SESSION 26: FLIGHT INSTRUMENTS — GPS, WAAS, RNAV, FMS, AND AUTOPILOT

1. GPS determines an aircraft's position by:

A. Measuring bearing from ground-based VOR stations

B. Sensing the Earth's magnetic field

C. Calculating range to multiple satellites and triangulating position

D. Detecting Doppler shift from a single satellite

2. A standard (non-WAAS) IFR GPS requires which integrity-monitoring function to use the unit for IFR?

A. ADS-B Out

B. DME paired tuning

C. RAIM (Receiver Autonomous Integrity Monitoring)

D. A second magnetic compass

3. RAIM ensures that the GPS:

A. Receives ground-based augmentation

B. Can detect a satellite providing erroneous information and alert the pilot

C. Pairs automatically with DME

D. Functions only above 18,000 feet

4. WAAS (Wide Area Augmentation System) improves GPS by providing:

A. Correction signals that improve accuracy and integrity, enabling vertical guidance approaches

B. A backup magnetic heading reference

C. Ground-based localizer signals

D. Marker beacon indications

5. A WAAS-capable GPS can fly which approach type that a non-WAAS GPS cannot?

A. LNAV

B. VOR

C. LPV (with vertical guidance to a DA)

D. Localizer

6. Before relying on a non-WAAS GPS for an IFR approach, the pilot must verify:

A. The autopilot is engaged

B. The DME is tuned

C. The marker beacons are operative

D. RAIM is available (predicted/annunciated) for the approach

7. A GPS database must be current because:

A. Outdated waypoints, procedures, or frequencies could provide incorrect navigation

B. The receiver will not power on with an old database

C. WAAS requires a daily update

D. The autopilot depends on the database revision date

8. As a GPS approach progresses, the receiver sequences through sensitivity modes. In the terminal mode, CDI sensitivity is typically:

A. ±5 NM full scale

B. ±0.3 NM full scale

C. ±2.5 degrees

D. ±1 NM full scale

9. In the approach (final) mode, a GPS CDI sensitivity typically scales to approximately:

A. ±5 NM full scale

B. ±2 NM full scale

C. ±1 NM full scale

D. ±0.3 NM full scale

10. An RNAV system allows an aircraft to navigate:

A. Only along VOR radials

B. Only on published Victor airways

C. On any desired path within the coverage of referenced navaids or GPS

D. Only using ground-based DME

11. An FMS (Flight Management System) integrates navigation by:

A. Replacing the need for any pilot input

B. Combining multiple navigation sources and managing the flight plan, often coupling to the autopilot

C. Providing only fuel quantity information

D. Functioning solely as a backup attitude indicator

12. When receiving radar vectors, a GPS navigator is typically placed in suspend (or OBS) mode to:

A. Increase CDI sensitivity automatically

B. Disable the autopilot

C. Update the database

D. Prevent automatic waypoint sequencing during the vectors

13. If automatic waypoint sequencing is not suspended during radar vectors, the navigator may:

A. Sequence ahead to a waypoint the pilot is not navigating to, giving misleading CDI guidance

B. Shut down entirely

C. Switch to VOR mode

D. Increase the glideslope sensitivity

14. A "RAIM annunciation" warning during an approach in a non-WAAS GPS indicates:

A. Integrity monitoring is unavailable, and the approach may not be reliable

B. The autopilot has disconnected

C. The database is current

D. The aircraft has captured the glideslope

15. An autopilot in "heading" (HDG) mode will:

A. Track the GPS flight plan automatically

B. Capture and hold the glideslope

C. Maintain a selected altitude only

D. Fly the heading selected on the heading bug

16. An autopilot in "NAV" mode coupled to the GPS will:

A. Hold wings level only

B. Maintain a constant airspeed

C. Track the active GPS course/flight plan

D. Capture the localizer back course automatically

17. A pilot using automation must always:

A. Monitor the automation to confirm it is doing what the pilot intends

B. Trust the autopilot without cross-checking

C. Disengage all navigation radios

D. Rely solely on the moving map

18. "Automation surprise" or mode confusion is a risk that pilots mitigate by:

A. Leaving the autopilot in a single mode for the whole flight

B. Understanding and verifying the active and armed autopilot/FMS modes

C. Never using the autopilot in IMC

D. Disabling the flight director

19. A WAAS GPS approach to LPV minimums provides vertical guidance to a:

A. Minimum descent altitude requiring a level segment

B. Circling altitude only

C. Visual descent point

D. Decision altitude, flown like a precision approach

20. Loss of GPS integrity (RAIM unavailable) during an approach requires the pilot to:

A. Continue to the published DA regardless

B. Execute a missed approach or revert to another approach type, as appropriate

C. Increase the descent rate

D. Disengage the transponder

21. A GPS substitute for DME or ADF is permitted in many operations, allowing a suitably equipped GPS to:

A. Replace the magnetic compass

B. Eliminate the need for a current database

C. Identify DME fixes and intersections in lieu of DME/ADF

D. Provide glideslope guidance

22. The pilot's fundamental responsibility when coupling the autopilot to an approach is to:

A. Brief and verify the modes, monitor the coupled approach, and be ready to disconnect and fly manually

B. Set the autopilot and stop monitoring the instruments

C. Disable the CDI to avoid distraction

D. Rely on the autopilot to make the go/no-go decision

23. A pilot loads an RNAV (GPS) approach but the receiver fails to transition to approach mode before the FAF. The pilot should:

A. Continue to the LPV DA regardless

B. Recognize the approach mode is not active and not descend to the approach minimums as if it were

C. Increase CDI sensitivity manually

D. Disconnect the autopilot and continue visually

24. The increasing CDI sensitivity as a GPS approach progresses serves to:

A. Reduce pilot workload by widening the course

B. Provide finer course guidance precision approaching the runway

C. Disable automatic sequencing

D. Pair the DME automatically

25. The fundamental principle of automation management in IFR flight is that the pilot:

A. Remains the manager of the automation, always monitoring and verifying its behavior

B. Should never intervene once automation is engaged

C. Must hand-fly all approaches

D. Relies on automation to replace situational awareness

ANSWER KEY & EXPLANATIONS – SESSION 26

1. C. Triangulate satellites — GPS determines position by calculating range to multiple satellites and triangulating.

2. C. RAIM — A non-WAAS IFR GPS requires RAIM to be used for IFR.

3. B. Detect bad satellite — RAIM detects a satellite providing erroneous information and alerts the pilot.

4. A. Correction/integrity — WAAS provides correction signals that improve accuracy and integrity, enabling vertical guidance approaches.

5. C. LPV — A WAAS GPS can fly LPV (with vertical guidance to a DA), which a non-WAAS GPS cannot.

6. D. RAIM available — Before a non-WAAS GPS IFR approach, the pilot must verify RAIM is available (predicted/annunciated).

7. A. Outdated data risk — A current database is required because outdated waypoints, procedures, or frequencies could provide incorrect navigation.

8. D. ±1 NM terminal — Terminal mode CDI sensitivity is typically ±1 NM full scale.

9. D. ±0.3 NM final — Approach (final) mode CDI sensitivity scales to approximately ±0.3 NM full scale.

10. C. Any desired path — RNAV allows navigation on any desired path within the coverage of referenced navaids or GPS.

11. B. Integrates/couples — An FMS combines multiple navigation sources and manages the flight plan, often coupling to the autopilot.

12. D. Prevent sequencing — On radar vectors, the GPS is suspended/OBS to prevent automatic waypoint sequencing.

13. A. Misleading guidance — Unsuspended sequencing during vectors may jump ahead to a waypoint the pilot isn't navigating to, giving misleading CDI guidance.

14. A. Integrity unavailable — A RAIM annunciation in a non-WAAS GPS indicates integrity monitoring is unavailable and the approach may not be reliable.

15. D. Selected heading — In HDG mode the autopilot flies the heading selected on the heading bug.

16. C. Track GPS course — In NAV mode coupled to GPS, the autopilot tracks the active GPS course/flight plan.

17. A. Monitor automation — A pilot using automation must always monitor it to confirm it is doing what is intended.

18. B. Verify modes — Automation surprise is mitigated by understanding and verifying the active and armed autopilot/FMS modes.

19. D. Decision altitude — An LPV approach provides vertical guidance to a decision altitude, flown like a precision approach.

20. B. Miss or revert — Loss of GPS integrity during an approach requires a missed approach or reversion to another approach type, as appropriate.

21. C. GPS as DME/ADF substitute — A suitably equipped GPS may identify DME fixes and intersections in lieu of DME/ADF.

22. A. Brief/monitor/ready to disconnect — When coupling the autopilot to an approach, the pilot briefs and verifies modes, monitors the approach, and is ready to disconnect and fly manually.

23. B. Don't descend as if active — If the approach mode is not active before the FAF, the pilot must not descend to the approach minimums as if it were.

24. B. Finer precision — Increasing CDI sensitivity provides finer course guidance precision approaching the runway.

25. A. Pilot manages automation — The fundamental principle is that the pilot remains the manager of the automation, always monitoring and verifying its behavior.