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Area of Operation **II** - Task **H**

Night Operations

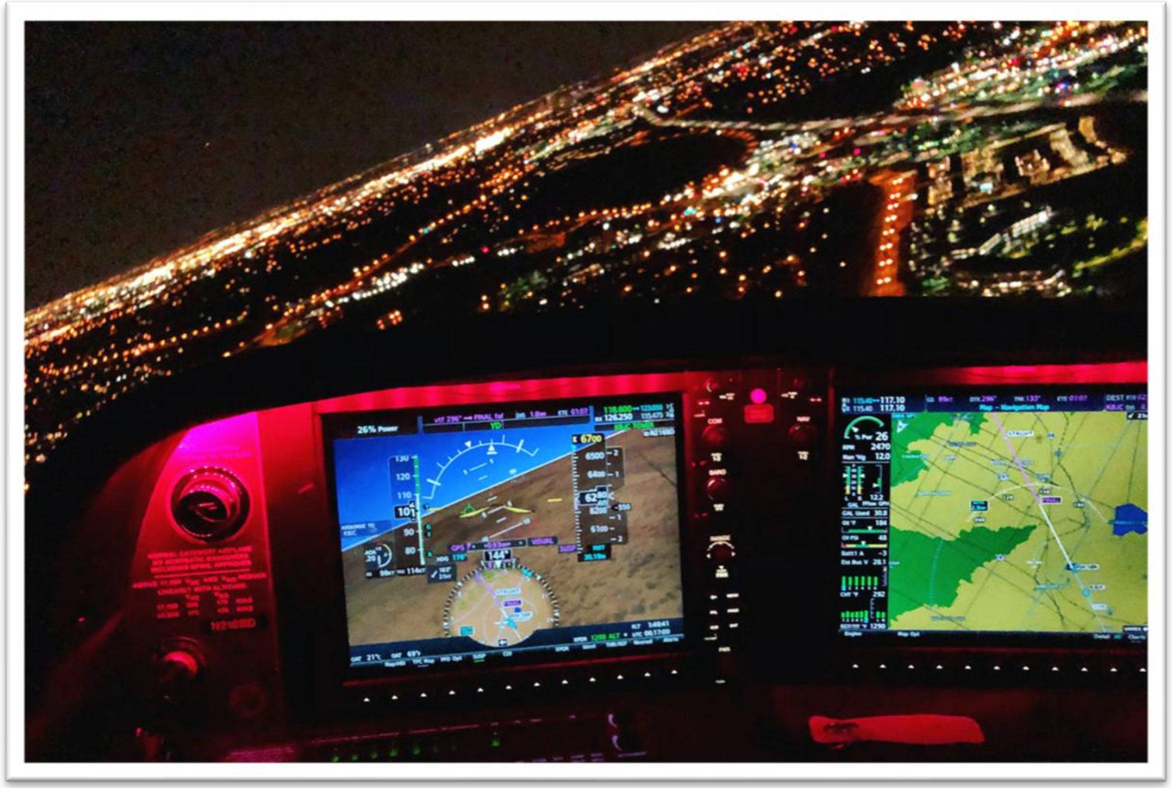
westflying

Key References:
- Airplane Flying Handbook
- Pilot's Handbook of Aeronautical Knowledge

Content

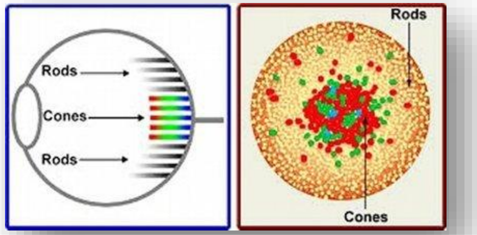
1. Introduction

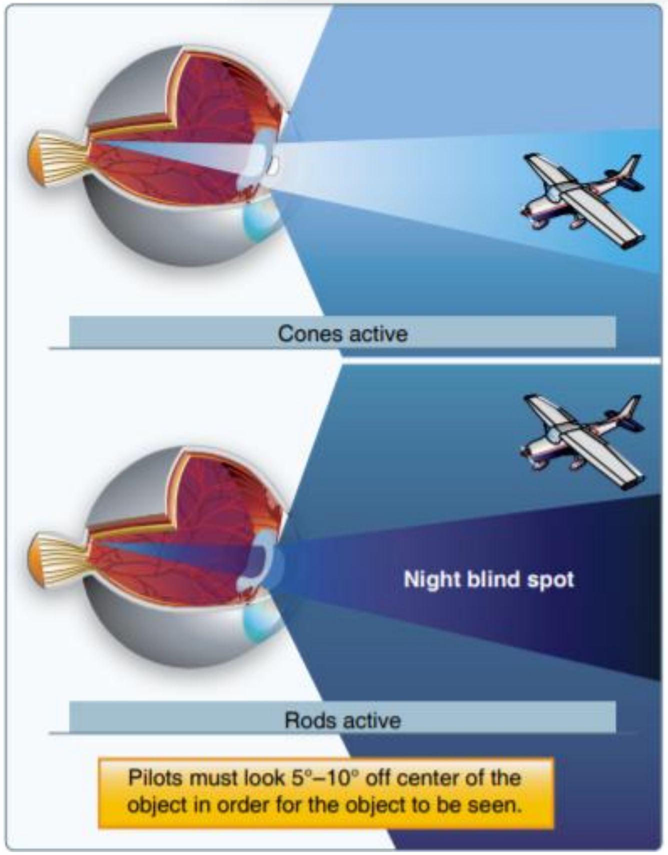
- **What**: Learn about the factors related to operating an airplane at night
- **Why**: Night flying is different than day flying and presents unique situations that can be hazardous
- **What to expect when flying at night**
  - ✓ Pleasant overall
  - ✓ Air is generally smoother (convection dissipates)
  - ✓ Less aircraft in the sky
  - ✓ Quieter radio
  - ✓ ATC less busy and more accommodating
  - ✓ More shorter routes (less crowded airspaces)
  - ✓ Easier to spot aircraft in distance (lights)
  - ☒ Mountains and obstruction might be invisible
  - ☒ Less options for forced landing (higher risk)
  - ☒ Harder to spot weather
  - ☒ More challenging ground operations
  - ☒ Spatial disorientation

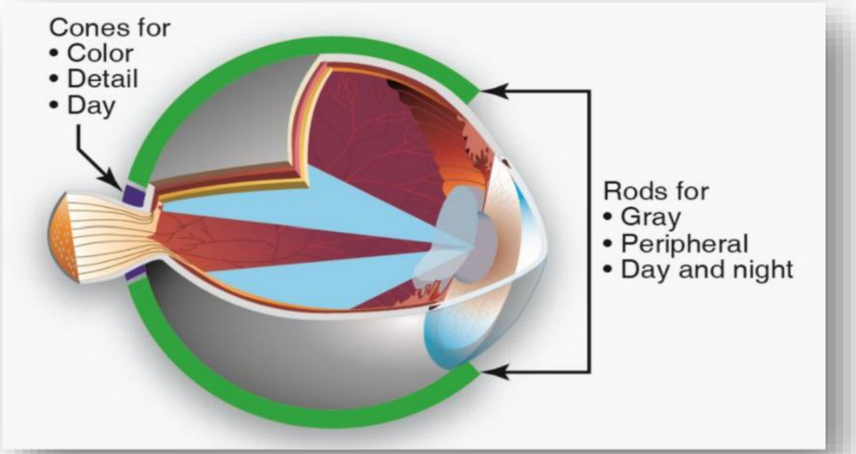


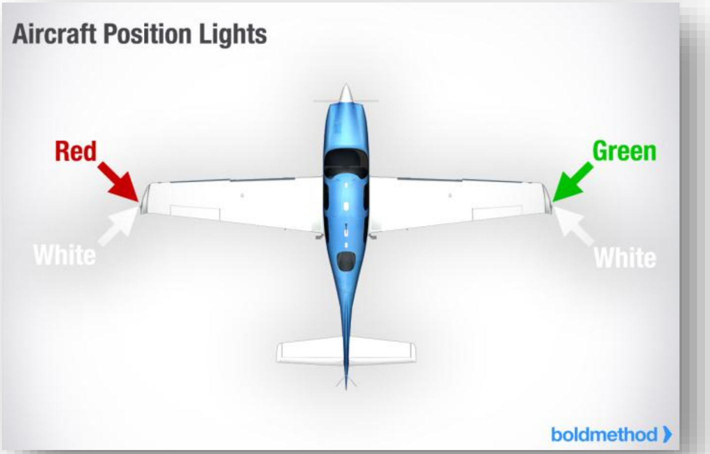
2. Night Vision

- **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
- **Night Vision is based on Rods**
  - Poor resolution, degrades at altitude and with medication (or CO poisoning)
  - Night adaptation takes about 30min
- **Effective Scan at night**
  - Look 5-10º off-center (cones are blind spot) and interpret position lights









3. Disorientation and Optical Illusions

- **Combatting Disorientation:**
  - Use visual references as much as possible
  - Leverage vertical guidance (VASI, PAPI, glideslope)
  - Verify attitude by reference to the instruments
- **Illusions**
  - False Horizon – The natural horizon is mistaken by lights or other reference
  - Autokinesis – When staring at a point of light (dim light), it appears to move on its own
    - ✓ *Focus on objects at varying distances and avoid fixating*
  - Ground Lighting – Ground lighting can be mistaken for runway or approach lights
  - Featureless Terrain (Black hole) – The aircraft appears to be higher than it is
    - ✓ *Leverage PAPI/VASI, and in doubt, make a higher approach*
  - Reversible Perspective Illusion – Another aircraft appears to be moving away when it is actually getting closer
    - ✓ *Observe their lights (increasing intensity = getting closer) and position lights (Green on the left = getting closer)*
  - Size-Distance Illusion – Light getting brighter or dimmer can be mistaken for getting closer or farther away
  - Flicker Vertigo – Flickering light (4-20 cycles per second) can produce unpleasant and dangerous reactions
    - ✓ *If in the clouds and strobes reflection is making you dizzy, turn them off momentarily*

4. Interior Lights and Pilot Equipment

- **Interior Lights**
  - Dim PFM/MFD (continue dimming as your eyes adapt)
  - Turn on only necessary interior/instrument lights and dim as much as possible

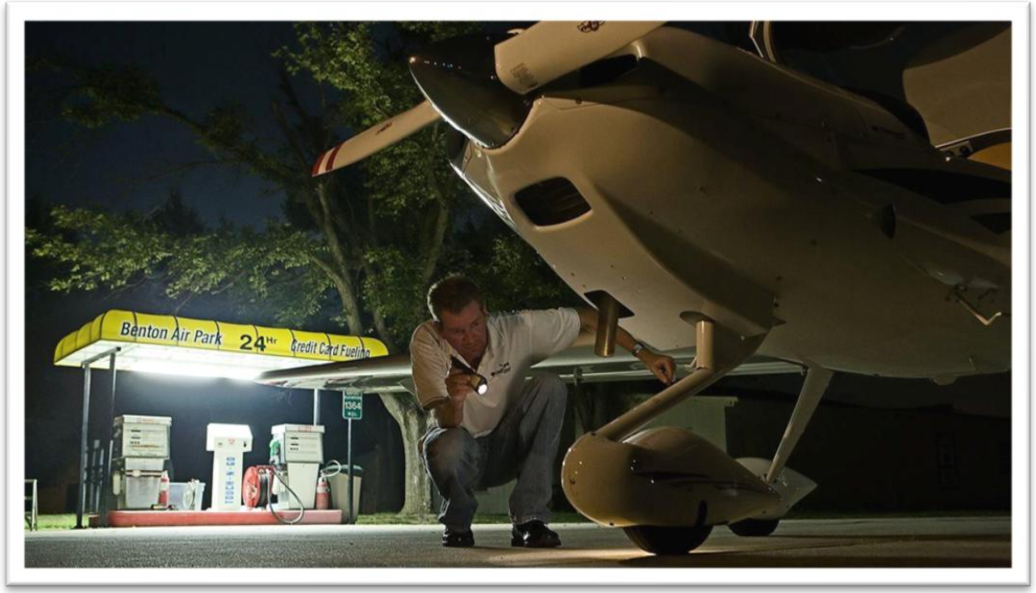
- **Pilot Equipment**
  - White Flashlight – Preflight
  - Red Flashlight – to read charts
    - ✓ *Red light is non-glaring and will not impair night vision*
    - ✓ *Red light distort color perceptions (chart, checklist, etc)*
  - Aeronautical Charts
    - ✓ *Yellow areas mean ground/city lights*
    - ✓ *If using Foreflight ➔ Turn it to the night (dark) mode*

- **Avoid looking at Bright lights**
  - Strobes of other aircraft at the ramp

5. Preflight Inspection at Night

- **Ensure Night Required Equipment** **(91.205)**
  A TOMATO FLAMES (day VFR) + FLAPS (night VFR)
  - **F** – Fuses (spare set or 3 each kind)
  - **L** – Landing light (if for hire)
  - **A** – Anticollision lights
  - **P** – Position lights (nav lights)
  - **S** – Source of electrical energy

- **Walk Around**
  - Use a white flashlight for the inspection
  - Normal walk around but extra focus on night equipment
  - Don't stare directly at the strobes
  - Check all lights
  - Check ramp for obstructions



6. Engine Start, Taxi and Run-up

- **Engine Start**
  - Turn on position and anti-collision lights prior to start, and announce “clear prop”
  - Take extra precaution to ensure the propeller area is clear
  - To avoid battery drain, leave all unnecessary equipment off until after start
- **Taxiing**
  - It is hard to spot an airplane on the ground at night!
  - Turn on Navigation, position, and anti-collision lights
    - ✓ *Strobe lights should not be illuminated during taxi if they will adversely affect other pilots*
    - ✓ *Turn on taxi light when moving or intending to move, turn it off when stopped / yielding*
  - Taxi slower, be more cautious (less time to react), sterile cockpit, focus outside
  - Crossing a Runway: All exterior lights should be illuminated
  - Orientation ➔ Airport Diagram, be familiar w/ taxiway markings, lights, and signs
- **Run-up**
  - Airplane movement is harder to detect at night
  - Be extra cautious for other people, aircraft, equipment

Aircraft Exterior Lights are defined on AIM 4-3-23

7. Takeoff and Climb

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- **General**
  - Same procedures as during the day, but with reduced visual references
  - Flight instruments are used to a greater degree
- **Clear final approach** *(Note illusions when parallel runways)*
- **Entering the runway**
  - All lights on, except the landing light (turn it on when clear to takeoff)
    - ✓ *Line up approximately 3' off the centerline (allows landing aircraft to differentiate you from runway lights)*
    - ✓ *Cleared for takeoff (controlled field) or starting takeoff roll (uncontrolled): Landing lights on*
  - Verify the proper runway (runway signs, heading, ground markings, lights, etc.)
- **Takeoff Roll**
  - Same as a day takeoff, but with less visual references ➔ Check the flight instruments more frequently
- **Climb**
  - Darkness can make it difficult to tell if the airplane is climbing ➔ Easier to lose reference of the horizon
  - Check instruments, VSI, Altitude indicator and Attitude Indicator (mindful of the "black hole departure")

Aircraft Exterior Lights
are defined on AIM 4-3-23

8. In-Flight Orientation

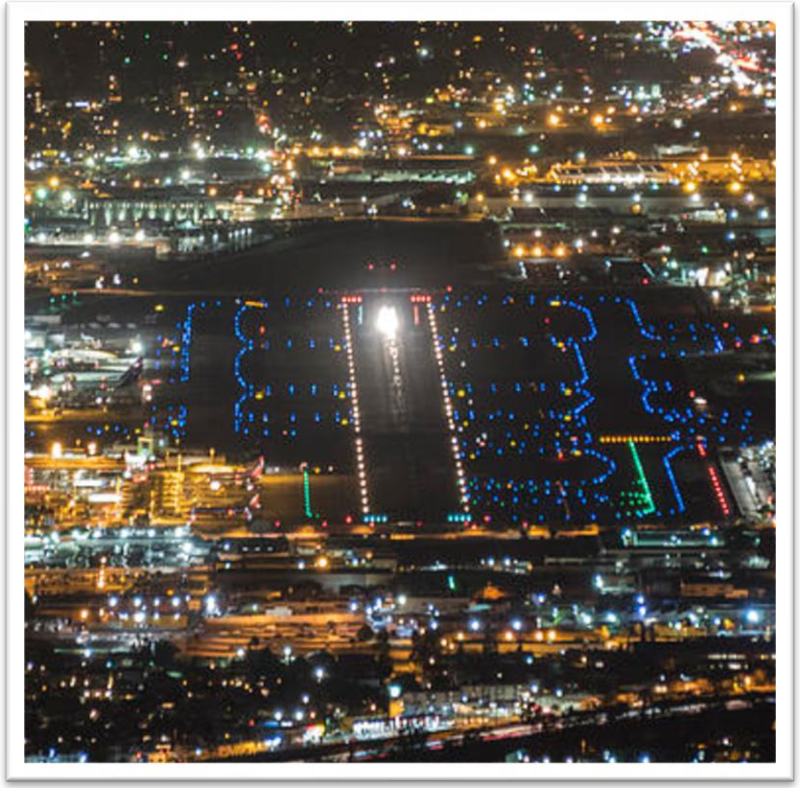
- **Navigating**
  - Good references: <u>Large concentrations of lights</u> (cities, highways), <u>patterned lights</u> (airports, street grids)
  - <u>Finding airports at night</u>: look for the green-white flashing airport beacons 
  - Fly at <u>higher altitude</u> and combine with radio navigation

- **Ground Based Lighting**
  - Lighting appear different at higher and lower altitudes
- **Clouds and Low Visibility**
  - <u>Identify</u> and <u>avoid VFR into IMC</u> conditions:
    - ✓ *Gradual disappearance of the ground*
    - ✓ *Glowing (halo) around ground lights*
    - ✓ *Reflection of the strobe light*
  - If on IMC, <u>turn around and return to VMC conditions</u>

- **Large Bodies of Water**
  - Easy to become disoriented: <u>water blends with the horizon</u>
  - Rely more heavily on the instruments and radio navigation

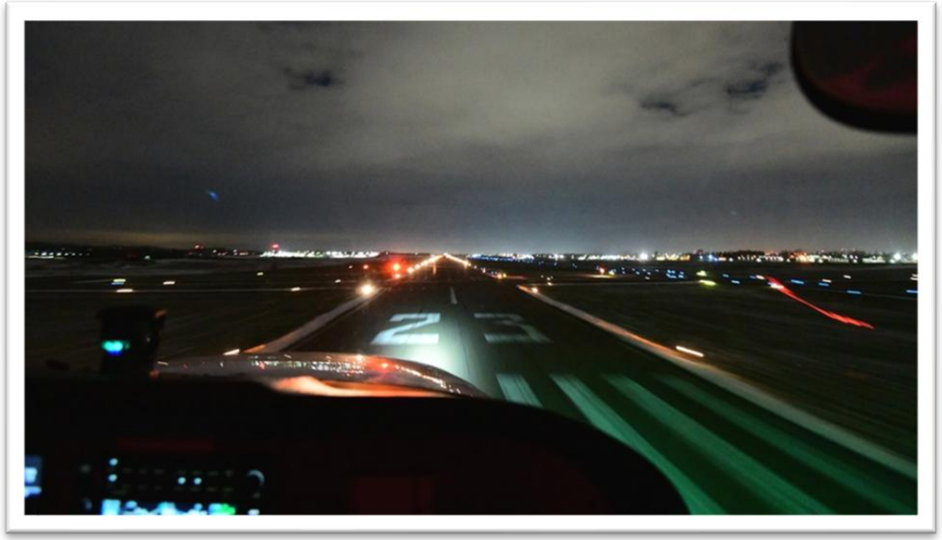
9. Traffic Pattern at Night

- **Identify the airport lighting**
  - Fly towards the airport beacon
  - Might need to key the mic to activate runway lighting
- **Compare the runway with the heading indicator**
- **Positively identify the runway threshold and runway-edge lights**
- **Fly the traffic pattern:**
  - The same way you would fly it during the day
  - Use consistent power, speed and configuration settings
  - You'll come out on glide path when you turn final
  - Careful with illusions
  - Keep situational awareness (maintain the runway in sight)

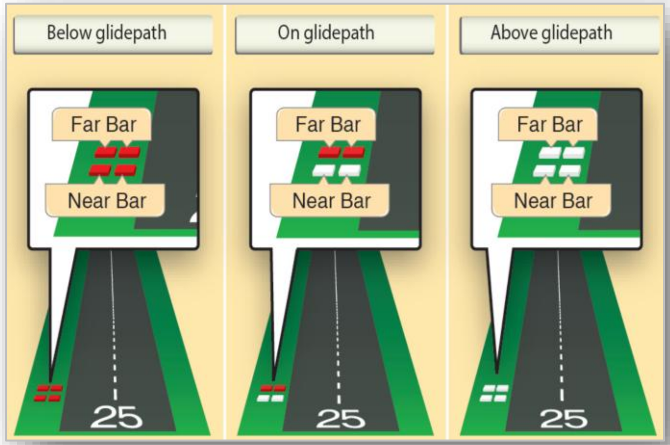


10. Approach, Landing & Go-Around

- **Approach**
  - Stable approach with greater reference to the flight instruments
  - If no centerline lights, align the airplane between the edge lights
  - Use vertical guidance whenever available



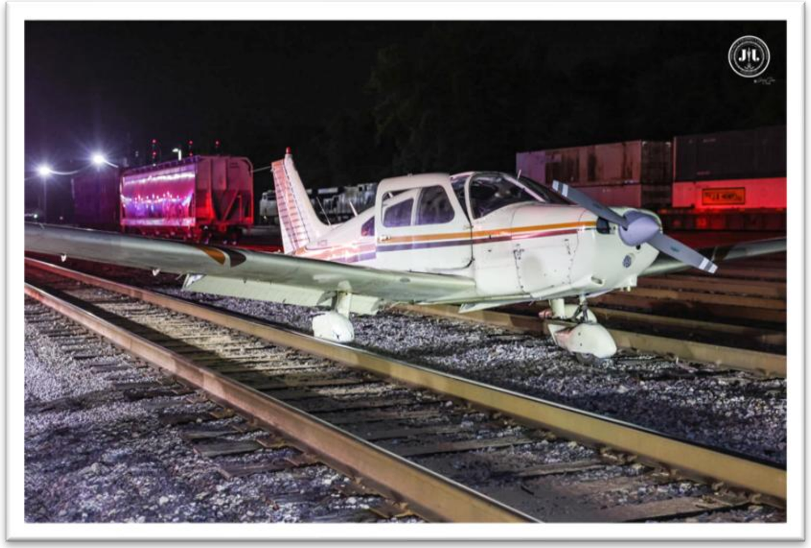
- **Landing**
  - Judgment of height/speed/sink rate may be impaired (roundout high)
  - Whenever possible, leverage PAPI and VASI
  - With Landing Lights:
    - ✓ *Start the roundout when the tire marks are visible*
  - Without Landing Lights:
    - ✓ *Start the roundout when the far end runway lights rises higher above the nose*
    - ✓ *Set a landing attitude and shallow rate of descent*
    - ✓ *Leave in a bit of power and slowly ease down (smooth sink rate)*



- **Go-Around**
  - Fly a normal go-around with greater reference to the instruments

11. Night Emergency Procedures

- **Electrical Failure**
  - Follow the POH/Checklist (reduce electrical load, backup instruments as needed, land asap)
- **Engine Failure**
  - Follow the POH/Checklist (usually the same procedure as day flight)
    - ✓ *Airspeed, landing area, trouble shooting, ATC call, transponder, forced landing checklist*
- **Considerations about Areas for Forced Landing at Night:**
  - If the condition of the terrain is known/suitable ➔ turn towards an unlighted portion of the area
    - ✓ Likely inhabited land (fields) but can also be hazards (mountains)
    - ✓ Roads are generally surrounded by power lines or other hazards
    - ✓ Parking lots might seem attractive at first, but might endanger others
    - ✓ It will come down to ADM
  - Consider an emergency landing area close to public access



Questions?