Objectives	▪ The student should develop knowledge of the elements related to the operation and use of VORs
Key Elements	▪ Always ID VOR before use ▪ Fly with the correct flag to avoid reverse sensing ▪ VORs are line of sight ▪ Twist 10 turn 10 for arcs
Elements	▪ Components ▪ Tracking with the VOR ▪ VOR Tips ▪ Intercepting and Maintaining a Selected Course ▪ Intercepting and Maintaining a DME Arc
Schedule	▪ Review lesson objectives ▪ Review lesson material ▪ Conclusion & Review
Equipment	▪ White Board / Markers ▪ References
CFI Actions	▪ Present lesson ▪ Use teaching aids ▪ Ask/ answer questions
Student Actions	▪ Participate in discussion ▪ Take notes ▪ Ask / answer questions
Completion Standards	▪ The student understands the VOR, and is able to proficiently track and intercept radials as well as hold DME arcs

Additional Notes: _____
_____
_____
_____

CE = Common Error

Introduction

Overview

Review objectives / Elements

What

The VOR is a NAVAID used for navigation and approach procedures. This lesson will focus on more in-depth use of the VOR for tracking and intercepting and DME arcs

Why

VORs are the backbone of the airway system so all instrument pilots need to be proficient in their use

How

Components

Ground Station

- VOR station orientated to magnetic north that transmits 360 courses to or from the station
- More in TSA Lesson 2

Airborne Equipment

- Antenna – receives the signal form the VOR
- Tuning device – Selects the frequency and is able to ID the station
- VOR instrument:
  - OBS – Selects desired radial
  - CDI – Shows deflection between current radial and the one selected by OBS
  - TO/FROM flag – Shows whether selected course will take the aircraft to or from the station

Tracking with the VOR

- Tune the VOR frequency and ID it to verify you are receiving the correct VOR
  - The morse code identifier will be transmitted over VOR frequency
  - If the station is out of service, the ID wont be transmitter
    - Do not use the station if you doing hear an ID
- Rotate the OBS to center the CDI with a "TO" indication
  - Centered "TO" flag gives us bearing to the station
  - Centered "FROM" flag gives us our current radial
- Turning to the heading indicated on the OBS will track directly to the station with no wind
- When wind exists, the aircraft must crab into the wind to avoid drifting off course

- Upon arrival at the station, the flag will change from a "TO" to a "FROM"
- Be aware of reverse sensing
    - Flying with the improper flag will cause the CDI to read backwards (you are the needle)
    - Your heading should be within 180° of the selected course on the OBS

VOR Tips

- CE – Incorrect tuning and ID procedures
- Always ID the station
- Remember, VORs have service volumes (AIM 1-1-8) and they are line of sight
- Correct for wind drift, and don't reset the OBS course (Don't home to the station, this is not a NDB, we are in the 21st century)
- Fly with the correct flag, TO if you are flying to the station, FROM is you are from the station

Intercepting and Maintaining a Selected Course

- Find what radial the aircraft is done
    - Either center CDI with FROM flag or add 180° to a centered TO flag
- Find what radial you want to go to
- Find the difference in the radials
- Multiply difference by 2, this is your intercept angle
    - Intercept angle will be minimum 20° and maximum 90°
- Add or subtract the intercept angle to the inbound or outbound course
- CE – Failure to properly set the navigation selector on the course to be intercepted
    - Set inbound or outbound course in OBS
- Does it make sense, Measure twice cut once
- Fly that heading

Intercepting and Maintain a DME Arc

- CE – Failure to use proper procedures for course or DME arc intercepting and tracking
- Lead the turn into the ARC by ½ mile
    - The turn will be 90° in the direction of the desired ARC
    - Rotate the OBS 10 degrees in the direction that you will be arcing
- Fly this heading until the needle centers
- Once the needle centers, do a standard rate turn 10° towards the VOR and rotate the OBS another 10°
- Repeat this until you are 10° prior to inbound course, or crossing lead radial
- CE – Improper procedures for intercepting a course or LOC from a DME arc
- Lead Radial means switch to LOC or inbound VOR course
- Adjustment for distance will be made be amount if turn
    - Too far, turn more
    - Too close, turn less or no turn
    - Still twist 10

Review & Conclusion

Conclusion

- Always ID VOR before use
- Fly with the correct flag to avoid reverse sensing
- VORs are line of sight
- Twist 10 turn 10 for arcs

ACS Skill Standards

1. Tune and correctly identify the navigation facility/program the navigation system and verify system accuracy as appropriate for the equipment installed in the aircraft.
2. Determine aircraft position relative to the navigational facility or waypoint.
3. Set and correctly orient to the course to be intercepted.
4. Intercept the specified course at appropriate angle, inbound to or outbound from a navigational facility or waypoint.
5. Maintain airspeed ±10 knots, altitude ±100 feet, and selected headings ±5°.
6. Apply proper correction to maintain a course, allowing no more than ¾-scale deflection of the CDI. If a DME arc is selected, maintain that arc ±1 nautical mile.
7. Recognize navigational system or facility failure, and when required, report the failure to ATC.
8. Use an MFD and other graphical navigation displays, if installed, to monitor position, track wind drift, and to maintain situational awareness.
9. Properly use the autopilot, if installed, to intercept courses.