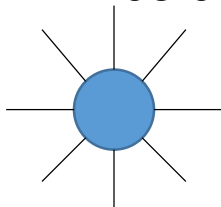


SYE 3803
Fundamentals of Avionics
Spring 2014

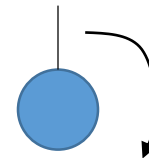
Dr. Thomas Fallon
Email: tfallon@spsu.edu

VHF Omnidirectional Radio Range (VOR) and Distance Measuring Equipment

- Short-range radio navigation; Typically less than 200 nm
- Developed in the 1930s; widely deployed after WWII (1946)
- Still in use today, but being replaced by RNAV (Area Navigation – Originally Random Navigation – revoked then reinstated with wide adoption of GPS)
- Used to establish Victor airways below 18,000 feet; Jetways, or Jet routes, above 18,000 feet
- VHF range: 108 to 117.95 MHz
 - 50 KHz frequency spacing
 - 108.0 to 111.95 MHz band (4 MHz) shared between ILS and VOR navigation
 - Odd 100 KHz digit used for ILS
 - Ex. 108.10, 108.30, 108.55
 - Even 100 KHz digit used for VOR navigation
 - Ex. 108.00, 108.05, 108.45



Omnidirectional Master Signal



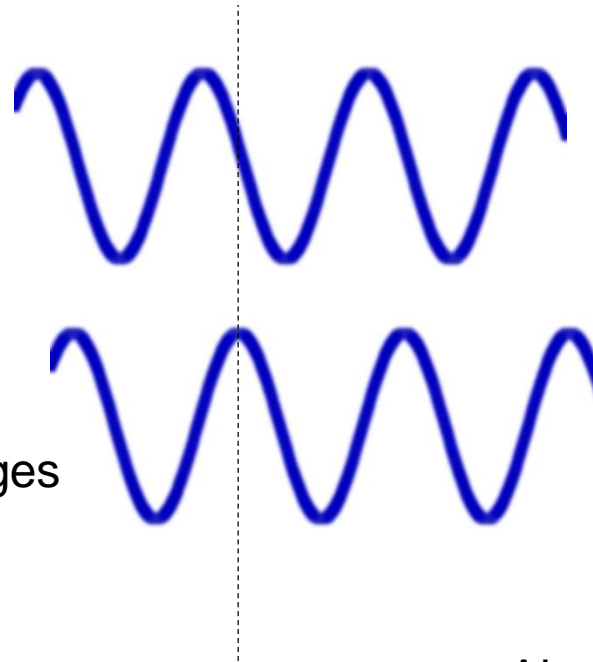
Directional Variable Signal
rotates 30 times a second

Demodulated VOR Navigational Signals

VOR bearings are aligned with magnetic north and increase in single degree increments clockwise

Omnidirectional master signal

Directional variable signal
phase of transmitted signal changes
with rotation angle



Aircraft is 90° east of
the station

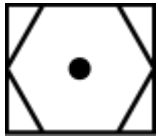
Aircraft is 90° **From** station
Aircraft is 270° **To** station

VOR Composite Signal and Symbols

- VOR composite signal includes navigational, station identifier, and voice signals
- Station identifier is usually a two- or three-letter Morse Code word
- Voice signal usually can be used for an audible version of the station identifier, in-flight service broadcasts, and HIWAS (Hazardous Inflight Weather Advisory Service) broadcasts



VOR



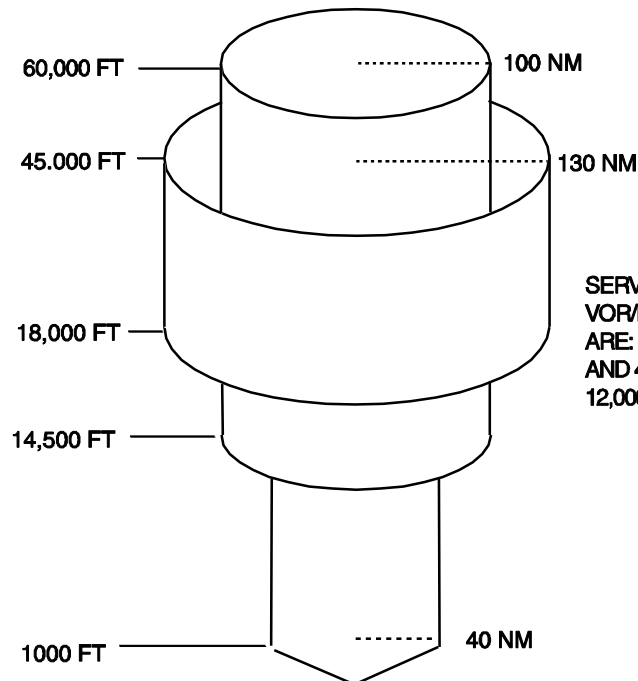
VOR/DME



VORTAC

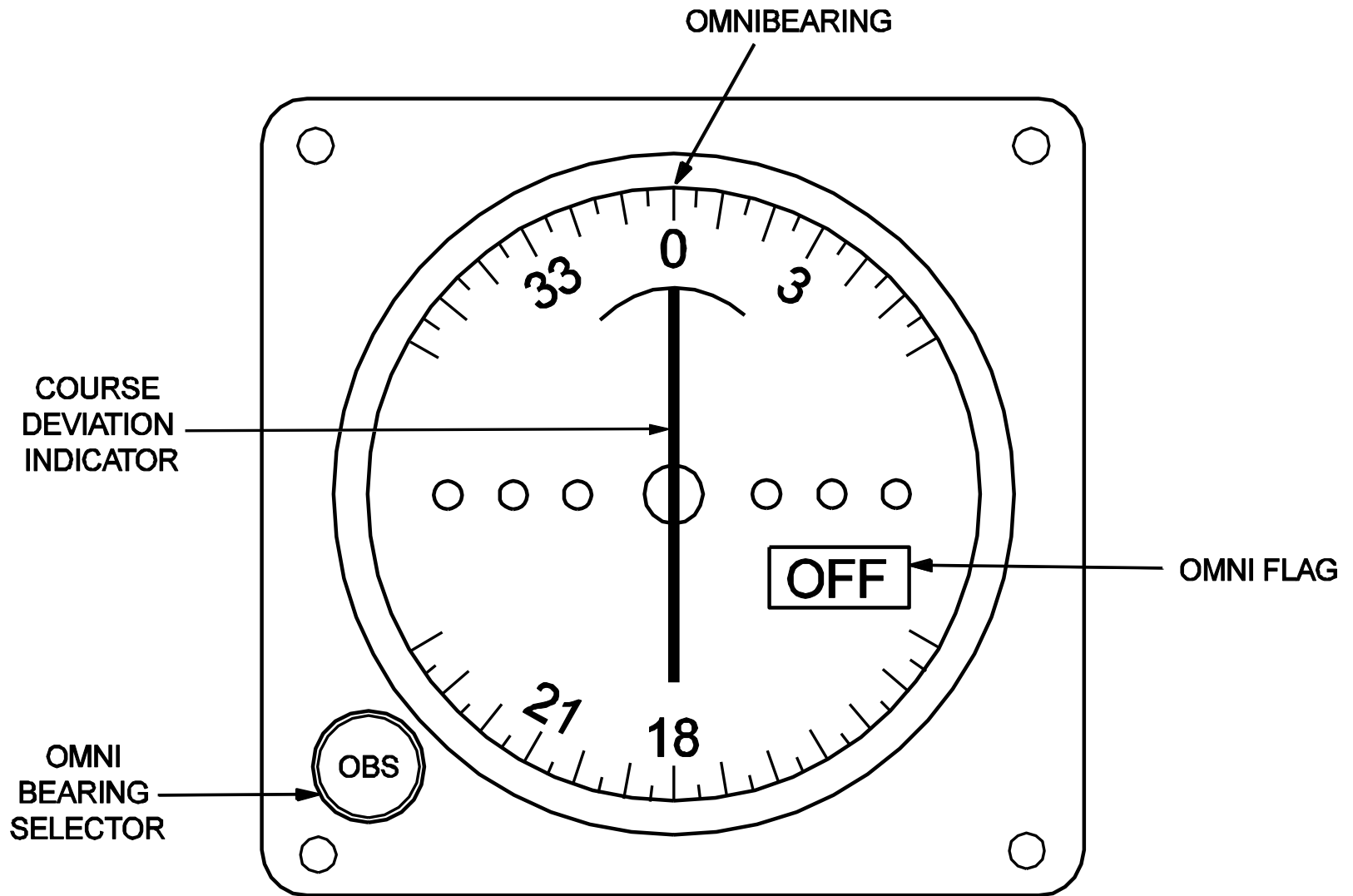
VOR Standard Service Volumes

Service Class	Range	Altitude (feet AGL)
Terminal (T)	25 NM	1000 < Alt < 12,000
Low Altitude (L)	40 NM	1000 < Alt < 18,000
High Altitude (H)	40 NM	1000 < Alt < 14,500
High Altitude (H)	100 NM	14,500 < Alt < 60,000
High Altitude (H)	130 NM	18,000 < Alt < 45,000

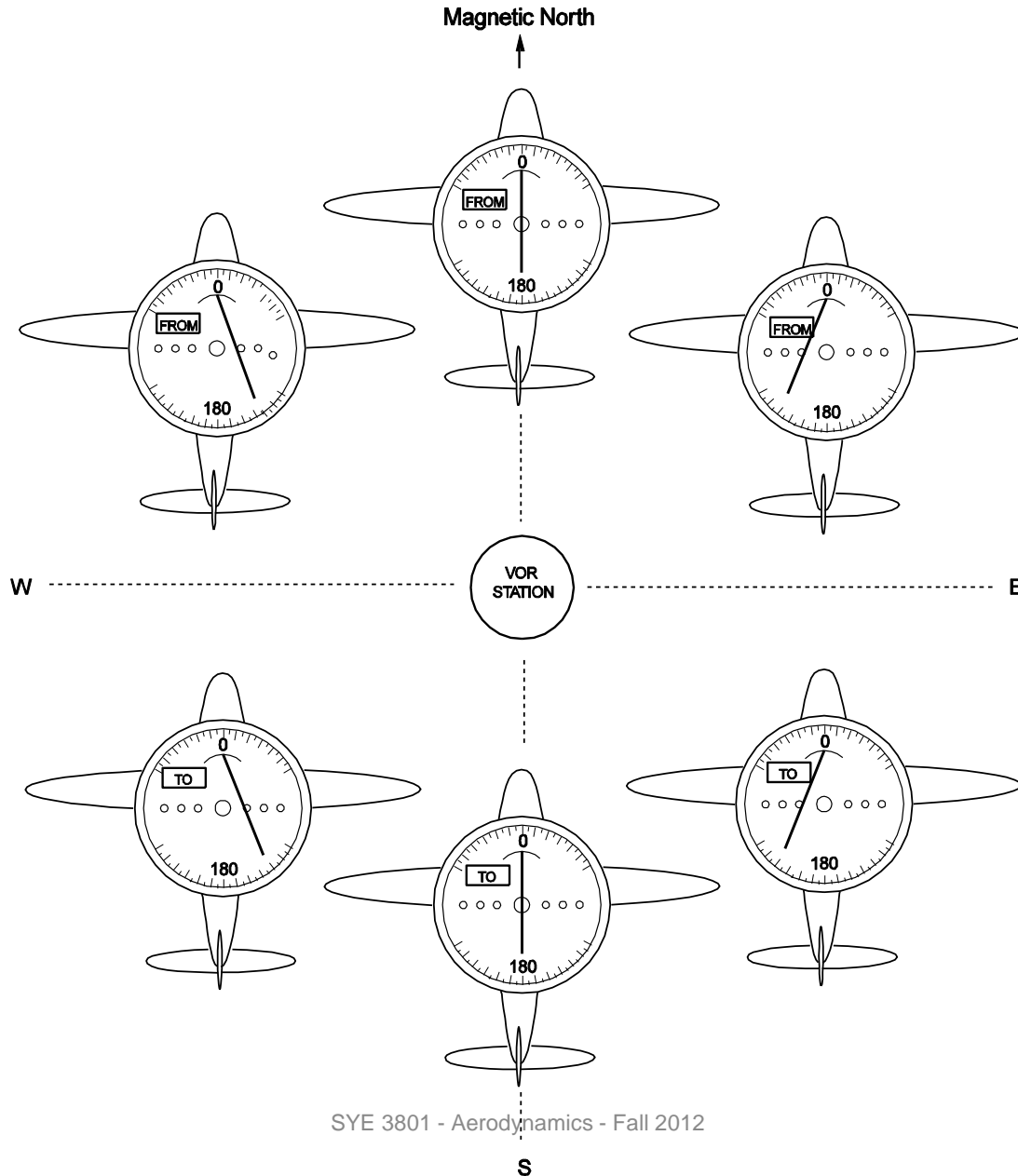


SERVICE VOLUME FOR A HIGH-ALTITUDE TYPE (H) VOR/DME/TACAN GROUND STATION. TWO OTHER TYPES ARE: (L) LOW-ALTITUDE, WHICH COVERS UP TO 18,000 FEET AND 40 NM; AND (T) TERMINAL, WHICH COVERS UP TO 12,000 FEET AND OUT TO 25 NM.

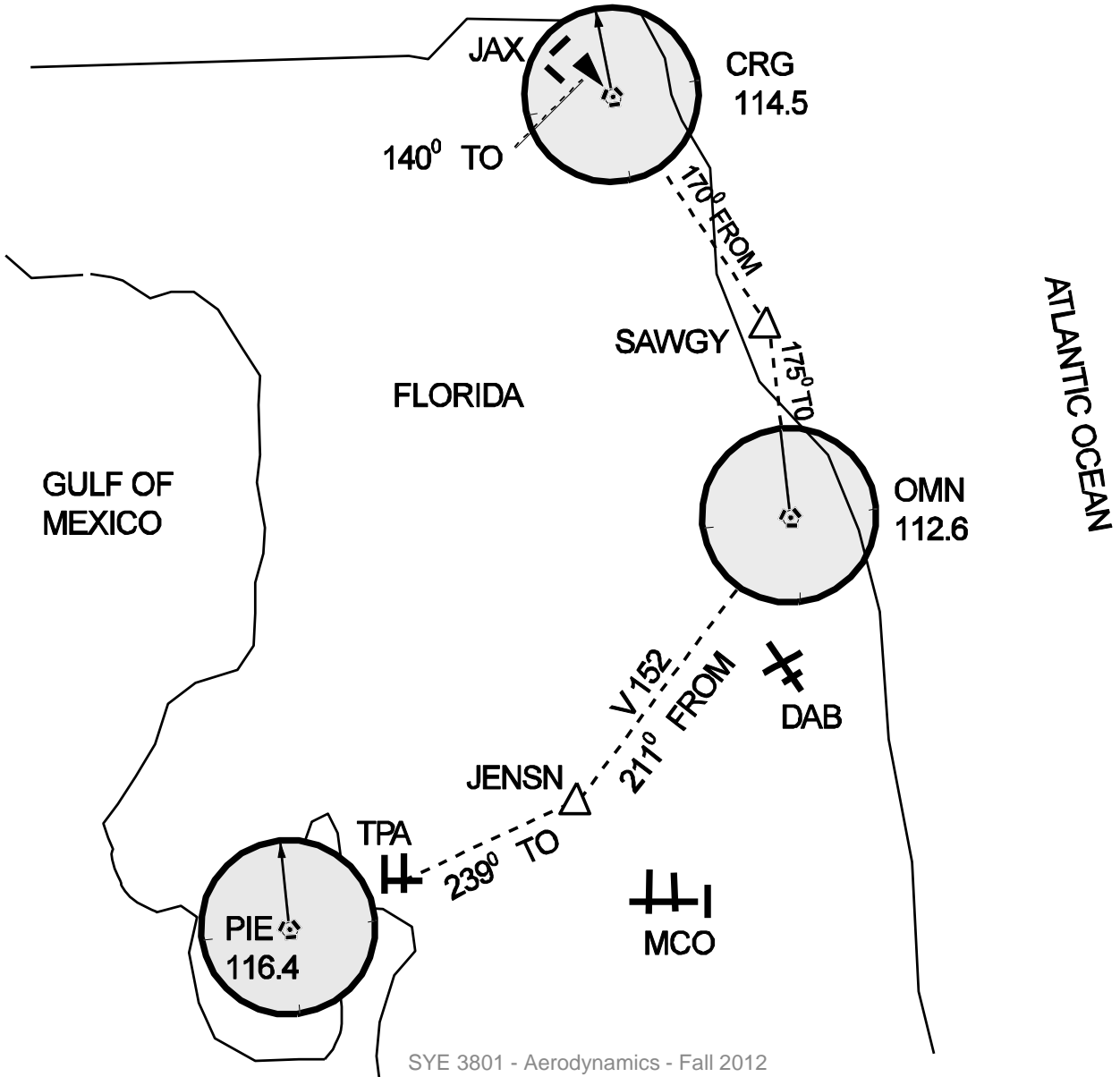
VOR Display with CDI



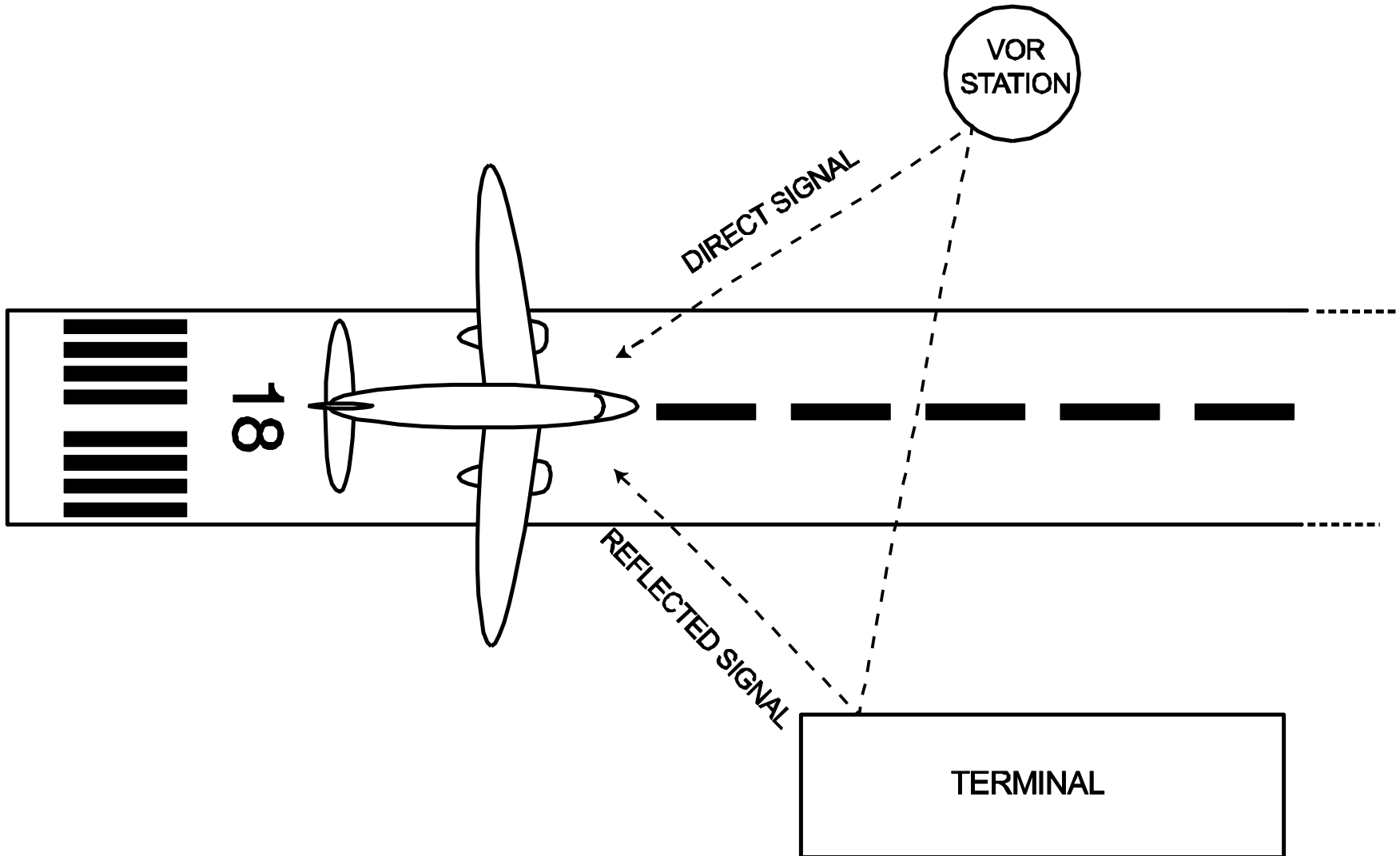
VOR CDI Position and Aircraft Location



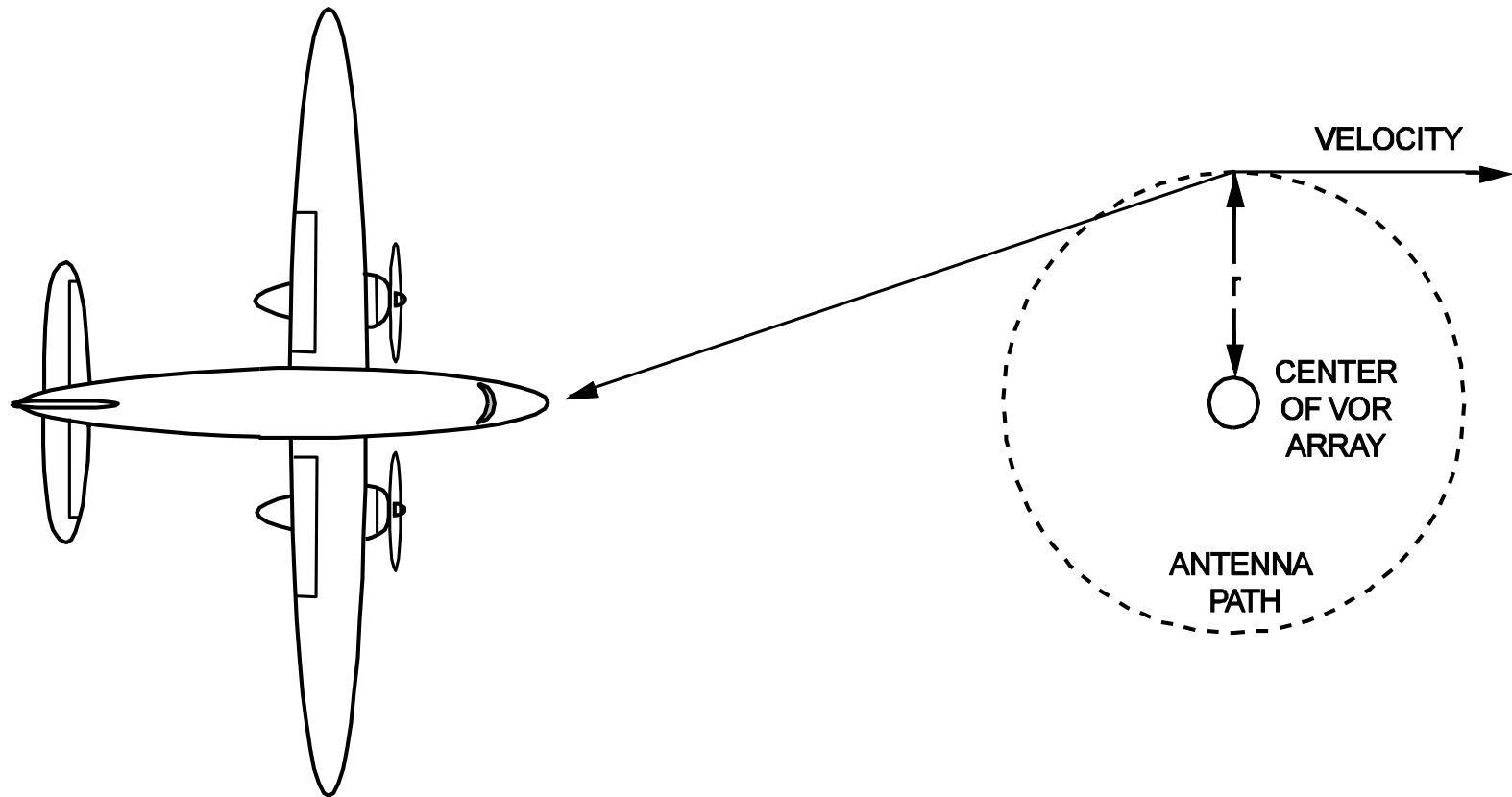
VOR Navigation from Jacksonville to Tampa



VOR: Multipath Signal

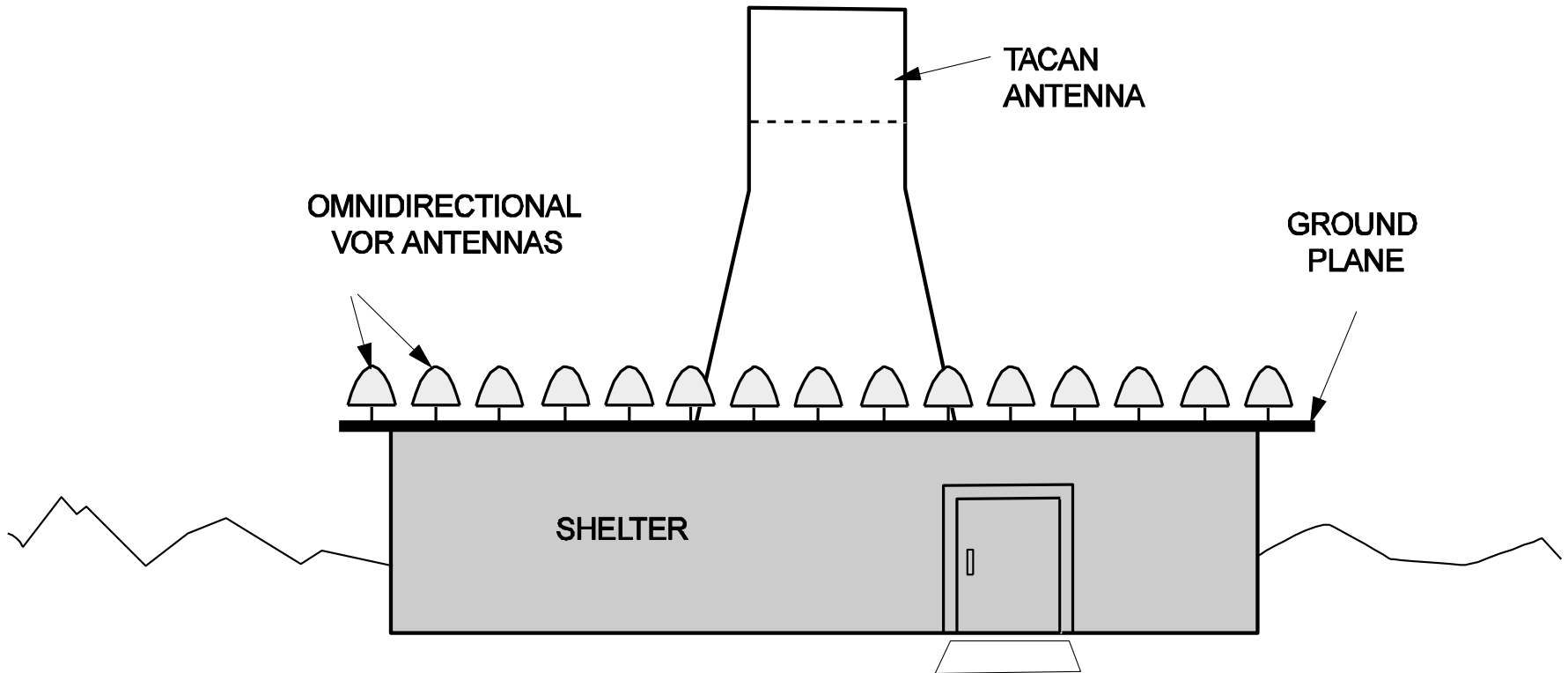


Doppler VOR Geometry



Doppler VOR provides more accurate bearing information and is less prone to signal reflection generated errors. By using a larger, circular antenna, such errors are greatly reduced.

Doppler VOR Station



VOR Tutorial: <https://www.youtube.com/watch?v=iCCk2ch-xL4>