ACS AREA V — NAVIGATION SYSTEMS

Sessions 47–56

Area V is where the instrument pilot learns to go somewhere precisely. The control skills of Area IV keep the aircraft upright and on profile; Area V puts that controlled aircraft on an exact path through the sky — intercepting a course, tracking it against the wind, flying an arc, and following the complex departure and arrival procedures that connect airports to the en route structure. This is the navigation craft that turns a clearance into a flight path the aircraft actually flies.

These ten sessions move from the ground-based fundamentals to modern area navigation. Sessions 47 and 48 cover VOR course interception and tracking and DME arcs — the classic radio-navigation skills. Sessions 49 through 51 turn to the satellite and area-navigation systems: GPS modes and RAIM, WAAS and LPV with database integrity, and RNAV/FMS operation. Sessions 52 through 55 cover the procedures that structure departures and arrivals — SIDs and ODPs, STARs with their descents and crossing restrictions, fly-by versus fly-over waypoints, and transition levels with speed restrictions. Session 56 closes the area with a mixed en route scenario that connects a departure procedure, an airway intercept, an arc, and an arrival the way a real flight strings them together.

The recurring theme across this area is that the equipment is only as good as the pilot's understanding of what mode it is in and what it is doing. A VOR needle and a GPS course line look similar but behave differently; an RNAV system in the wrong mode will track a path the pilot did not intend. Work these sessions with the charts and your own navigator's logic in front of you, and return to Chapters 6 and 10 wherever a mode, an annunciation, or a crossing restriction does not come cleanly.

SESSION 47: NAVIGATION SYSTEMS — VOR COURSE INTERCEPTION AND TRACKING

1. To track inbound to a VOR on a specific course, the pilot sets the OBS to the:

A. Radial the aircraft is currently on

B. Reciprocal of the desired track

C. Desired course (to the station) with a TO indication

D. Aircraft's present heading

2. A "radial" is defined as a magnetic course:

A. Inbound to the VOR station

B. Measured from the aircraft to the station

C. FROM the VOR station

D. Equal to the aircraft heading

3. With the OBS set to 360 and a TO indication, the aircraft is located:

A. North of the station

B. South of the station (on the 180 radial), tracking toward it

C. East of the station

D. On the 360 radial

4. The CDI needle deflecting to the right means the selected course is:

A. To the right of the aircraft; fly right to intercept/correct toward it

B. To the left of the aircraft

C. Directly behind the aircraft

D. Already centered

5. To intercept a course, the pilot first determines the aircraft's position relative to the course, then:

A. Flies directly to the station

B. Turns to the reciprocal

C. Maintains the current heading

D. Selects an intercept heading that converges on the course at a chosen intercept angle

6. A larger intercept angle results in:

A. A slower intercept

B. No intercept at all

C. A quicker intercept but a sharper turn to roll out on course

D. Reverse sensing

7. When the CDI begins to center as the aircraft approaches the selected course, the pilot should:

A. Begin turning to the course heading to roll out tracking the course as the needle centers

B. Continue the intercept heading until well past the course

C. Reverse course

D. Increase the intercept angle

8. "Tracking" a VOR course means:

A. Flying directly over the station repeatedly

B. Maintaining the OBS reciprocal

C. Keeping the CDI centered by applying wind correction to hold the course over the ground

D. Ignoring the CDI

9. If, while tracking a course, the CDI drifts left, the wind is pushing the aircraft:

A. Toward the station

B. Right of course; turn left to re-intercept and establish a left wind correction

C. Onto the course

D. Behind the station

10. "Bracketing" is the technique of:

A. Flying the reciprocal heading

B. Making progressively smaller heading corrections to find the wind correction angle that holds the CDI centered

C. Maintaining a fixed crab regardless of drift

D. Ignoring small deviations

11. As an aircraft tracking a course gets closer to the VOR, the CDI becomes:

A. Less sensitive

B. Reverse-sensing

C. Inoperative

D. More sensitive (smaller distance per dot), requiring smaller corrections

12. Over the station, the aircraft passes through the "cone of confusion," indicated by:

A. A brief CDI fluctuation and a TO/FROM flag change

B. A steady centered CDI

C. A glideslope capture

D. A loss of electrical power

13. After station passage tracking outbound, the OBS is typically set to the:

A. Reciprocal of the inbound course

B. Aircraft heading

C. Nearest airway only

D. Outbound course (radial) with a FROM indication

14. "Reverse sensing" on a VOR occurs when the OBS is set to a course roughly opposite the direction of flight, causing the CDI to:

A. Center permanently

B. Become more sensitive

C. Indicate corrections opposite to the needed direction

D. Show the distance

15. Using an HSI instead of a conventional CDI helps prevent reverse sensing because the HSI:

A. Orients the course display to the aircraft heading, so corrections are intuitive

B. Shows the DME distance

C. Eliminates wind correction

D. Replaces the VOR receiver

16. A pilot tracking the 090 radial outbound (FROM) holds the CDI centered and notes the needle drifting right. The correct correction is to:

A. Turn right to re-intercept and apply a right wind correction

B. Turn left

C. Maintain heading

D. Reverse course

17. The first step in any VOR interception or tracking task is to:

A. Engage the autopilot

B. Set the DME

C. Tune and identify the correct VOR station

D. Center the CDI with a FROM flag

18. Identifying the VOR by its Morse code confirms:

A. The aircraft's distance

B. The correct, operational station is tuned

C. The glideslope is active

D. The wind correction angle

19. To intercept and track a course with the least overshoot in strong wind, the pilot should:

A. Lead the turn onto course and immediately establish an estimated wind correction angle

B. Roll out exactly on the course heading with no wind correction

C. Use the maximum intercept angle

D. Ignore the wind

20. A 30-degree intercept angle means the aircraft's heading differs from the desired course by:

A. 90 degrees

B. 30 degrees

C. 45 degrees

D. 10 degrees

21. When the CDI shows full-scale deflection while tracking, the aircraft is:

A. Directly on course

B. Over the station

C. Reverse sensing

D. At or beyond the edge of the usable course width (about 10 degrees off course)

22. A pilot wants to intercept the 270 radial inbound. The inbound course to the station on that radial is:

A. 270

B. 090 (the reciprocal, with a TO indication)

C. 180

D. 360

23. Maintaining course on a VOR requires the pilot to integrate the CDI with the:

A. Altimeter for course

B. Heading indicator, applying a wind correction angle and verifying with the CDI

C. VSI for tracking

D. Magnetic compass only

24. A small CDI deviation while tracking should be corrected with:

A. A 45-degree turn

B. A course reversal

C. A reciprocal heading

D. A small heading change toward the needle, then a reduced wind correction angle

25. The fundamental skill of VOR interception and tracking is to:

A. Fly directly over the station continuously

B. Maintain the OBS at the aircraft heading

C. Orient to the radial, intercept the desired course at a controlled angle, and track it with wind correction by keeping the CDI centered

D. Disregard the CDI in wind

ANSWER KEY & EXPLANATIONS — SESSION 47

1. C. Desired course, TO — To track inbound, the OBS is set to the desired course to the station with a TO indication.

2. C. FROM the station — A radial is a magnetic course FROM the VOR station.

3. B. South, on 180 radial — OBS 360 with a TO indication places the aircraft south of the station (on the 180 radial), tracking toward it.

4. A. Course to the right — A right CDI deflection means the selected course is to the right; fly right to intercept/correct toward it.

5. D. Select intercept heading — After determining position relative to the course, the pilot selects an intercept heading that converges on the course at a chosen intercept angle.

6. C. Quicker intercept, sharper rollout — A larger intercept angle gives a quicker intercept but a sharper turn to roll out on course.

7. A. Turn as needle centers — As the CDI begins to center, the pilot turns to the course heading to roll out tracking the course.

8. C. Keep CDI centered with wind correction — Tracking means keeping the CDI centered by applying wind correction to hold the course over the ground.

9. B. Drift left = right of course — A CDI drifting left while tracking means the wind pushed the aircraft right of course; turn left to re-intercept and establish a left wind correction.

10. B. Progressively smaller corrections — Bracketing makes progressively smaller heading corrections to find the wind correction angle that holds the CDI centered.

11. D. More sensitive near station — The CDI becomes more sensitive closer to the VOR (smaller distance per dot), requiring smaller corrections.

12. A. Cone of confusion — Station passage produces a brief CDI fluctuation and a TO/FROM flag change.

13. D. Outbound course, FROM — Tracking outbound, the OBS is set to the outbound course (radial) with a FROM indication.

14. C. Opposite corrections — Reverse sensing occurs when the OBS is set roughly opposite the direction of flight, causing the CDI to indicate corrections opposite to the needed direction.

15. A. HSI orients to heading — An HSI prevents reverse sensing by orienting the course display to the aircraft heading, making corrections intuitive.

16. A. Turn right to re-intercept — Tracking 090 outbound with the needle drifting right, the correction is to turn right to re-intercept and apply a right wind correction.

17. C. Tune/identify — The first step in any VOR task is to tune and identify the correct VOR station.

18. B. Correct station — Identifying the Morse code confirms the correct, operational station is tuned.

19. A. Lead and establish WCA — To minimize overshoot in strong wind, lead the turn onto course and immediately establish an estimated wind correction angle.

20. B. 30 degrees — A 30-degree intercept angle means the heading differs from the desired course by 30 degrees.

21. D. Edge of course width — Full-scale CDI deflection means the aircraft is at or beyond the edge of the usable course width (about 10 degrees off course).

22. B. 090 TO — To intercept the 270 radial inbound, the inbound course is 090 (the reciprocal, with a TO indication).

23. B. HI + CDI — Maintaining course integrates the CDI with the heading indicator, applying a wind correction angle and verifying with the CDI.

24. D. Small change + reduced WCA — A small CDI deviation is corrected with a small heading change toward the needle, then a reduced wind correction angle.

25. C. Orient/intercept/track — The fundamental skill is to orient to the radial, intercept the desired course at a controlled angle, and track it with wind correction by keeping the CDI centered.