

SESSION 43: UNUSUAL ATTITUDES — SPATIAL DISORIENTATION AND PHYSIOLOGICAL ILLUSIONS

1. Spatial disorientation is best defined as:

- A. A failure of the aircraft's attitude indicator
- B. A navigation error
- C. The inability to correctly perceive the aircraft's position, attitude, or motion relative to the earth
- D. A type of radio failure

2. The three sensory systems that contribute to orientation are the:

- A. Pitot, static, and vacuum systems
- B. Auditory, olfactory, and tactile systems
- C. Eyes, ears, and nose
- D. Visual, vestibular (inner ear), and somatosensory ("seat of the pants") systems

3. In instrument conditions, the most reliable orientation system is:

- A. The vestibular system
- B. The somatosensory system
- C. The visual system — but only when referencing the flight instruments
- D. The inner ear

4. "The leans" is a vestibular illusion in which the pilot:

- A. Feels level after a slow roll, then feels banked the opposite way when returning to level
 - B. Sees a false horizon
 - C. Feels the aircraft pitching up during acceleration
 - D. Perceives a light as moving
5. The leans typically results from:
- A. A rapid recovery from a turn
 - B. Looking at a sloping cloud bank
 - C. A bank entered so slowly the inner ear does not detect it, then a correction the inner ear does detect
 - D. Acceleration on takeoff
6. The "coriolis illusion" is produced when a pilot:
- A. Accelerates rapidly
 - B. Stares at a fixed light
 - C. Looks at a tilted horizon
 - D. Moves the head (e.g., looking down) during a prolonged turn, producing a tumbling sensation
7. The coriolis illusion is especially dangerous because the tumbling sensation can cause the pilot to:
- A. See a false horizon
 - B. Make abrupt control inputs that worsen disorientation and may cause loss of control
 - C. Misread the altimeter
 - D. Lose radio contact
8. The "graveyard spiral" occurs when a pilot in a prolonged turn:

- A. No longer senses the turn, may level the wings momentarily, re-enters the turn, and pulls back as altitude is lost, tightening the spiral
- B. Accelerates and feels a climb
- C. Sees a false horizon and banks
- D. Stares at a star and feels motion

9. The "somatogravic illusion" causes a pilot to feel a false:

- A. Turn during straight flight
- B. Bank during a climb
- C. Roll during deceleration
- D. Pitch-up (climb) sensation during rapid forward acceleration

10. Per the somatogravic illusion, the dangerous pilot response to the false pitch-up during acceleration is to:

- A. Add power
- B. Push the nose down, potentially into a descent or terrain
- C. Bank the aircraft
- D. Pull the nose up

11. A rapid deceleration can produce a somatogravic sensation of:

- A. A turn
- B. A roll
- C. Pitching down (a dive), prompting a dangerous nose-up input
- D. A climb

12. The "false horizon" illusion is a visual illusion caused by:

- A. The inner ear
- B. The somatosensory system
- C. Rapid acceleration
- D. A sloping cloud bank, ground lights, or a star field misperceived as the true horizon

13. "Autokinesis" is a visual illusion in which:

- A. The aircraft appears to roll
- B. A stationary light, stared at in the dark, appears to move
- C. The horizon appears to tilt
- D. The pilot feels a false climb

14. The "black hole approach" illusion occurs on a night approach over:

- A. A brightly lit city
- B. A well-marked runway
- C. Dark, featureless terrain or water, causing the pilot to fly an unsafely low approach
- D. A sloping runway only

15. The single most effective defense against all spatial disorientation illusions is to:

- A. Trust and fly the flight instruments, disregarding bodily sensations
- B. Trust the inner ear
- C. Rely on the "seat of the pants" feel
- D. Stare at the outside lights

16. When sensations conflict with the instruments in IMC, the pilot must:

- A. Average the two
- B. Trust the bodily sensation
- C. Look outside for a horizon
- D. Believe the instruments, because the sensations are unreliable

17. Head movements during turns in IMC should be:

- A. Made rapidly to refresh orientation
- B. Minimized to avoid triggering the coriolis illusion
- C. Made only while looking down
- D. Increased to confirm the turn

18. A pilot who enters IMC without an instrument rating typically loses control within minutes primarily because:

- A. Spatial disorientation overwhelms the untrained pilot's ability to maintain control by instruments
- B. The engine fails
- C. The radios fail
- D. The aircraft runs out of fuel

19. The vestibular system is unreliable in flight because the inner ear:

- A. Cannot accurately sense gradual or sustained motion and is fooled by accelerations
- B. Senses only visual cues
- C. Is more accurate than the instruments
- D. Detects the true horizon

20. The "inversion illusion" can cause a pilot to feel:

- A. A turn during straight flight
- B. Tumbling backward after an abrupt change from climb to level flight, prompting a dangerous nose-down input
- C. A false horizon
- D. A light moving

21. A pilot experiencing the leans should:

- A. Re-enter the bank to relieve the sensation
- B. Look outside for the horizon
- C. Trust the bodily feeling
- D. Continue flying the instruments, accepting that the level sensation is false

22. Preventing spatial disorientation includes:

- A. Avoiding all night flight
- B. Relying on physical sensations
- C. Maintaining instrument proficiency, an effective cross-check, and avoiding unnecessary head movements
- D. Disabling the attitude indicator

23. The "graveyard spiral" leads to loss of altitude because the pilot:

- A. Climbs to avoid the turn
- B. Sees a false horizon
- C. Tightens the descending turn while attempting to correct a perceived wings-level descent by pulling back
- D. Accelerates out of the turn

24. A pilot transitioning from visual to instrument conditions should:

- A. Establish reliance on the instruments before sensory illusions develop
- B. Continue looking outside as long as possible
- C. Trust the inner ear during the transition
- D. Make rapid head movements to adapt

25. The fundamental principle of combating spatial disorientation is that:

- A. The pilot's sensations are the most reliable reference
- B. A trained instrument pilot must trust the instruments over conflicting bodily sensations to maintain control
- C. The outside lights provide the best reference at night
- D. Disorientation cannot be overcome by any means

ANSWER KEY & EXPLANATIONS – SESSION 43

1. C. Inability to perceive state — Spatial disorientation is the inability to correctly perceive the aircraft's position, attitude, or motion relative to the earth.

2. D. Visual/vestibular/somatosensory — The three orientation systems are the visual, vestibular (inner ear), and somatosensory ("seat of the pants") systems.

3. C. Visual via instruments — In IMC, the most reliable system is the visual system, but only when referencing the flight instruments.

4. A. Leans — The leans is feeling level after a slow roll, then feeling banked the opposite way when returning to level.

5. C. Undetected slow bank — The leans results from a bank entered so slowly the inner ear misses it, then a correction the inner ear detects.

6. D. Head movement in turn — The coriolis illusion is produced by moving the head during a prolonged turn, producing a tumbling sensation.

7. B. Abrupt inputs — The coriolis illusion is dangerous because the tumbling sensation can cause abrupt control inputs that worsen disorientation and may cause loss of control.

8. A. Graveyard spiral — In a graveyard spiral, the pilot no longer senses the turn, may level momentarily, re-enters the turn, and pulls back as altitude is lost, tightening the spiral.

9. D. Somatogravic climb feel — The somatogravic illusion causes a false pitch-up (climb) sensation during rapid forward acceleration.

10. B. Push nose down — The dangerous response to the somatogravic false pitch-up is to push the nose down, potentially into a descent or terrain.

11. C. Deceleration → dive feel — Rapid deceleration produces a somatogravic sensation of pitching down, prompting a dangerous nose-up input.

12. D. False horizon — The false horizon illusion is caused by a sloping cloud bank, ground lights, or a star field misperceived as the true horizon.

13. B. Autokinesis — Autokinesis is a stationary light, stared at in the dark, appearing to move.

14. C. Black hole — The black hole approach illusion occurs over dark, featureless terrain or water, causing an unsafely low approach.

15. A. Trust the instruments — The single most effective defense is to trust and fly the flight instruments, disregarding bodily sensations.

16. D. Believe the instruments — When sensations conflict with the instruments in IMC, the pilot must believe the instruments.

17. B. Minimize head movement — Head movements during turns in IMC should be minimized to avoid the coriolis illusion.

18. A. Disorientation overwhelms — An untrained pilot in IMC loses control because spatial disorientation overwhelms the ability to maintain control by instruments.

19. A. Inner ear fooled — The vestibular system is unreliable because the inner ear cannot accurately sense gradual or sustained motion and is fooled by accelerations.

20. B. Inversion illusion — The inversion illusion is tumbling backward after an abrupt climb-to-level change, prompting a dangerous nose-down input.

21. D. Fly instruments — A pilot with the leans should continue flying the instruments, accepting that the level sensation is false.

22. C. Proficiency/cross-check — Preventing disorientation includes maintaining instrument proficiency, an effective cross-check, and avoiding unnecessary head movements.

23. C. Tightening spiral — The graveyard spiral loses altitude because the pilot tightens the descending turn while pulling back to correct a perceived wings-level descent.

24. A. Rely on instruments early — Transitioning to IMC, the pilot should establish reliance on the instruments before sensory illusions develop.

25. B. Trust instruments over sensation — The fundamental principle is that a trained instrument pilot must trust the instruments over conflicting bodily sensations to maintain control.