

SESSION 77: EMERGENCIES — IN-FLIGHT ICING ENCOUNTER: RECOGNITION AND RESPONSE

1. Structural icing forms on an aircraft in flight when:
 - A. The engine runs too lean
 - B. The static port freezes
 - C. The aircraft flies through visible moisture at or below freezing temperatures
 - D. The air is dry and cold

2. The three general categories of in-flight icing are:
 - A. Wing, tail, and propeller
 - B. Light, moderate, and severe
 - C. Rime, clear, and mixed
 - D. Structural, induction, and instrument icing

3. "Induction icing" refers to ice that:
 - A. Forms on the wings
 - B. Obstructs the engine's air intake (e.g., carburetor or air filter), reducing power
 - C. Blocks the pitot tube
 - D. Coats the windshield

4. "Instrument icing" most directly threatens the:

- A. Wings
- B. Engine
- C. Pitot-static system (and other sensors), causing erroneous indications
- D. Landing gear

5. The most significant aerodynamic effect of structural ice accumulation is:

- A. Disrupted airflow that reduces lift, increases drag and weight, and raises the stall speed
- B. Improved lift
- C. Reduced drag
- D. No effect on performance

6. Even a small amount of ice on the wing leading edge can:

- A. Improve climb performance
- B. Reduce weight
- C. Significantly degrade lift and increase the stall speed
- D. Have no effect

7. Ice accumulation increases the stall speed, which means the aircraft can stall at:

- A. A lower angle of attack only
- B. A higher airspeed than normal
- C. A lower airspeed
- D. The same speed regardless

8. A particularly dangerous form of tail icing can cause a:

- A. Wing stall only
- B. Loss of the propeller
- C. Engine failure
- D. Tailplane (horizontal stabilizer) stall, often during flap extension, producing a sudden nose-down pitch

9. Ice on the propeller:

- A. Improves thrust
- B. Reduces propeller efficiency and thrust, and can cause vibration
- C. Has no effect
- D. Cools the engine

10. "Anti-ice" systems are designed to:

- A. Prevent ice from forming (e.g., heated surfaces, weeping wing, pitot heat)
- B. Remove ice after it forms
- C. Melt ice on the ground only
- D. Detect ice only

11. "De-ice" systems are designed to:

- A. Prevent ice from forming
- B. Heat the cabin
- C. Remove ice after it has accumulated (e.g., pneumatic boots that break off ice)
- D. Detect ice only

12. Pneumatic de-ice boots work by:

- A. Heating the wing
- B. Inflating to crack and shed accumulated ice from the leading edges
- C. Spraying fluid
- D. Vibrating

13. A limitation of light-aircraft icing equipment is that most are:

- A. Not certified for flight into known icing, and any installed equipment has operational limits
- B. Capable of unlimited icing flight
- C. Effective against severe icing
- D. Required on all aircraft

14. Encountering unexpected icing, the first and most important action is to:

- A. Continue the flight as planned
- B. Exit the icing conditions — change altitude or course to reach air that is warmer than freezing or clear of visible moisture
- C. Increase speed
- D. Lower the flaps

15. Climbing or descending to escape icing depends on:

- A. The fuel remaining
- B. The transponder code
- C. The aircraft weight only
- D. The location of warmer-than-freezing air or above the moisture, based on temperature and cloud tops/bases

16. If warmer air is below and terrain permits, the pilot may:

- A. Climb into colder air
- B. Maintain altitude
- C. Descend to an altitude where the temperature is above freezing to melt/sublimate the ice
- D. Increase speed only

17. During an icing encounter, the pilot should also:

- A. Retract the flaps and ignore the airspeed
- B. Reduce power
- C. Carry extra airspeed on approach/landing (the higher stall speed) and consider not extending full flaps if tail icing is a concern
- D. Slow to minimum controllable airspeed

18. Carrying additional airspeed when ice-contaminated is prudent because:

- A. It cools the engine
- B. It reduces drag
- C. It charges the de-ice boots
- D. The stall speed is increased and handling is degraded, so a margin above the contaminated stall speed is needed

19. A pilot accumulating ice should advise ATC and:

- A. Request a different altitude or routing to exit the icing, and a priority handling if needed
- B. Squawk 7500
- C. Continue silently
- D. Cancel IFR

20. "Known icing conditions" generally refers to:

- A. Any cloud
- B. Forecast freezing temperatures only
- C. Visible moisture only
- D. Conditions where ice formation is reported or forecast/observed such that a reasonable pilot would expect icing

21. Flight into known icing in an aircraft not certified/equipped for it is:

- A. Permitted with caution
- B. Recommended
- C. Prohibited/unsafe — the aircraft lacks the means to cope with ice accumulation
- D. Required to be reported

22. Carburetor icing (an induction icing form) is addressed by:

- A. Pitot heat
- B. De-ice boots
- C. The alternate static source
- D. Applying carburetor heat to melt the ice and restore induction air

23. Pitot heat protects against instrument icing by:

- A. Heating the wing
- B. Preventing ice from blocking the pitot tube, preserving airspeed indication
- C. Heating the cabin
- D. Removing wing ice

24. The best overall strategy regarding icing is to:

- A. Avoid known/forecast icing conditions in the first place, especially in aircraft not equipped for it, through preflight planning
- B. Rely on de-ice equipment
- C. Fly faster
- D. Climb above all clouds

25. The fundamental principle of handling in-flight icing is that the pilot must:

- A. Continue through the ice
- B. Recognize the accumulation and its performance effects, use any available anti/de-ice equipment within its limits, exit the icing promptly by changing altitude/course, carry an airspeed margin, and land as soon as practical
- C. Slow down and maintain altitude
- D. Disregard the stall speed increase

ANSWER KEY & EXPLANATIONS – SESSION 77

1. C. Visible moisture + freezing — Structural icing forms when the aircraft flies through visible moisture at or below freezing temperatures.
2. D. Structural/induction/instrument — The three general categories of in-flight icing are structural, induction, and instrument icing.
3. B. Air intake — Induction icing obstructs the engine's air intake (e.g., carburetor or air filter), reducing power.
4. C. Pitot-static/sensors — Instrument icing most directly threatens the pitot-static system and other sensors, causing erroneous indications.

5. A. Reduced lift/more drag — The most significant effect of structural ice is disrupted airflow that reduces lift, increases drag and weight, and raises the stall speed.
6. C. Degrades lift/raises stall — Even a small amount of leading-edge ice can significantly degrade lift and increase the stall speed.
7. B. Higher airspeed — Ice raises the stall speed, so the aircraft can stall at a higher airspeed than normal.
8. D. Tailplane stall — Tail icing can cause a tailplane stall, often during flap extension, producing a sudden nose-down pitch.
9. B. Reduced thrust/vibration — Propeller ice reduces propeller efficiency and thrust and can cause vibration.
10. A. Prevent formation — Anti-ice systems prevent ice from forming (heated surfaces, weeping wing, pitot heat).
11. C. Remove after forming — De-ice systems remove ice after it has accumulated (e.g., pneumatic boots).
12. B. Inflate/crack ice — Pneumatic boots inflate to crack and shed accumulated ice from the leading edges.
13. A. Not certified for known icing — Most light-aircraft icing equipment is not certified for flight into known icing, and any installed equipment has operational limits.
14. B. Exit the icing — The first and most important action is to exit the icing conditions by changing altitude or course.
15. D. Location of warmer/clear air — Climbing or descending to escape icing depends on the location of warmer-than-freezing air or above the moisture.

16. C. Descend to above-freezing — If warmer air is below and terrain permits, the pilot may descend to an altitude where the temperature is above freezing.

17. C. Extra airspeed/flap caution — During icing, the pilot carries extra airspeed on approach/landing and considers not extending full flaps if tail icing is a concern.

18. D. Higher stall speed — Additional airspeed is prudent because the stall speed is increased and handling is degraded.

19. A. Request altitude/route — The pilot advises ATC and requests a different altitude or routing to exit the icing, with priority handling if needed.

20. D. Reported/forecast icing — "Known icing conditions" refers to conditions where ice formation is reported or forecast/observed such that a reasonable pilot would expect icing.

21. C. Prohibited/unsafe — Flight into known icing in an aircraft not certified/equipped for it is prohibited/unsafe.

22. D. Carburetor heat — Carburetor icing is addressed by applying carburetor heat to melt the ice and restore induction air.

23. B. Protects pitot — Pitot heat prevents ice from blocking the pitot tube, preserving airspeed indication.

24. A. Avoid icing — The best overall strategy is to avoid known/forecast icing conditions through preflight planning.

25. B. Recognize/equip/exit/margin/land — The fundamental principle is to recognize the accumulation and its effects, use any available anti/de-ice equipment within its limits, exit the icing promptly, carry an airspeed margin, and land as soon as practical.