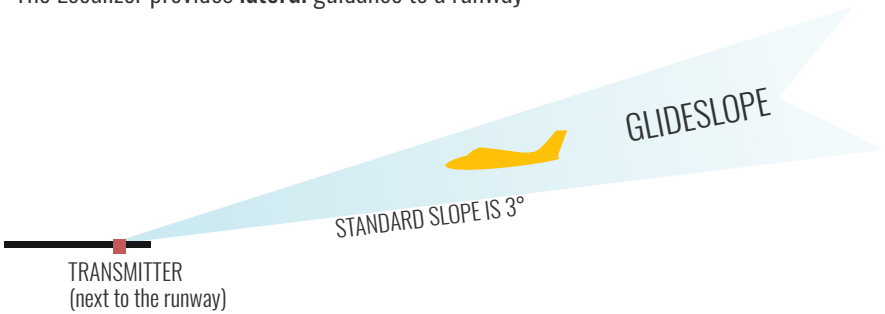
When we are directly overhead the station, the DME will not read zero, but will read our altitude.

At 6,000 feet, for example, the DME will read 1 nm directly over the station.

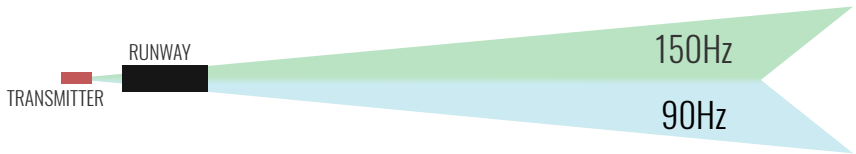
ILS - LOCALIZER AND GLIDESLOPE



The Localizer provides **lateral** guidance to a runway



The Glideslope provides **vertical** guidance to a runway



A localizer sends out two signals at different frequencies. Receivers detect the area of signal overlap and use that as the centerline of the localizer.

The glideslope works similarly, but vertically.

In the "old days" localizers simply transmitted morse code: dashes on one side and dots on the other. When on the centerline, the pilot would hear a steady tone.

GPS

GPS WORKS THROUGH TRILATERATION
(Measuring distance from stations to pinpoint location)

2D - 2 FIXES

TWO CIRCLES RESULTS IN TWO POSSIBLE FIXES.

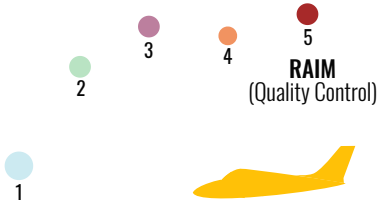
2D - 1 FIX

THREE CIRCLES RESULTS IN A SINGLE FIX.

3D - 1 FIX

ONE MORE SATELLITE REQUIRED TO FACTOR IN ALTITUDE.

In this graphic, we are depicting circles, but remember the sattelites are measuring distance in all directions — the more accurate representation is a sphere.



RAIM uses one more sattelite to check the **accuracy** of the others.

ADF

AN ADF RECEIVES NDB SIGNAL

The system works by using two antennae:

Loop Antenna - Directional. Signal strength determines direction.

Sense Antenna - Non-directional. Determines whether airplane is going towards or away from the station.