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Area of Operation **II** - Task **C**

Visual Scanning and Collision Avoidance

Content

westflying

Key References:

- Airplane Flying Handbook
- Pilot's Handbook of Aeronautical Knowledge
- Pilot's role in collision avoidance (AC 90-48)

1. Introduction

- **What**: Learn about the pilot's role in scanning the sky for potential collision threats, and how to do it effectively
- **Why**: All pilots are bounded by the "see-and-avoid" while in VMC to avoid mid-air collisions

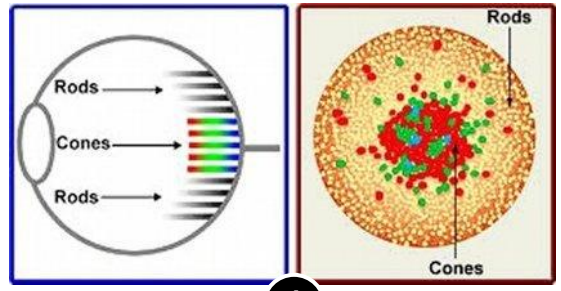
- **See and Avoid: §91.113(b)**
  - If visual conditions allow (VFR or IFR) → **Pilot must see and avoid other aircraft**

- **Right of Way rules: §91.113(c-g)**
  - Distress: Aircraft in distress has right-of-way over any other
  - Converging:
    - ✓ *Same category: aircraft to the Right has right-of-way*
    - ✓ *Different category: **Ballon → Glider → Airship → Airplane/Rotorcraft***
    - ✓ *Towing/refueling has right-of-way of any other engine-driven aircraft*
  - Approaching head-on: both aircraft change course to the Right
  - Overtaking: the aircraft being overtaking has right-of-way (overtakes to the Right)
  - Landing: aircraft on final has right-of-way
    - ✓ *If multiple aircraft, lowest altitude has RoW… but shall not take advantage*

2. Visual Scanning

1 Eyes

- Cones: ~5M cells (center of the retina, rear of the eye), see colors, high spatial acuity
- Rods: ~100M cells (peripheral area), no colors, 1000x more sensitive, peripheral/night vision



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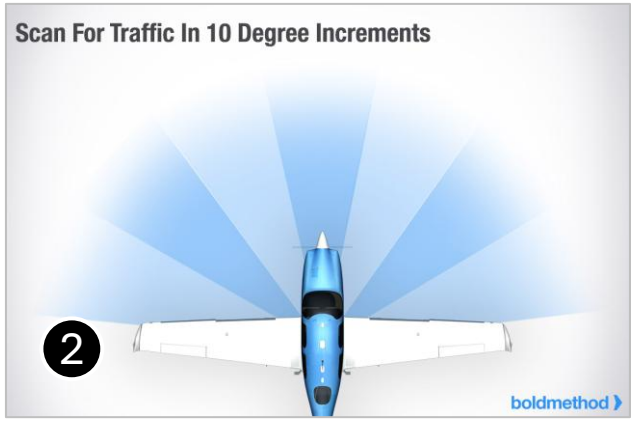
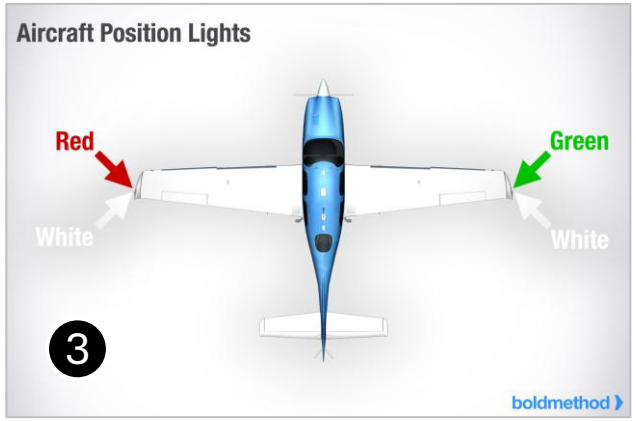
• Effective Scan

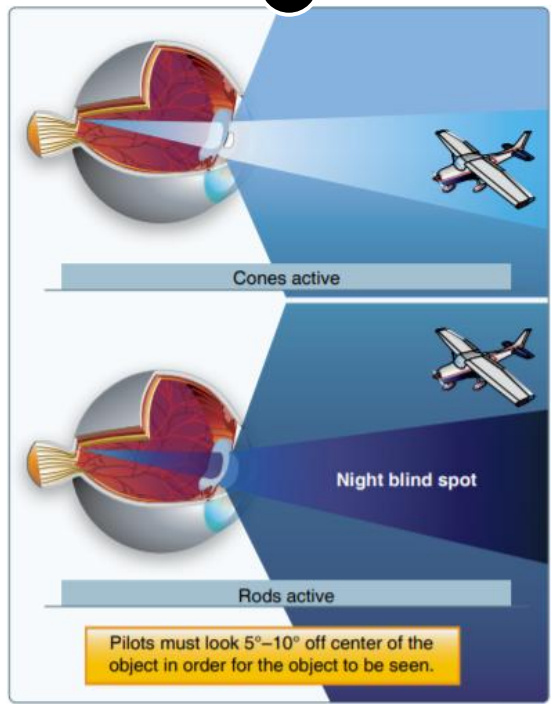
2 Day: short (at least 1 second) and regularly spaced eye movement (10° sector)

3 Night: look 5-10° off-center (cones are blind spot) and interpret position lights

4 Leverage ADS-B In to enhance situational awareness







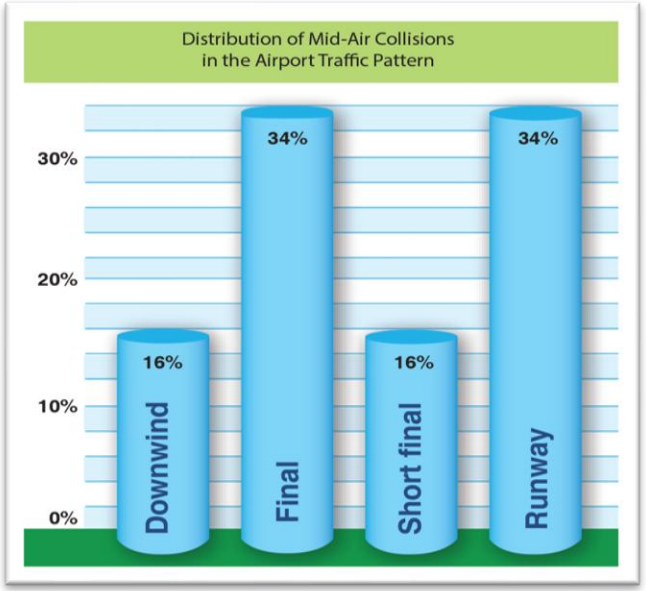
3. Clearing Procedures

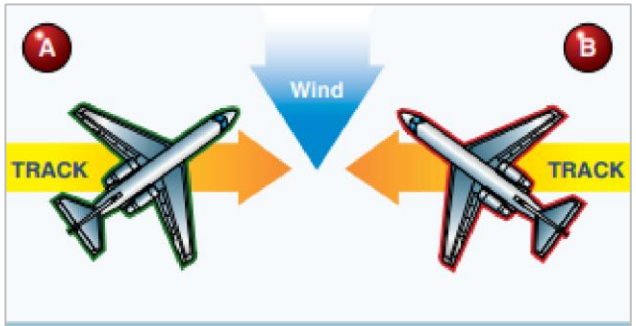
- **Before Takeoff**
  - Ensure the runway and final is clear (both approaches in non-towered fields)
- **Climbs & Descents**
  - Execute gentle banks left and right, and maintain a consistent scan
  - Momentarily level off to see traffic ahead
- **Straight-and-Level**
  - Execute clearing turns at periodic intervals, and maintain a consistent scan
- **Traffic Patterns**
  - Descend to TPA before entering the pattern
  - Maintain a constant visual scan for other aircraft
  - If extending downwind/upwind, let others know and be extra vigilant
  - Ensure no traffic entering downwind "straight-in" before turning crosswind
  - Ensure final is clear before turning base and before turning final
  - *Be aware of Instrument flights coming on long final, "opposite" final, and circling opposite pattern*
- **Be aware of blind spots**

4. Recognizing Hazards

- **Mid-Air Collisions:**
  - Generally occur during daylight hours (most in the afternoon)
  - Most mid-air collisions occur under good visibility
  - Most likely to occur between two aircraft going in the same direction
  - Nearly all accidents occur at or near uncontrolled airports, below 1,000 feet
  - Pilots of all experience levels can be involved in mid-air collisions

- **Hazards to look for:**
  - Near VORs, training Areas, near airports or scenic areas
  - Blind Spots: Momentarily raise/lower the wing prior to turns/climbs/descents
  - Parallel/Multiple runways: overshoot and entering in the other aircraft's path
  - Same altitude traffic: use the horizon as reference (above = higher altitude)
  - Collision Course:
    - ✓ *If no relative movement (+ increasing size in the windscreen)*
    - ✓ *Traffic alerts from ATC always given based on track (not heading)*
    - ✓ *Take immediately action (don't become "mesmerized" w/ traffic)*





Traffic information would be issued to the pilot of aircraft "A" as 12 o'clock. The actual position of the traffic as seen by the pilot of aircraft "A" would be 1 o'clock. Traffic information issued to aircraft "B" would also be given as 12 o'clock, but in this case, the pilot of "B" would see traffic at 10 o'clock.

5. Collision Avoidance

- **General Recommendations:**
  - Cockpit Management: More preparation and organization allows for more focus outside
  - Visual Obstructions: Ensure clear windscreen (do not block it with maps/checklists)
  - Be Visible: Use exterior lights, and keep interior lights low at night to preserve night vision
  - Resources: Use ATC (flight following for traffic advisories) and ADS-B In whenever possible

- **Stay Safe around Airports:**
  - Report position 10 miles out and listen for reports from other inbound traffic
  - Descend to TPA before entering the pattern
  - Maintain a constant visual scan for other aircraft
  - Use exterior lights to improve the chances of being seen
  - At a non-towered airport:
    - ✓ *Monitor the correct CTAF (not all aircraft might be communicating)*
    - ✓ *Follow the proper pattern: 91.126 (class G), 91.127 (class E)*
    - ✓ *Report entering downwind, turning downwind to base, and base to final*
    - ✓ *Be aware of Instrument flights coming on long final, "opposite" final, and circling opposite pattern*

6. Degraded Vision

Several factors contributed with reducing the pilot's ability to properly scan

- **Environmental**
  - Excessive light (glare) causes watering eyes, temporary blindness ➔ use sunglasses and shades
  - Smoke, haze, dust, rain, and flying toward the sun can limit ability to see other aircraft
- **Lack of light**
  - Dim Lighting: small print and charts harder to read, taking focus from flying and scanning
  - Dark adaptation: Takes 30 minutes for full adaptation, but only a few seconds to lose it
  - Night vision can be impaired by pressure altitudes > 5,000ft, carbon monoxide, Vitamin A deficiency
- **Empty Field Myopia** (*Nothing to focus on*)
  - Causes focus on a point slightly ahead, resulting in poor scanning
  - How to prevent/minimize:
    - ✓ *Day: Force eyes to focus further ahead*
    - ✓ *Night: Force eyes to focus on distant light sources*
- **Other Physical health impact: medicines, fatigue, hypoxia, etc**

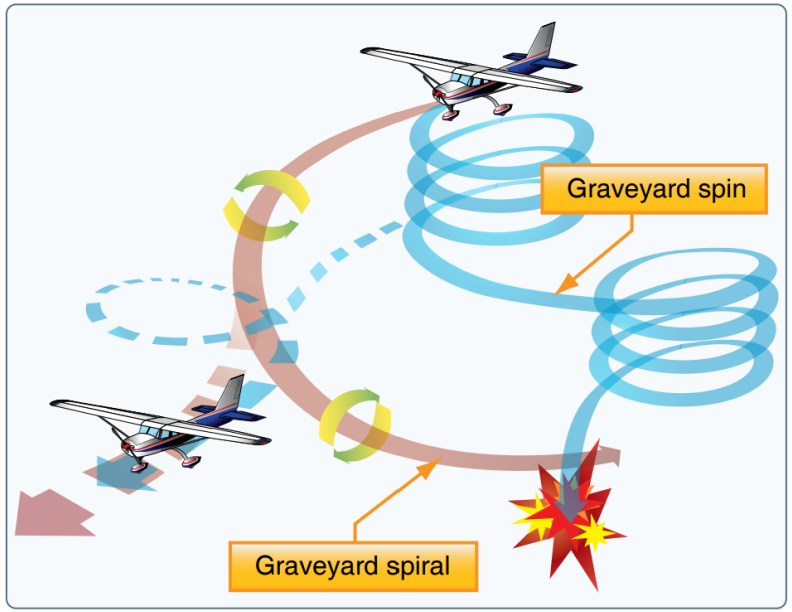
7. Controlled Flight into Terrain (CFIT)

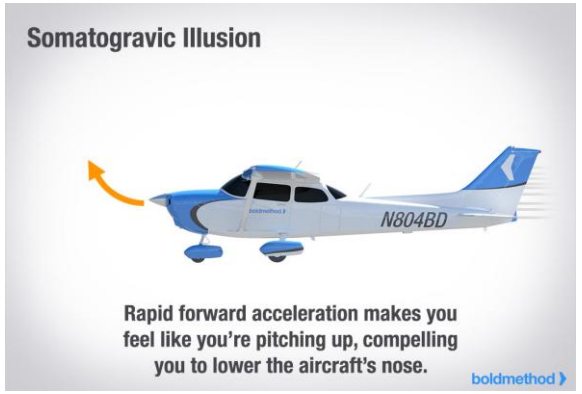
- CFIT: unintentional collision with terrain or obstacle while an aircraft is under positive control
- Approximately 40/year (most during the day in visual conditions) ➔ a relevant portion involving Wire Strikes
- **Common Causes**
  - Poor decision making
  - Low flying aircraft
  - Distractions and loss of Situational Awareness
  - Inadequate preparation or Improper operation
  - Marginal weather conditions
- **How to Avoid**
  - Training: particularly use of simulators when going to unfamiliar area
  - Plan ahead (take obstacles in consideration)
  - Maintain Situational Awareness
  - Avoid Marginal Weather
  - TAWS (Terrain Avoidance and Warning System) if equipped
  - Use Foreflight's "Hazard Advisor" and the "Profile View"

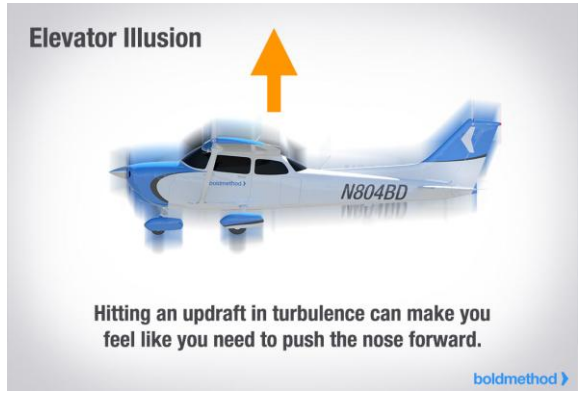
8. Spatial Disorientation & Illusions

Vestibular Illusions

- Leans: pilot levels after prolonged turn and thinks it is now turning opposite
- Coriolis: movement of head (looking down on iPad and up, gets disoriented)
- Graveyard Spiral: the Leans causes pilot to return to turn, loses altitude, pitch up
- Somatogravic: acceleration feels climbing, decelerations feels descending.
- Inversion: change from climb to straight/level feels tumbling backwards
- Elevator: updraft causes the pilot to pitch down



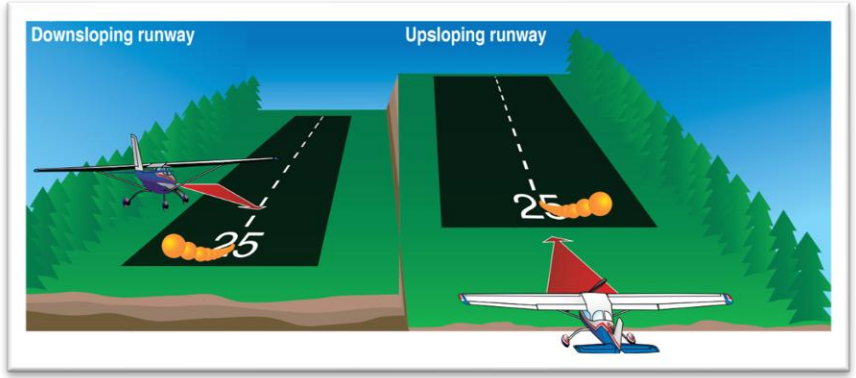


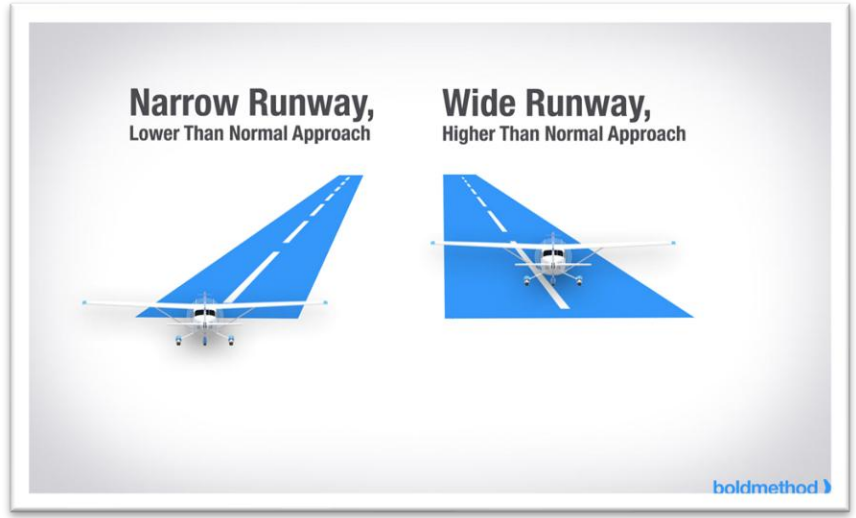


8. Spatial Disorientation & Illusions

Visual & Optical Illusions

- False Horizon: attempt to align the aircraft with sloped terrain, clouds or lights
- Autokinesis: in the dark, a stationary light may appear to move
- Runway Width: narrower runway appears high; wider runway appears low
- Runway Slope: upslope appears high; download appears low
- Featureless Terrain ("Black Hole"): the aircraft appears to be higher than it is
- Rain: illusion of being at a greater altitude (water refraction, horizon appears low)
- Haze: makes it appear of being at greater distance
- Fog: illusion of pitching up
- Ground lighting: other lights can be mistaken for runway/approach lights

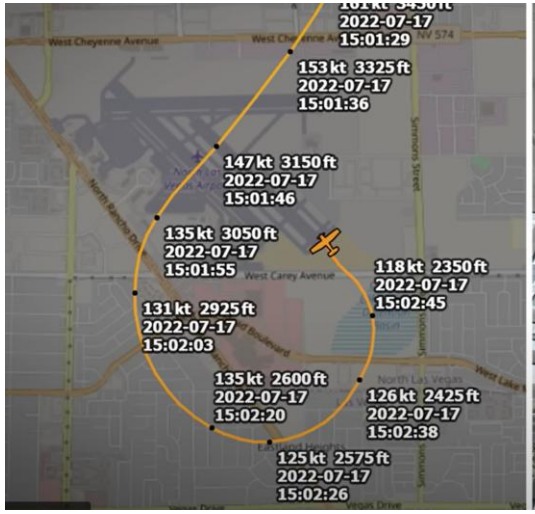




9. Real Cases

2022, North Las Vegas (KVGT, Class D)

Piper Malibu aligns to the wrong runway and collides w/ a C172 on final - 4 people (fatal)



2021, Centennial Airport, CO (KAPA, Class D)

Cirrus crosses rwy centerline and hits a Key Lime Air (Metroliner) - 2 people, no injuries

2022, Maryland

Pilot hits powerlines
Approaching too low
2 people, serious injury

2021, Georgia

Pilot hits powerlines
1 people, some injury

Questions?