

SYE 3803
Fundamentals of Avionics
Spring 2014

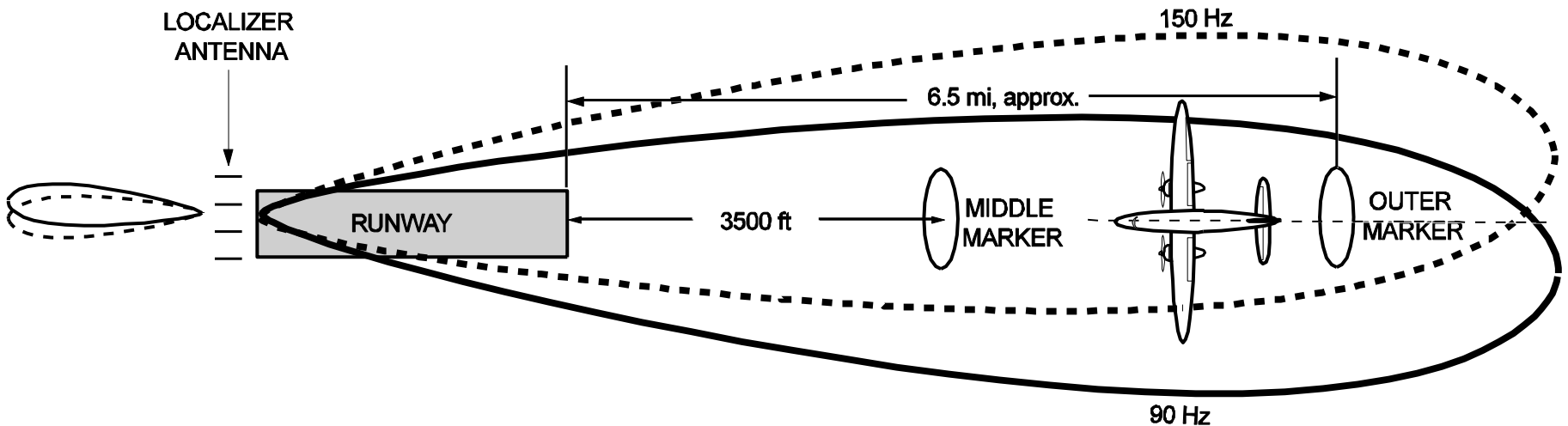
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Instrument Landing System (ILS)

- During Visual Meteorological Conditions (VMC) pilots can land using visual references and the standard aircraft instrumentation
- During Instrument Meteorological Conditions (IMC), however, pilots need to fly and land under Instrument Flight Rules (IRF).
 - Visibility is a meteorological term meaning how far one can see horizontally prominent objects
 - Ceiling is the height of the base of the clouds
 - URL: <http://www.aviationweather.gov/adds/cv>
 - URL: www.flightaware.com
- When visibility is less than half a mile and the ceiling is lower than 200 feet, a precision landing system is required
- Using ADF a pilot can track to an NDB located at an airfield, however, in IFR conditions locating the station is not sufficient to provide landing guidance
- VOR radials can be used to align an aircraft with the runway, but VORs do not provide glide slope information
- Some ILS Terms:
 - IAF (Initial Approach Fix) is usually the beginning of an instrument approach
 - FAF (Final Approach Fix) is where the aircraft enters final approach and is lined up with the runway
 - DH (Decision Height) is the height above the ground where the pilot either Must commit to landing or begin execution of a missed approach procedure
 - MAP (Missed Approach Point)
 - All ILS systems have published procedures that conform to FAA TERPS (Terminal Procedures), which specify minimal obstacle clearances and Related information

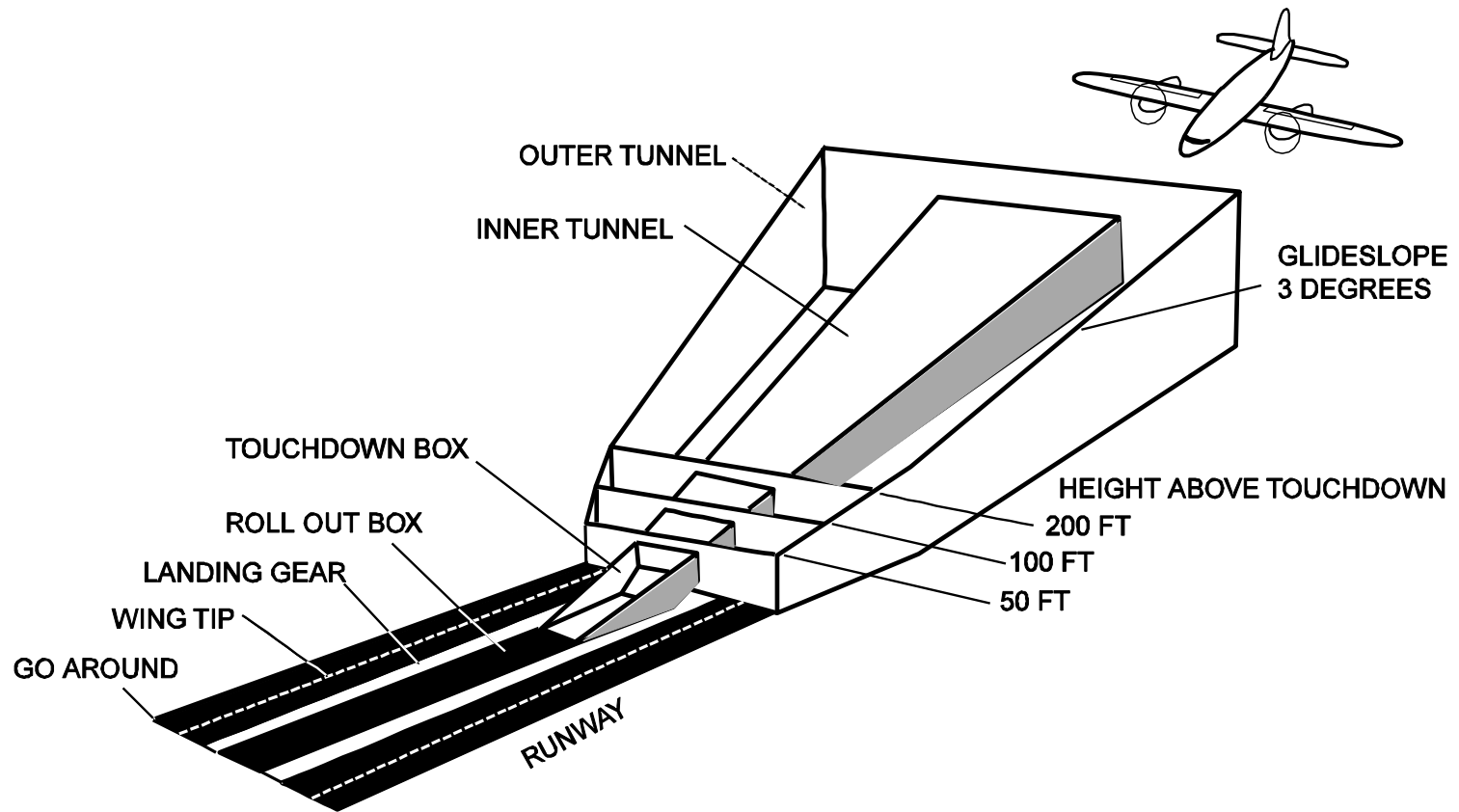
- ILS systems are usually comprised of horizontal and vertical approach guidance, position marker beacons, approach lights, and monitoring and control equipment
- Approximately 1200 US-based ILS systems and 500 more world wide
- ILS systems meet ICAO Standards and Recommended Practices (SARPS) to ensure ILS-equipped aircraft can land at ILS-equipped airports
- Horizontal, or lateral, guidance is provided by the Localizer, which provides a signal up to 20NM, although approach procedures require that it be intercepted at less than 20 NM
- The Localizer composite signal is aligned with the runway centerline
- Marker beacons transmit signals vertically thus informing the pilot that of their position along the ILS path
- The Localizer use VHF within the 108.1 – 111.95 MHz range starting at 108.10 MHz and increasing in 50 kHz increments; However, 108.10 MHz and 108.15 MHz only are reserved for test frequencies
- The Glide Slope provides vertical guidance, and is similar to an orthogonal Localizer, except that it uses UHF.
- The Glide Slope provides a signal which is usually oriented 3° down to the ground

- The Localizer, for the most part, creates two 40% AM-modulated, horizontally-polarized beams at 90 Hz and 150 Hz, respectively
- each beam is displaced to either side of the center line by a few degrees
- Since the two beams are closely spaced, an aircraft will receive the carrier frequency at twice the intensity when it is on center line
- This received signal while on center line has 20% modulation at both 90 and 150 Hz
- DDM is used when the aircraft is off center line to determine angular position with plus or minus 3 to 4°. This information drives a Horizontal Situation Indication, HSI, which is a CDI
- See “Modulation Index”: http://en.wikipedia.org/wiki/Amplitude_modulation#Modulation_index
- See DDM: <http://tinyurl.com/llqftzk>
- Usually the ILS received is shared with the VOR so that the CDI provides the lateral navigation when the VLOC (VOR Locator) frequency is selected. When used during ILS approaches the VOR TO/FROM flag and OBS are disabled



- Although markers only transmit vertically to give the pilot position information relative to the runway, they do not provide an intercept signal. Therefore, NDBs can be collocated with the outer marker so that the outer marker can be homed to in order to intercept the ILS system and begin the precision approach
- An outer marker with a collocated NDB is referred to as a Locator Outer Marker (LOM)
- ILS systems can have up to three markers (Outer, Middle, and Inner) all of which operate at 75 MHz
- URL: <http://tinyurl.com/mj7a7un>

Marker	Modulating Frequency (Hz)	Morse Code Aural Indicator	Visual Indicator	Typical Distance (NM)
Outer	400	2 dashed per second	Blue	4 to 7
Middle	1300	Alternating dots and dashes	Yellow	0.5 to 0.8
Inner	3000	6 dots per second	White	Beginning of runway threshold



- ILS categories: <https://haadbinhassan.wordpress.com/>
- ILS Landing: <http://tinyurl.com/meqxkfl>
- ILS Landing: <http://tinyurl.com/pqt4ekw>