Night Operations

Objective

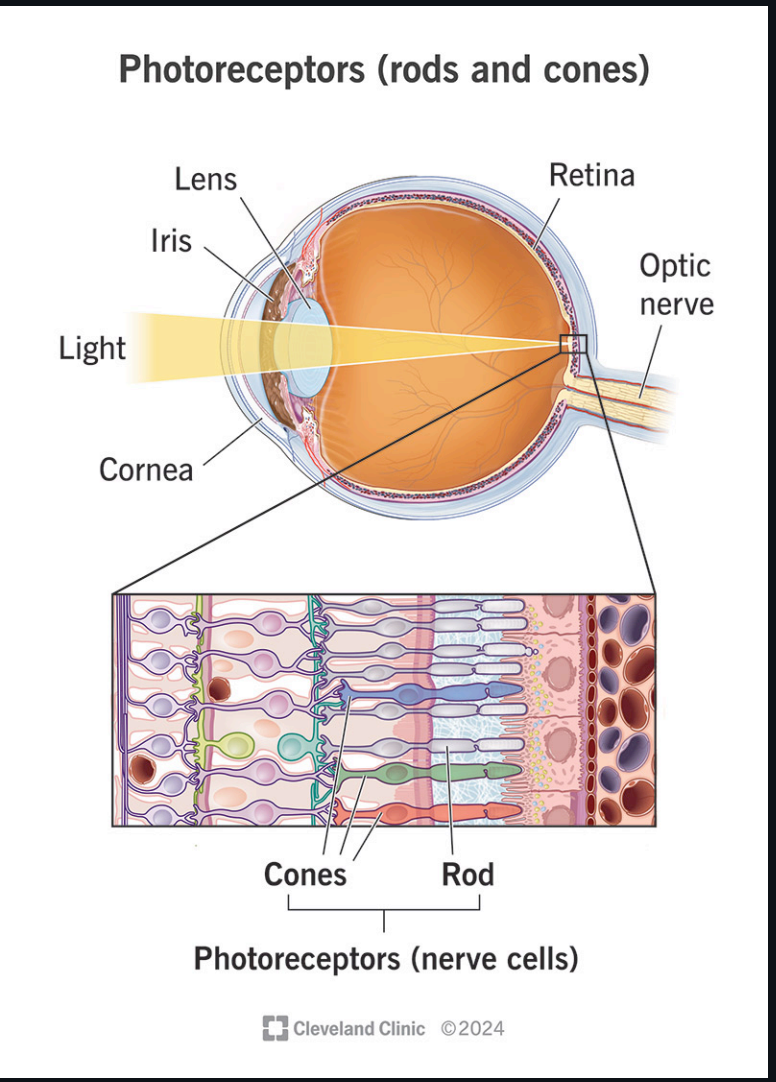
To understand the risks and challenges for operating aircraft at night.

Motivation

Night flying is a privilege of a private pilots, and involves numerous additional risk factors from day flying. We want to know how to identify and mitigate those risk, and fly effectively when its dark.

Overview

- The eye and night vision
- Dark Adaptation
- Night Illusions
- Legal definitions of night
- Night flying equipment
- Rotation Beacons
- Airport Lighting
- Pilot-Controlled Lighting
- Night takeoffs
- Night navigation
- Night approaches and landings

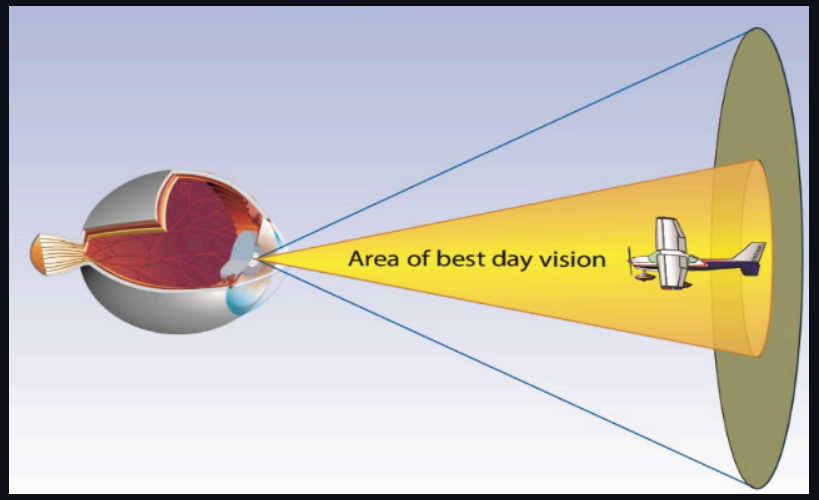


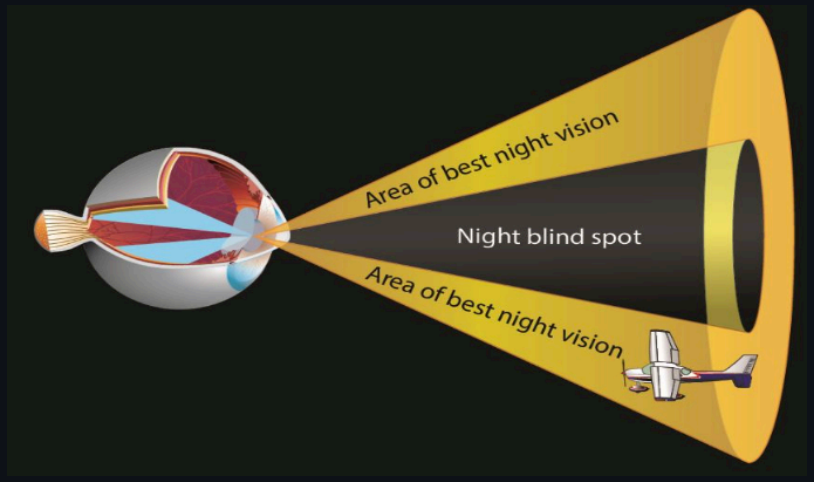
The Eye and Night Vision

Visual receptors in our eyes:

- Cones: Very acute, color, detail, daytime
- Rods: Very sensitive, gray, peripheral, day and night
  - Become deficient with even mild hypoxia

Vision Types





Vision types:

- Photopic vision: Primary central vision - cones
- Mesopic vision: Fading light vision - mix of cones and rods
- Scotopic vision: Dark conditions - rods

Dark Adaptation

- Dark to light: Adaptation is almost instant
- Light to dark: Upwards of 30 minutes
  - Avoid bright light exposure for 30 minutes
  - Cones adjust in 5-10 minutes, the eyes become 100 times more sensitive to light
  - Rods adjust in 30 minutes, the eyes become 100,000 time more sensitive
  - White light can cause temporary blindness and illusions

Factors Affecting Eyesight

- Rods require oxygen to function well
  - They can be impaired by cabin altitudes over 5,000 ft.
  - For this reason, oxygen use is recommended at night over 5,000'
- Fatigue
- Illness
- Smoking
- Drugs
- Alcohol
- Diet

Night Illusions

False Horizon

Autokinesis

- Staring at a single point of light against a dark background for several seconds
- The light will appear to move on its own
- Avoid fixating on single points of light and vary the focus of your eye
- Use good visual scanning technique, scanning the sky in chunks for a few seconds at a time

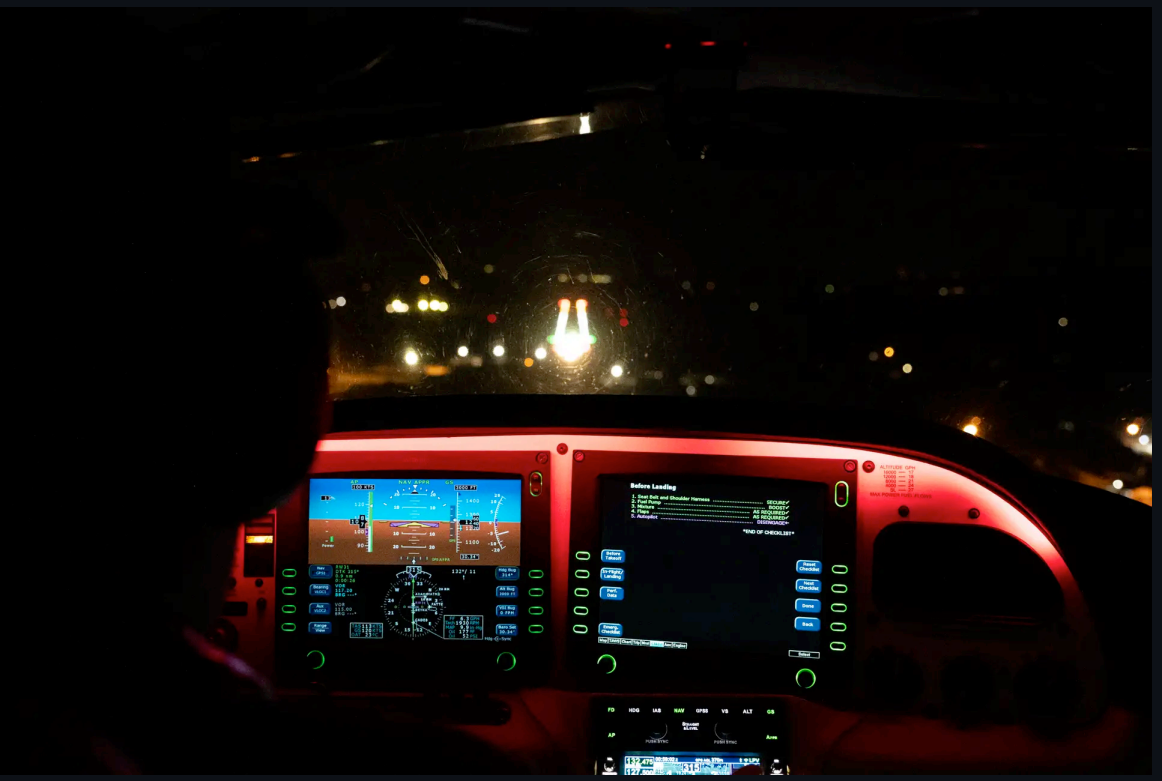
Flicker Vertigo

- Light flickering at a rate between 4 and 20 cycles per second
- Can produce unpleasant or dangerous reactions
- Nausea, vomiting, and vertigo
- Use good visual scanning techniques, avoiding fixation

Black Hole

Use caution when approaching to land with no lights except the runway lights, like over water or rural areas.

- This can cause the pilot to fly the approach lower than intended
- Use a runway with a VASI or PAPI
- Overfly the airport and fly a regular traffic pattern
- IFR pilots: Use an approach with vertical guidance (ILS, LPV, or Garmin visual)



Bright Approach Lights

- Bright approach lights can make you seem closer than you actually are
- Add glare on the windscreen
- Can become blinding as you approach the runway
- For pilot-controlled lighting, use a lower intensity

Using Landing Lights in Clouds

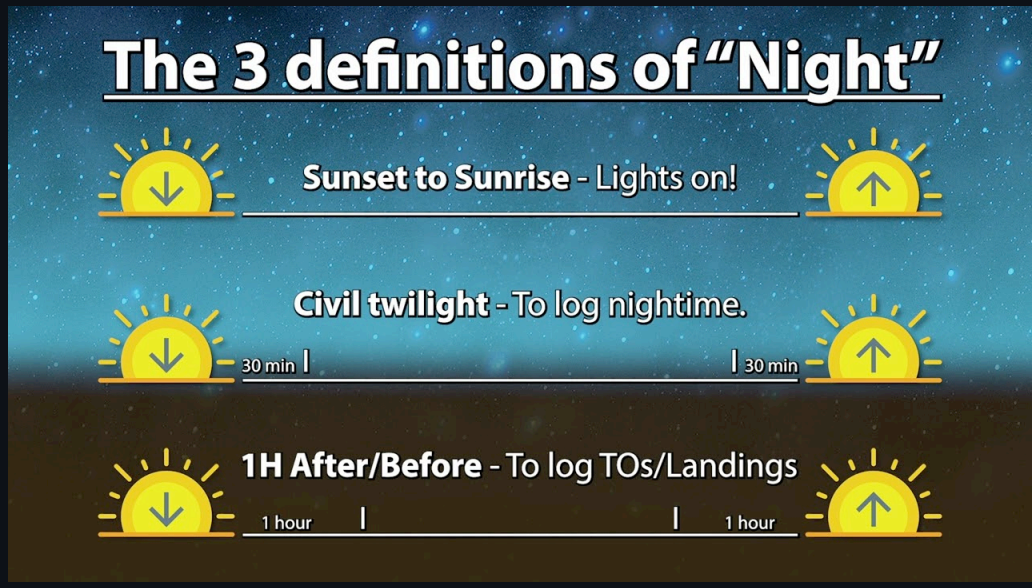
- Illumination of the clouds can cause distortion in the window
- Avoid using landing or taxi lights when flying in the clouds
- Avoid using stroke when in clouds

Legal Requirements for Night Operations

Legal Definitions of Night

There are three different legal definitions of night.

- Aircraft lights (91.209): Sunset to sunrise
  - Position/nav lights on
- Night flight (FAR Part 1) - End of evening civil twilight to start of morning civil twilight
  - Needed to log night flight hours for a certificate/rating
- 90-day night currency (61.57) - 1 hour after sunset to 1 hour before sunrise



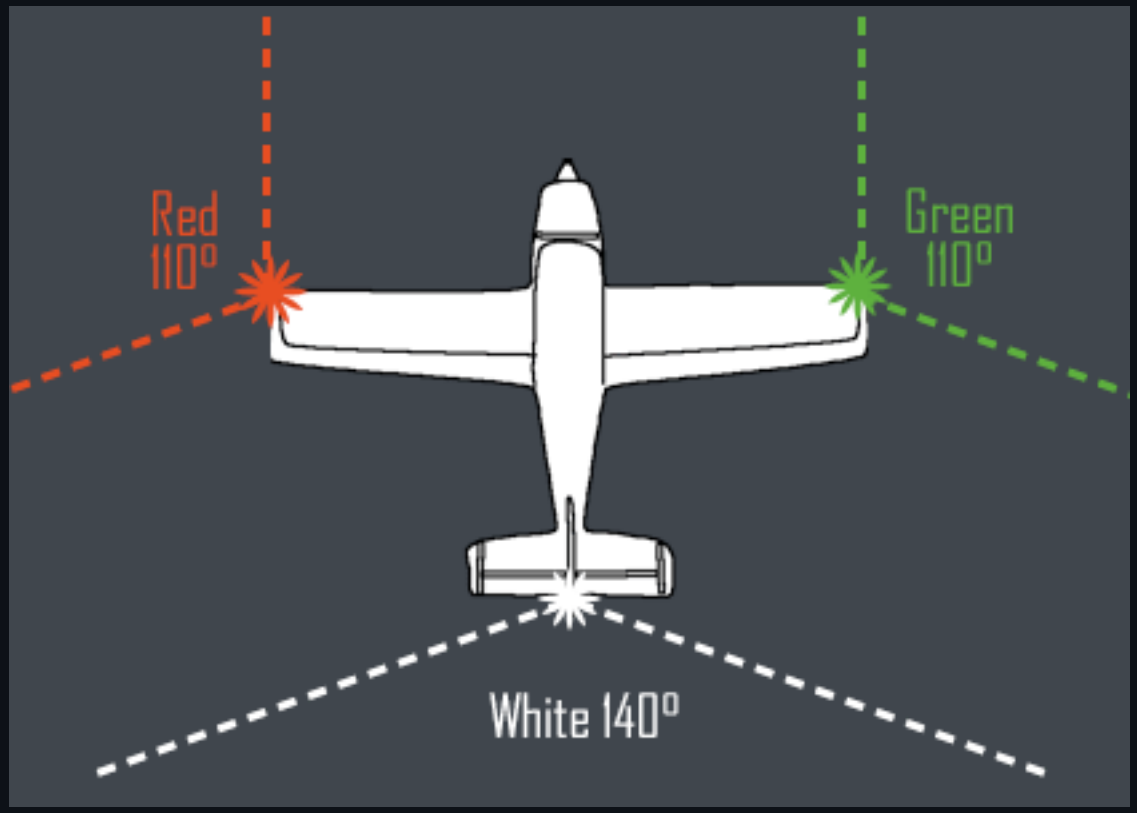
Night Flying Equipment

- Two flashlights, with spare batteries
  - Large white flash light for preflight
  - A smaller red flashlight for use in the cockpit
- Don't preflight with the red light, since hydraulic fluid may be read
- Headlamps with a white/red setting can be helpful in the cockpit

Night VFR - Required Equipment (91.205c)

- FLAPS
  - **F**uses (spares)
  - **L**anding light
  - **A**nti-collision light
  - **P**osition lights
  - **S**ource of electrical power

Position Light Requirements (91.209)



- Anti-collision or beacon lights must be on all the time
- Position lights must be on from sunset to sunrise

Knowledge Check: Position Light Recognition

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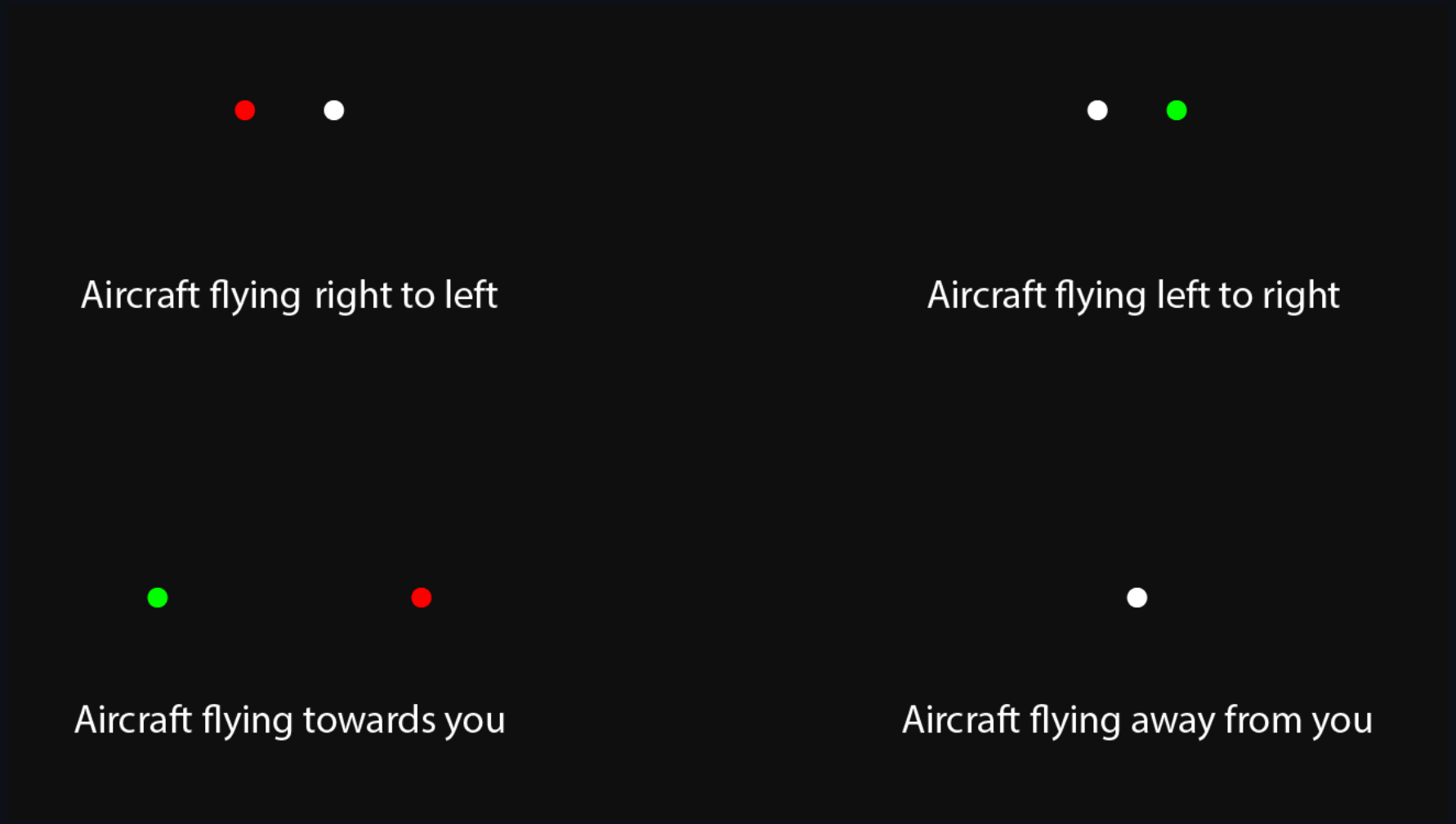
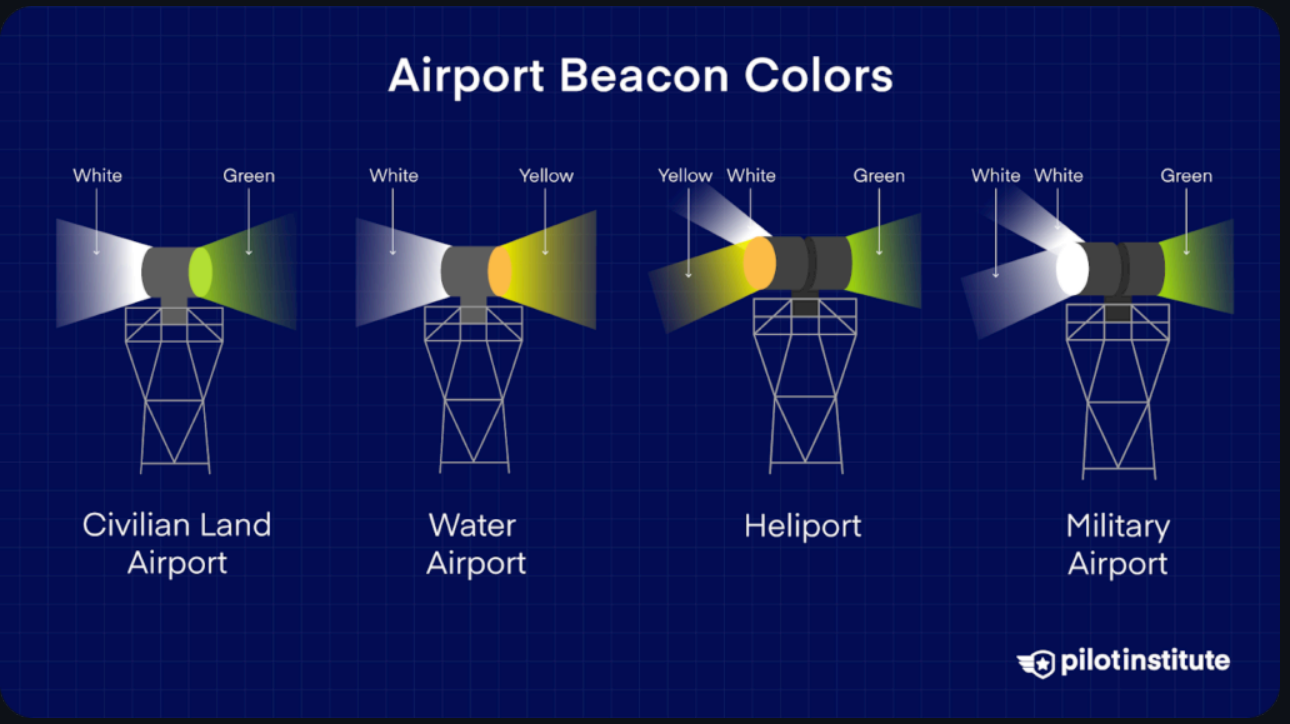


Airport Lighting



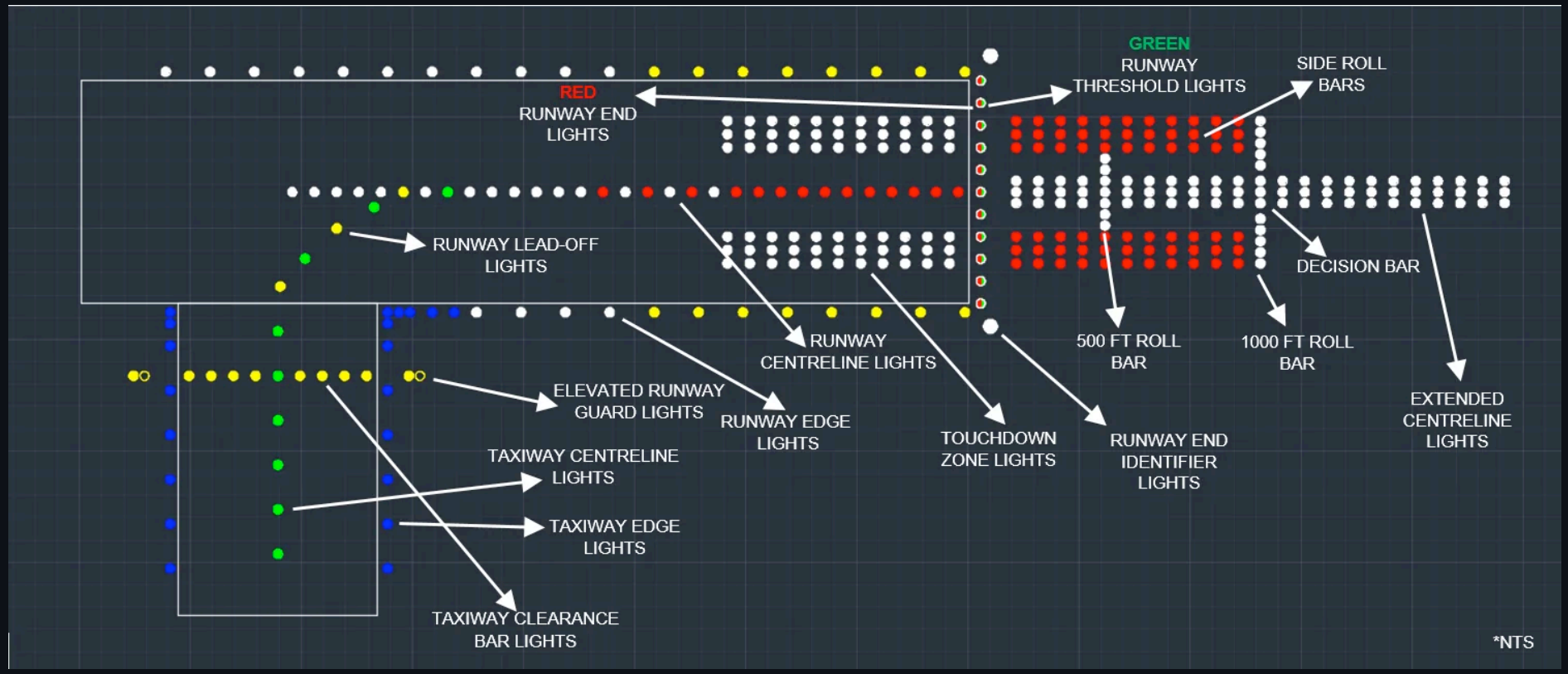
Rotation Beacons

Airport colors:

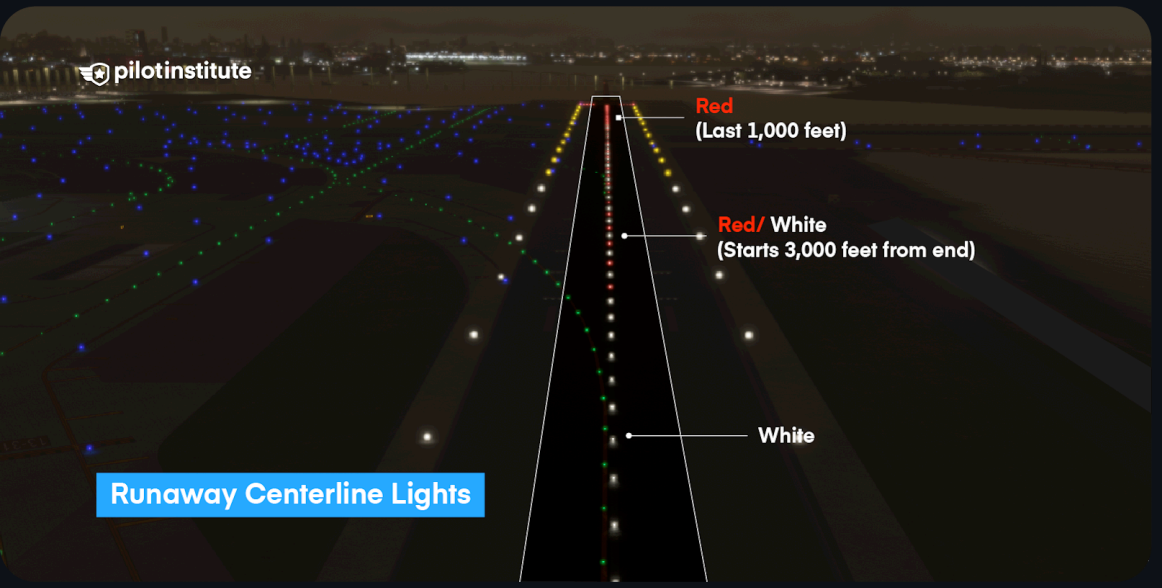
- White/green: Lighted land airport
- Two white flashes/green: Military airport
- White/yellow: Lighted water airport
- White/yellow/green: Lighted heliport

A beacon operating during the daytime may indicate IFR conditions.

Runway Lights



- Various types of approach lighting systems
- Run/green bidirectional lights are used to mark the end of the runway



Runway Lights (cont.)

- Centerline lights
  - White lights mark the centerline of the runway
  - Last 3000' of runway: Alternate red and white lights
  - Last 1000' of runway: All red lights
- Edge lights
  - White lights
  - Last 2000' of runway: Yellow lights

RENTON MUNI (RNT)(KRNT) 0 NW UTC–8(–7DT) N47°29.59′ W122
32 B TPA—See Remarks LRA NOTAM FILE RNT
RWY 16–34: H5382X200 (ASPH–CONC–GRVD) S–100, D–130, 2D–340 MIRL
RWY 16: REIL. PAPI(P2L)—GA 3.0° TCH 50′. Thld dsplcd 304′. Trees.
RWY 34: REIL. PAPI(P2L)—GA 3.75° TCH 59′. Thld dsplcd 340′. Road. Rgt tfc.
RUNWAY DECLARED DISTANCE INFORMATION
RWY 16: TORA–5382 TODA–5382 ASDA–5042 LDA–4742
RWY 34: TORA–5382 TODA–5382 ASDA–5082 LDA–4742
SERVICE: S4 **FUEL** 100LL, JET A, A+ **OX** 1, 2, 3, 4 **LGT** Actvt REIL Rwy 16 and 34; MIRL Rwy 16–34, and twy lgts—CTAF. Rwy 16 PAPI tempo inop.
NOISE: NOISE ABATEMENT procedures in effect ctc admin 425–430–7471.
AIRPORT REMARKS: Attended 1500Z‡–Dusk. Acft rqrg svcs ctc 122.85 or 122.77. Numerous flocks of birds invof arpt and along Lake Washington shoreline at all times. 100LL self serve fuel not avbl. Rwy 34 12′ blast fence 155′ from EOR. Be alert for Boeing production acft being towed across the rwy dur hrs twr clsd. SPB northwest corner of arpt. TPA–1032(1000). TPA West of the fld is 1218′ AGL due to terrain immediately west of the arpt. West twy clsd to acft with wing span 118′ or over. Twy B btn Twy B3 and Twy B5 clsd to acft with wing span 50′ or ov RNT twr has control of the W channel, over the water, at and blo 800′ AGL. outside of RNT twr opr hrs, ctc Boeing twr, 118.3, prior to opr in the W chan
AIRPORT MANAGER: 425-430-7476
WEATHER DATA SOURCES: ASOS 126.95 (425) 255–6080. LAWRS.
COMMUNICATIONS: CTAF 124.7 **ATIS** 126.95 **UNICOM** 122.95
® **SEATTLE APP/DEP CON** 119.2 (028°–160° SEA Rwy 16) (017°–079° SEA Rwy (223°–301° SEA, Rwy 34) 120.4 (301°–340° SEA, Rwy 34) 125.9 (290°– 34) 126.5 (161°–222° SEA, Rwy 16) (126°–222° SEA, Rwy 34) 128.5 (3 Rwy 34)

Pilot-Controlled Lighting (PCL)

- Usually on the CTAF frequency
  - Check chart supplement to confirm
- Clicking the microphone changes the intensity
  - 3 clicks: low intensity
  - 5 clicks: medium intensity
  - 7 clicks: high intensity

Taxiway Lights

- Blue lights outline the taxiway
- Green lights mark the taxiway centerline (at some airports)

Runway Guard Lights - Hold short bars

Used to indicate hold short bars

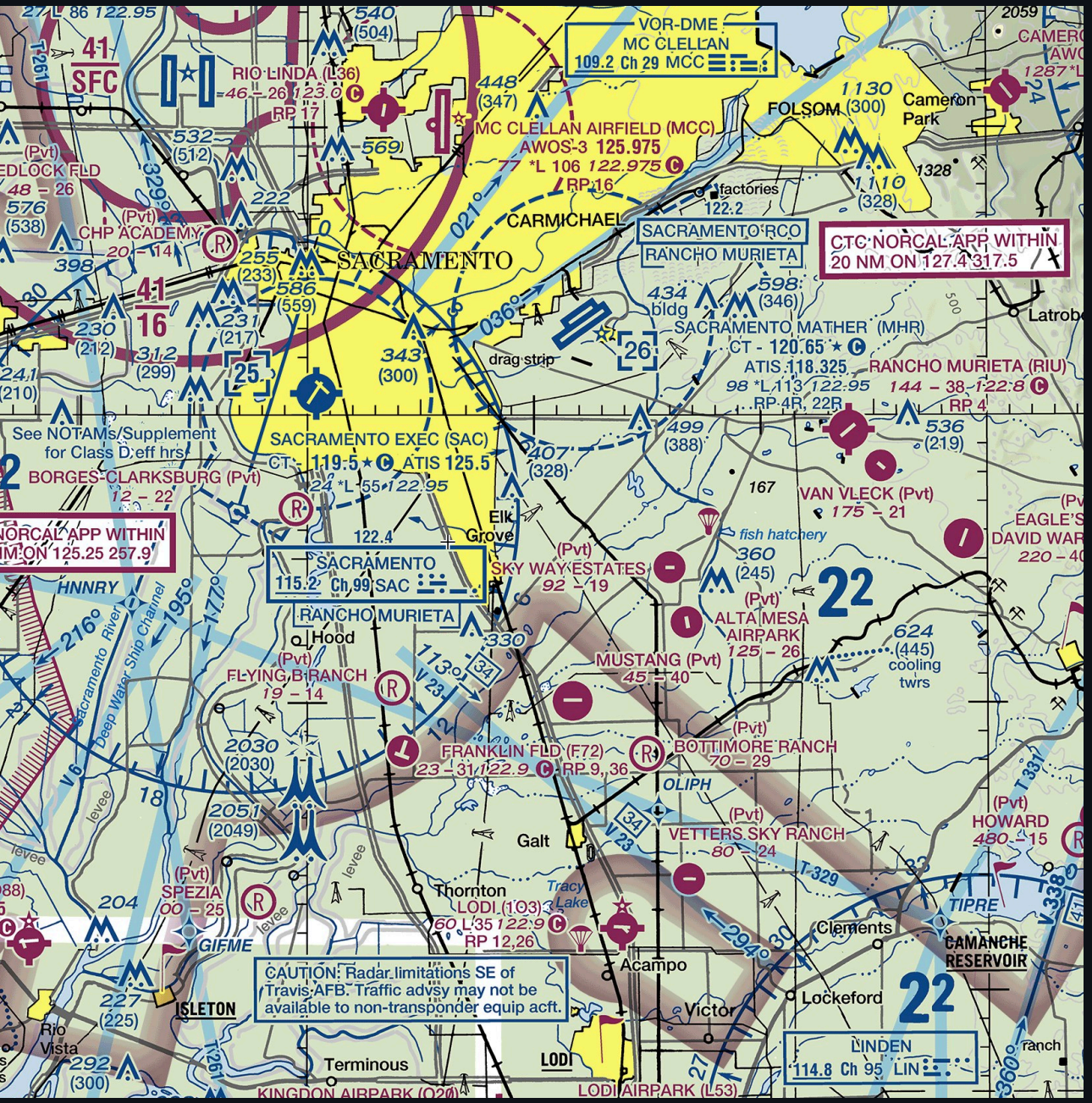
Red stop bar lights - Automatically activate when the runway is active

Start, Taxi, and Runup at Night

- Beacon/anti-collision lights on before starting engine
- Taxi with taxi lights, or landing lights on (if equipped)
- Hold brakes firmly during runup
  - It's difficult to detect any movement of the aircraft

Night Takeoffs

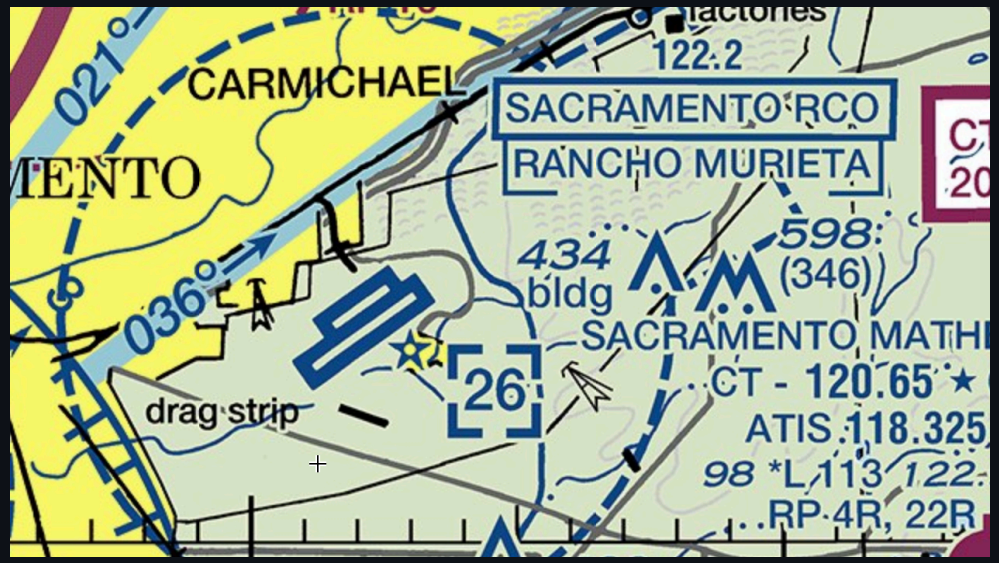
- Relay on flight instruments, since fewer visual references are available
- Ensure a positive rate of climb using the altimeter and VSI
- Use heading indicator to maintain heading



Night Navigation

- Be careful with iPad brightness at night
- Use good pilotage
  - Cross-check urban areas on the sectional with city lights
  - Identify airports and obstacles where you expect them

Beacons on a Sectional



Lighted Obstacles

Guy wires may extend outward from obstacles.

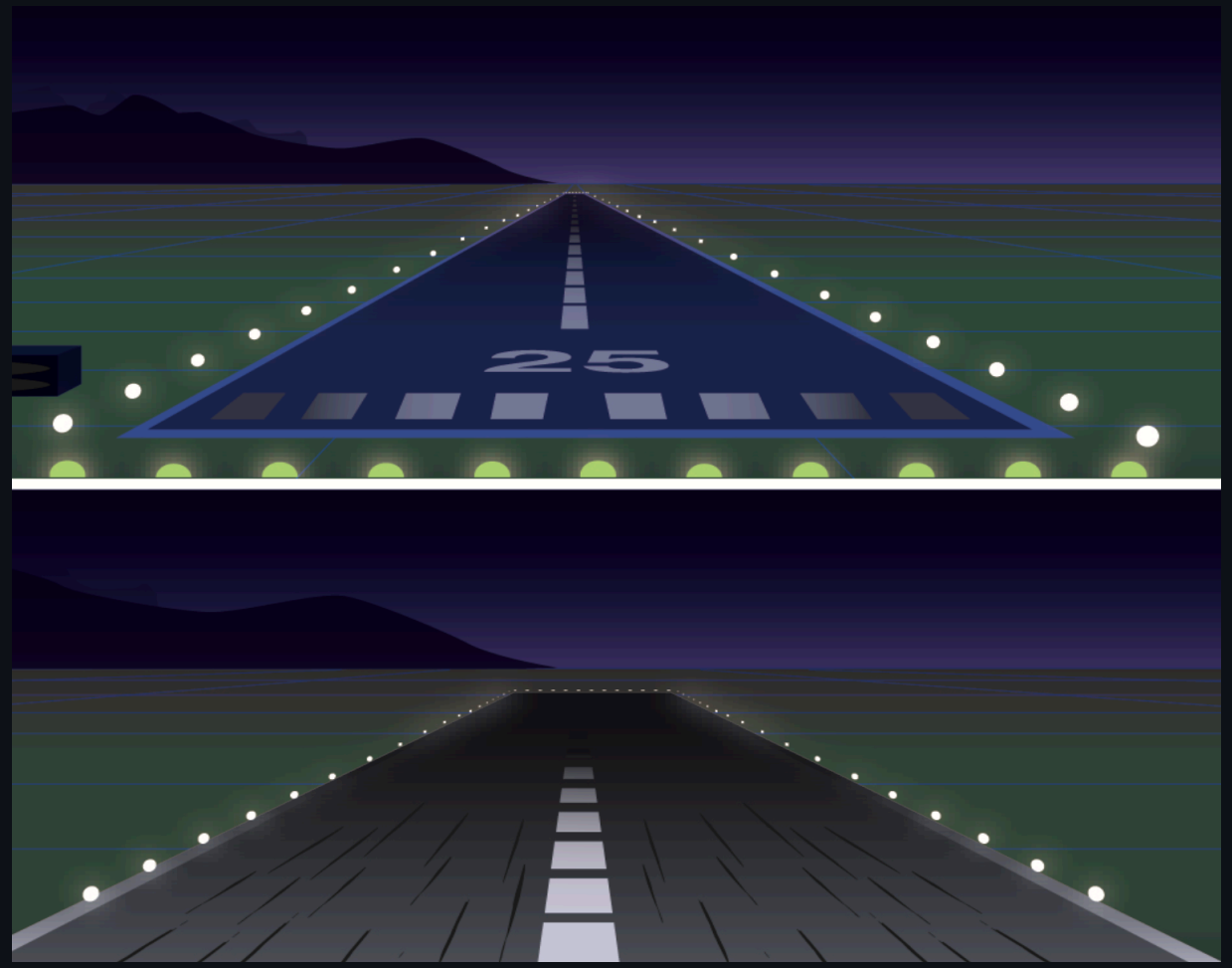
Wind turbines with high intensity lighting.

Obstacles with high-intensity strobe lighting systems may operate part-time or by proximity activation and are shown as follows:

Night Approaches and Landings

- Identify the airport and runway early
- Fly a normal traffic pattern
- Use normal power and flap settings
- Use a heading bug on the runway heading to help prevent disorientation
- Fly a stabilized approach
  - Use the VASI or PAPI
  - Use glideslope indicator, if available
- It can be difficult to judge distance and height
  - Tendency to approach slow and flare high

Judging Flare Height



Round out just when tire marks become visible on the runway.

Emergencies at Night

What is a minor emergency in the day may be a major emergency at night.

- Engine failure:
  - Same emergency procedure as the day, but landing options will be limited
- Alternator failure:
  - Attempt to reset the alternator with circuit breakers and master switch
  - Otherwise, turn off non-essential equipment and land

Summary

- Dark adaptation: 30 minutes to adjust
- Night illusions: Good scanning habits
- Legal definitions of night: Logging vs lights vs currency
- Night flying equipment: FLAPS
- Rotation beacons: Airports are green and white
- Airport lighting: PCL 3, 5, 7 clicks
- Night takeoffs: Use your instruments
- Night navigation: Use good pilotage
- Night approaches: Use glideslope aid
- Emergencies at night: Land on what you can see, but know the risks

Knowledge Check

You are flying at night and see a white light and a green light ahead of you.

What is the other aircraft's relative position?

Knowledge Check

You see a light on the ground that has two white flashes, then a green flash.

Can you land at that airport?

Knowledge Check

Your engine fails at night. You are flying above and Interstate highway.

Would you land on the highway? What are some of your concerns?

Knowledge Check

You are on a long cross-country flight at night in eastern Washington. You are flying over a large area of unlit terrain. In the distance you see a group of synchronized flashing red lights.

What do you think they are?