Private Pilot (ASEL) Ground School Course

Lesson 25 | Night Flying

Lesson Overview

Lesson Objectives:

- Develop knowledge of night flying
- Develop an understanding of the night illusions and pitfalls

Lesson Completion Standards:

- Student demonstrates satisfactory knowledge of night flying by answering questions and actively participating in classroom discussions.

Basics of Night Operations

Night Flying

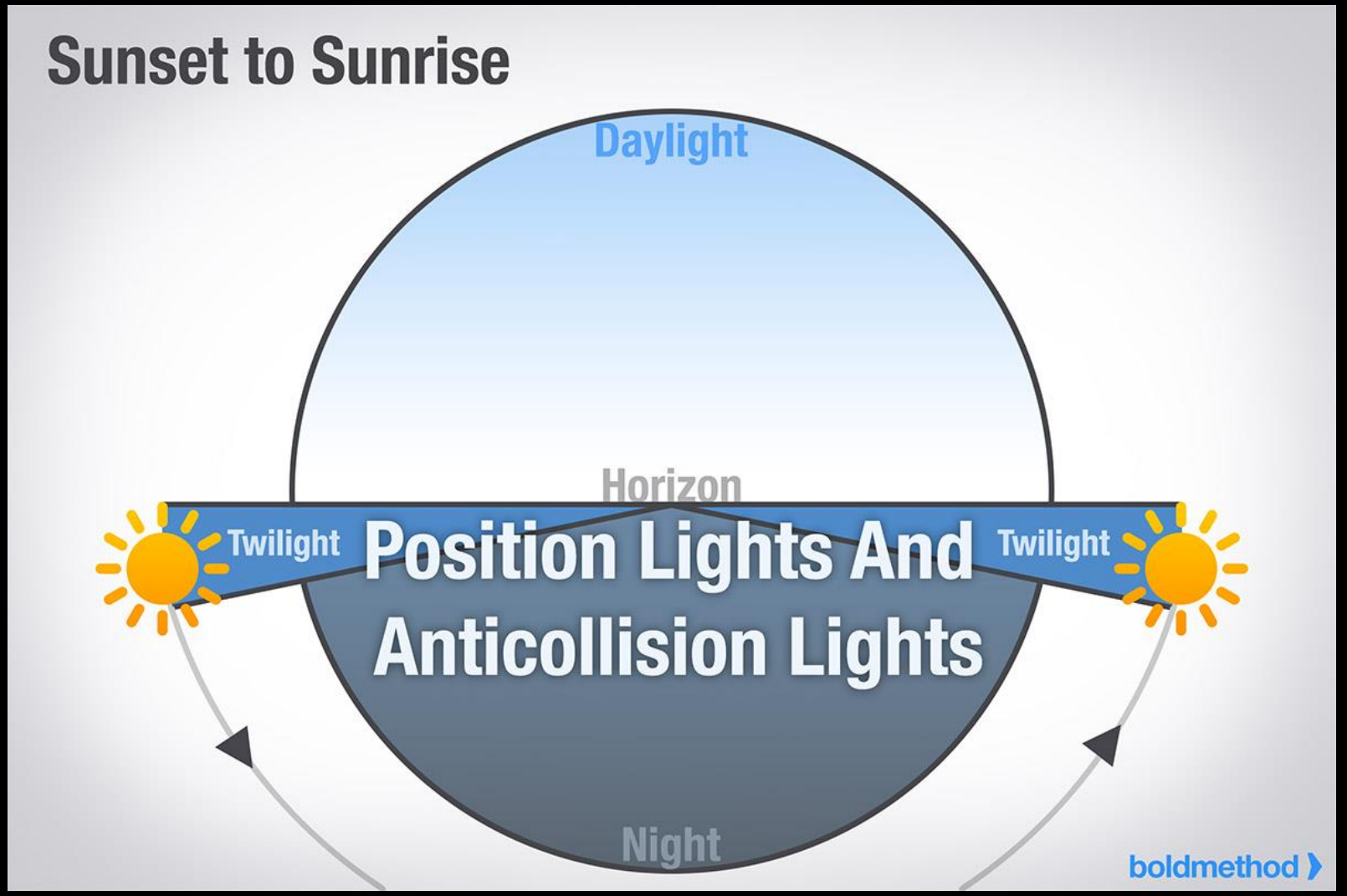
Definitions of Night

- According to Title 14 of the Code of Federal Regulations (14 CFR) part 1, Definitions and Abbreviations, night is defined as the time between the end of evening civil twilight and the beginning of morning civil twilight.
- There a multiple definitions of night used across the regulations that all serve different purposes.
- For example, when must we have the operationally required night equipment? What about night landing currency? What about logging night?

Definitions of Night

- When the sun goes down, night regulations start up. But not all of them, just the first one. In fact, you can't even start logging night time at sunset.
- According to FAR 91.209 you need to have your position lights on from sunset to sunrise. The FARs say you need lighted position lights "during the period a prominent unlighted object cannot be seen from a distance of 3 statute miles or the sun is more than 6 degrees below the horizon.“
- AKA Sunset-sunrise. But if you really want to know the definition of sunrise and sunset, here goes: "sunrise or sunset is defined to occur when the geometric zenith distance of the center of the Sun is 90.8333 degrees."

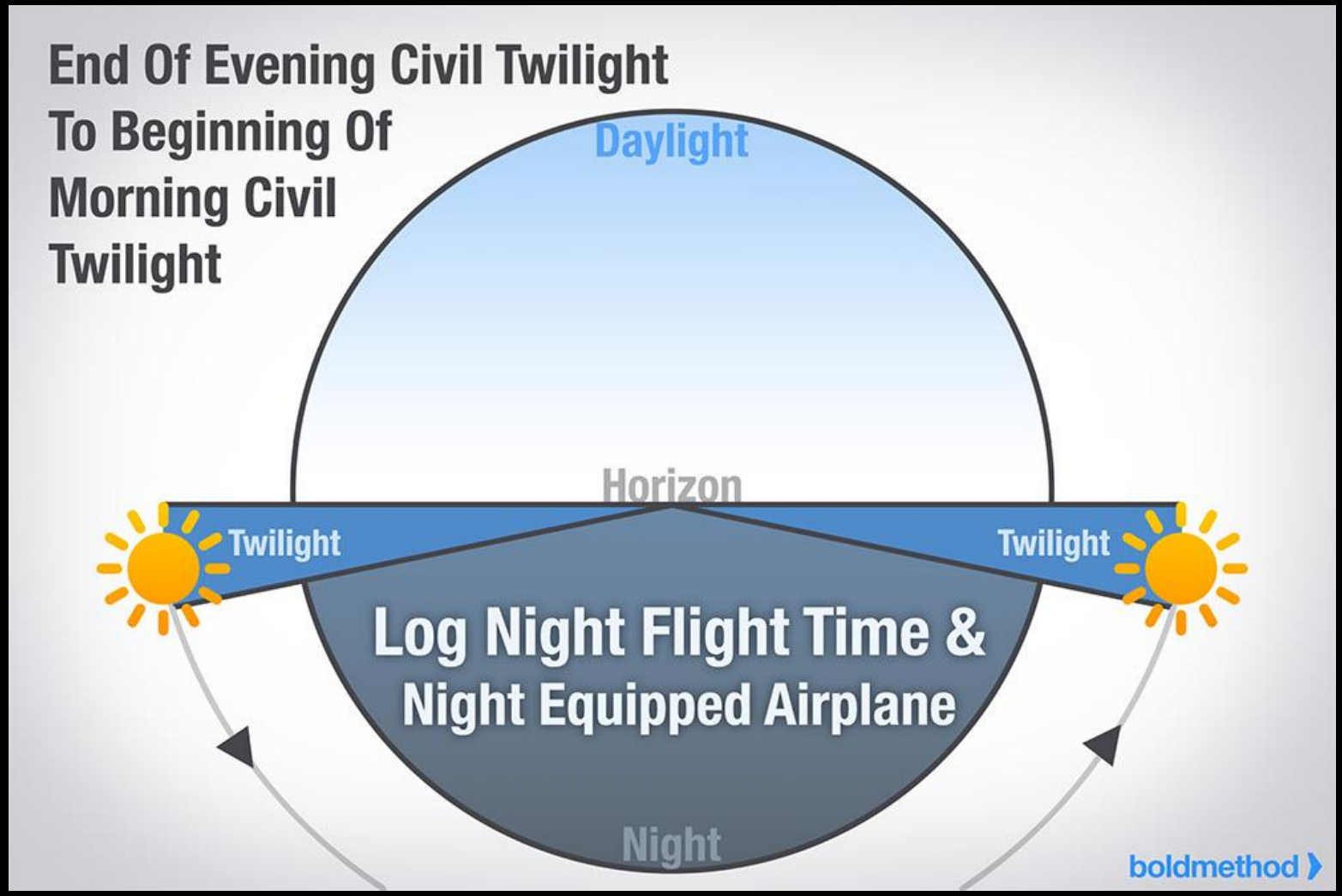
Definitions of Night



Definitions of Night

- For the purposes of logging night flight time “Night means the time between the end of evening civil twilight and the beginning of morning civil twilight, as published in the Air Almanac, converted to local time.”

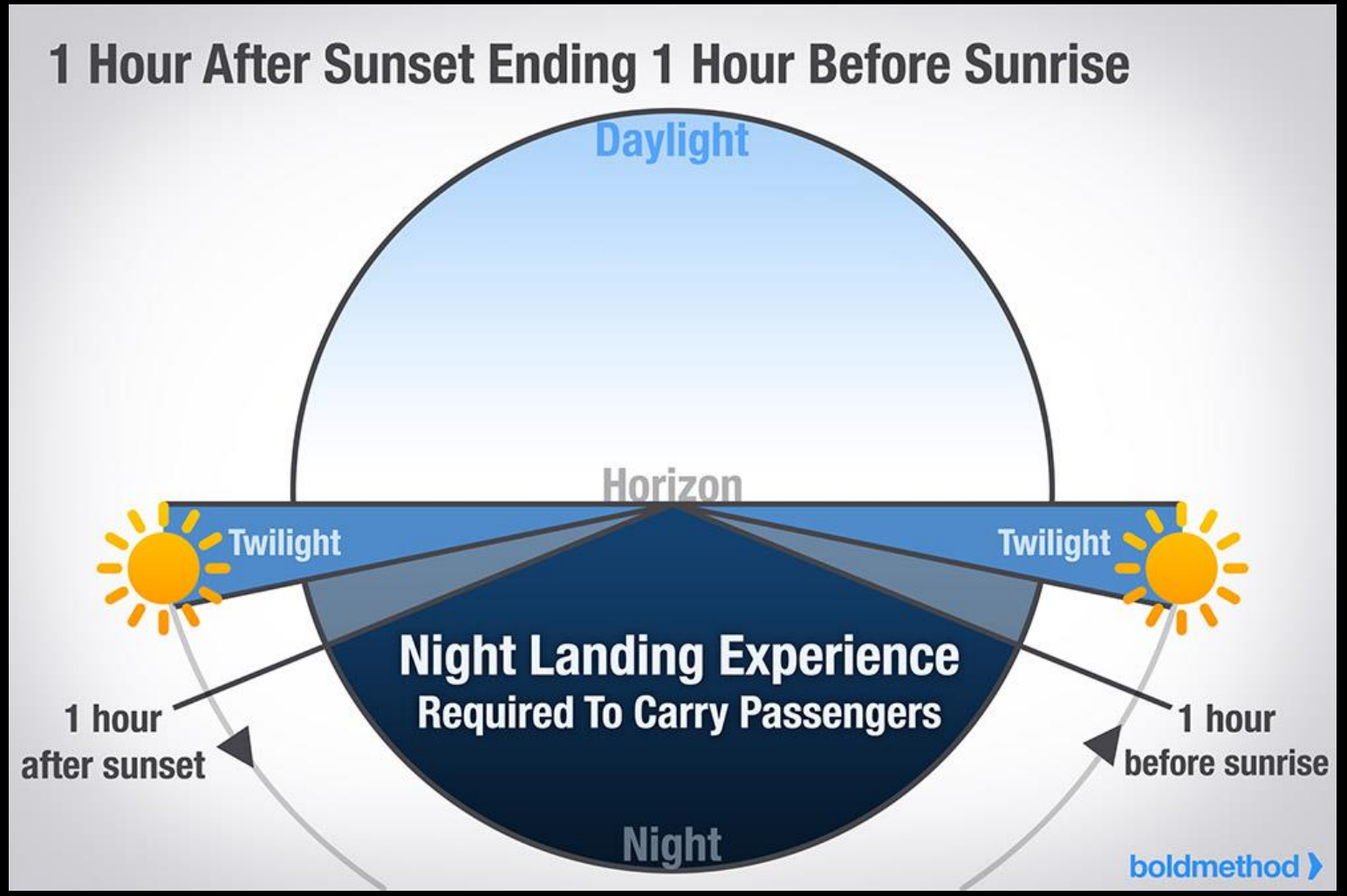
Definitions of Night



Definitions of Night

- According to FAR 61.57(b), to carry passengers between 1 hour after sunset and ending 1 hour before sunrise, you need to make at least 3 takeoffs and landings to a full stop in the preceding 90 days during the period beginning 1 hour after sunset and ending 1 hour before sunrise.

Definitions of Night



Definitions of Night

- Sunset to sunrise
  - Your position lights need to be on (and anticollision lights if you have them)
- The end of evening civil twilight to the beginning of morning civil twilight
  - You can log night flight time, and your plane needs to be night equipped
- 1 hour after sunset ending 1 hour before sunrise
  - You need to be night landing current to carry passengers

Night Equipment

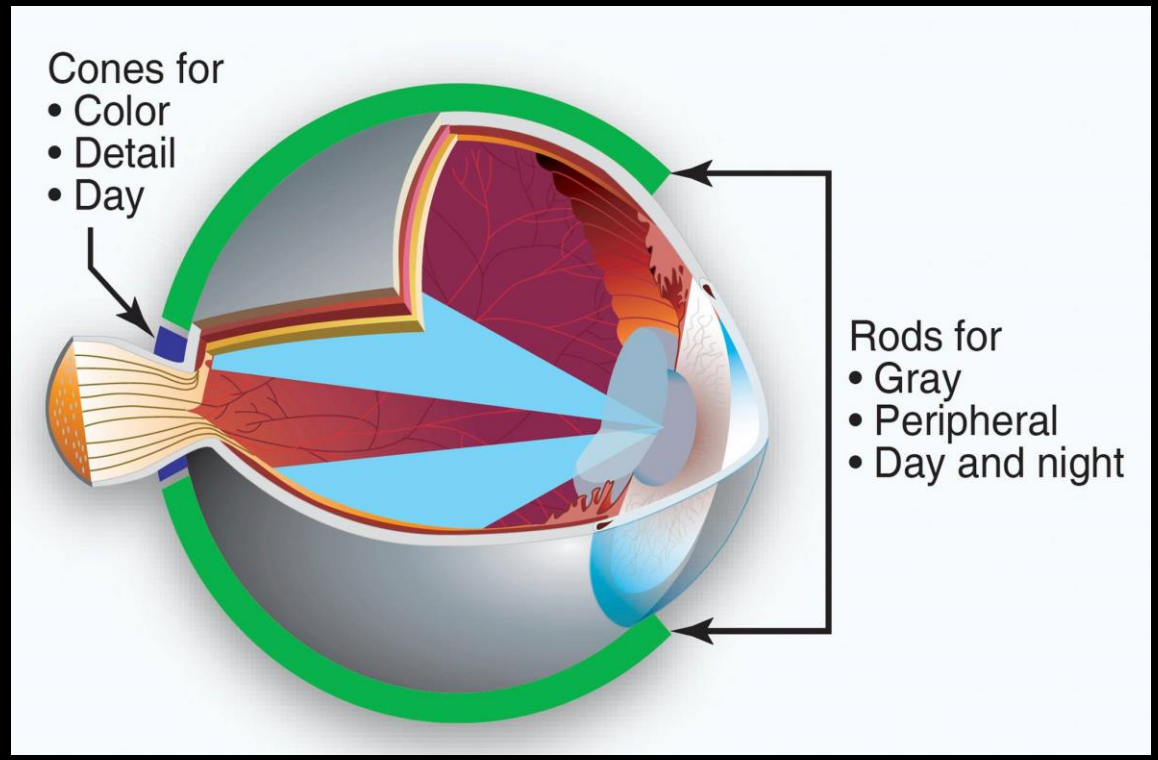
- Some additional considerations should be taken when making a night flight in regards to equipment you bring.
- At least one reliable flashlight is recommended as standard equipment on all night flights. A reliable incandescent or light-emitting diode (LED) flashlight able to produce white/red light and blue for chart reading is preferable. Almost required to make an effective pre-flight inspection.
- Survival equipment or clothing considerations.

Night Vision

- Generally, most pilots are poorly informed about night vision.
- Human eyes never function as effectively at night as the eyes of animals with nocturnal habits, but if humans learn how to use their eyes correctly and know their limitations, night vision can be improved significantly.
- Due to the physiology of the eye, limitations on sight are experienced in low light conditions, such as at night.
- To see at night, the eyes are used differently than during the day. Therefore, it is important to understand the eye's construction and how the eye is affected by darkness.

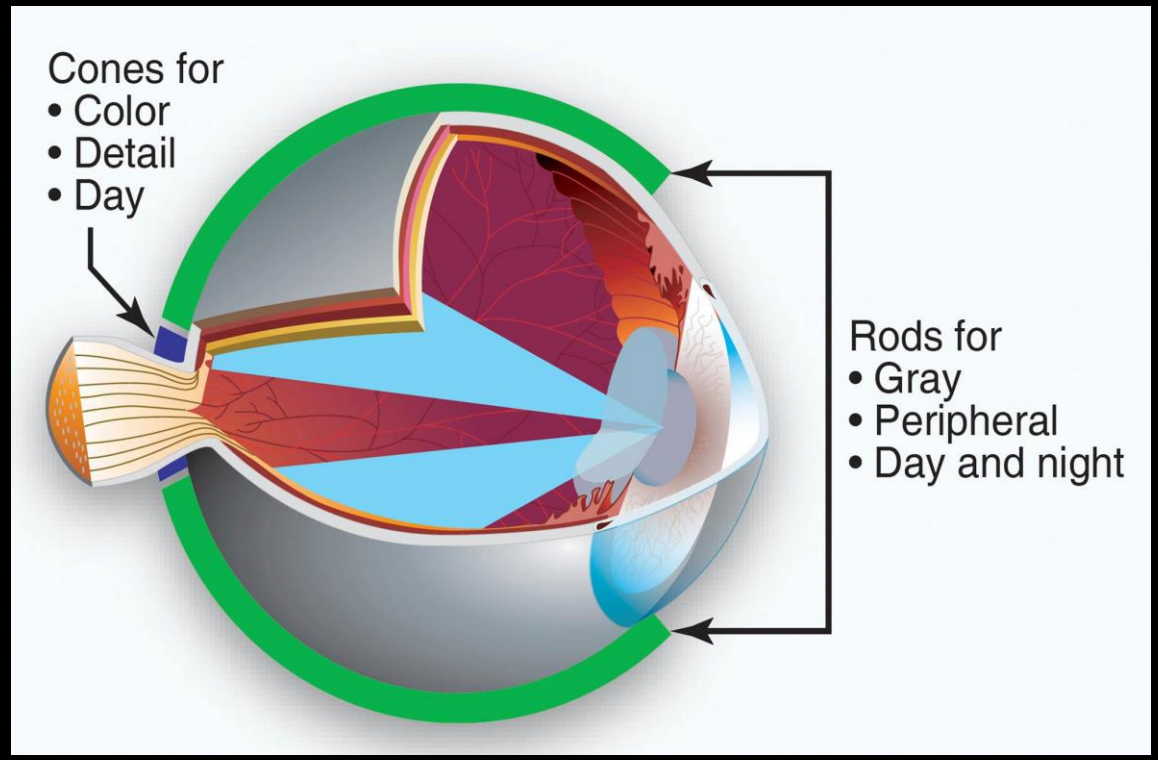
Rods and Cones

- Light-sensitive nerves called “cones” and “rods” are located at the back of the eye
- They connect to the cells of the optic nerve which transmits messages directly to the brain
- Cones are located in the center of the retina
- Rods are concentrated in a ring around the cones



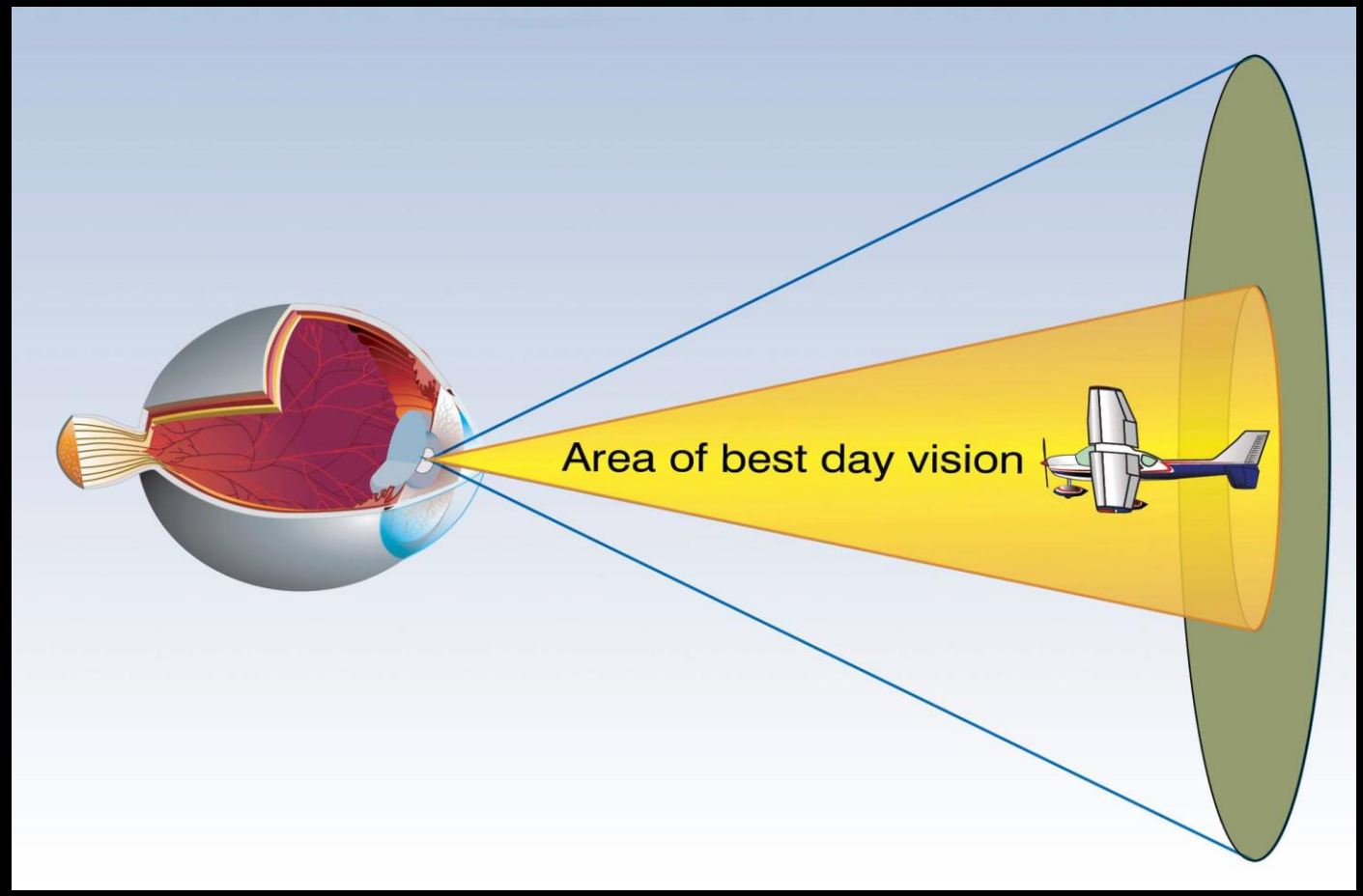
Rods and Cones

- The cones detect color, details, and faraway objects
- The rods function when something is seen out of the corner of the eye or peripheral vision
- They detect objects, particularly those that are moving, but do not give detail or color
- Rods make night vision possible

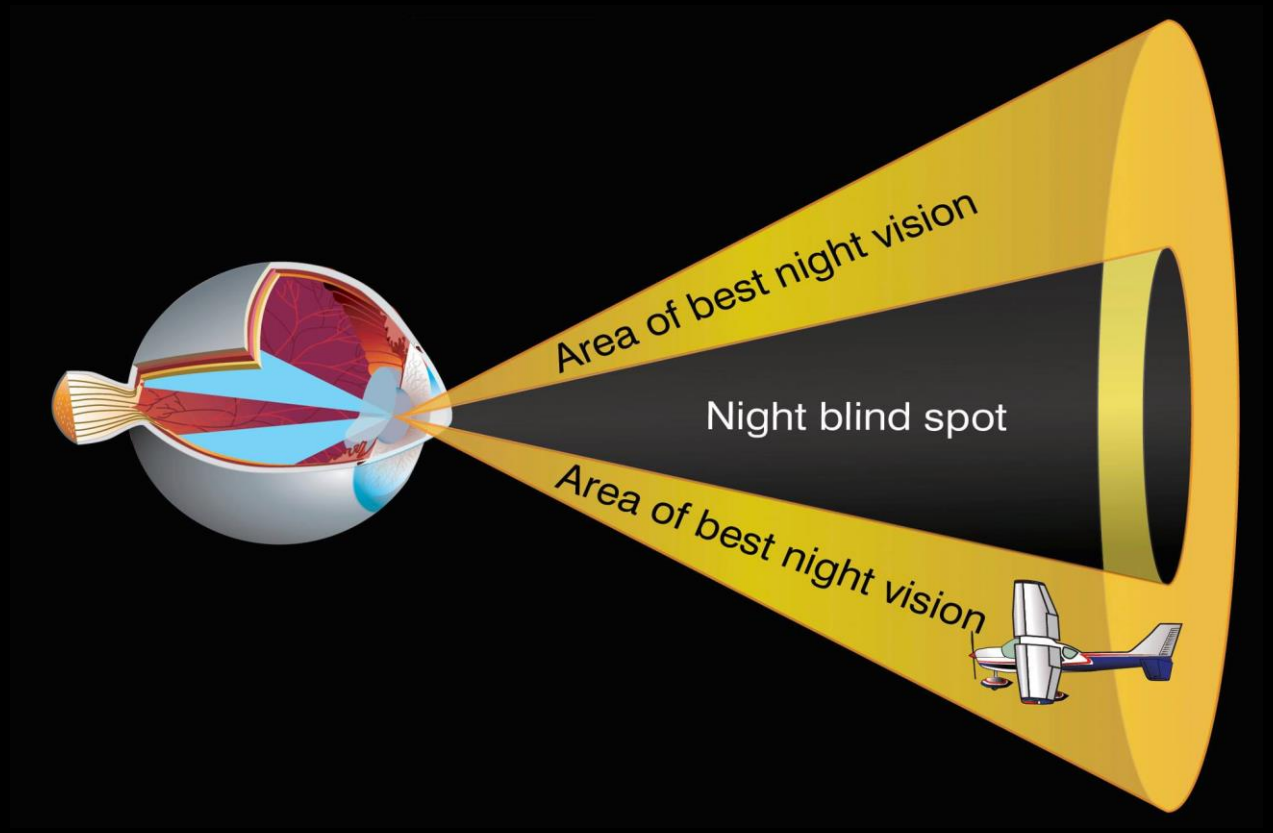


Daylight

- An object can be seen best by looking directly at it



Night Blind Spot



- In center of the field of vision
- If an object is in this area it may not be seen
- The size of this blind spot increases as the distance between the eye and the object increases
- Off-center viewing (looking to one side of an object) is important during night flight scanning

Dark Adaptation

- In darkness vision becomes more sensitive to light
- Vision is impaired by:
  - Exposure to cabin pressure altitudes above 5,000 feet
  - Carbon monoxide inhaled by smoking or from exhaust fumes
  - Deficiency in Vitamin A in the diet
  - Prolonged exposure to bright sunlight

Cockpit Lighting

- Dark adaptation, during which vision becomes more sensitive to light, can be achieved to a moderate degree within 20 minutes under dim red cockpit lighting
- After that, any exposure to white light, even for a few seconds, will seriously impair night vision

Night Illusions

Night Flying

Night Illusions

- On clear nights distant stationary lights can be mistaken for stars or other aircraft
- Cloud layers can confuse a pilot and indicate a false visual horizon
- Certain geometrical patterns of ground lights, such as a freeway, runway, approach, can cause confusion

Night Illusions

- Dark nights tend to eliminate reference to a visual horizon
- Pilots must rely less on outside references at night and more on flight and navigation instruments

Visual Autokinesis

- Can occur when staring at a single light source for several seconds on a dark night
- The result is that the light appears to be moving
- Will not occur if the visual field is expanded through scanning techniques
- A good scanning procedure reduces the probability of vision becoming fixed on one source of light

Flicker Vertigo

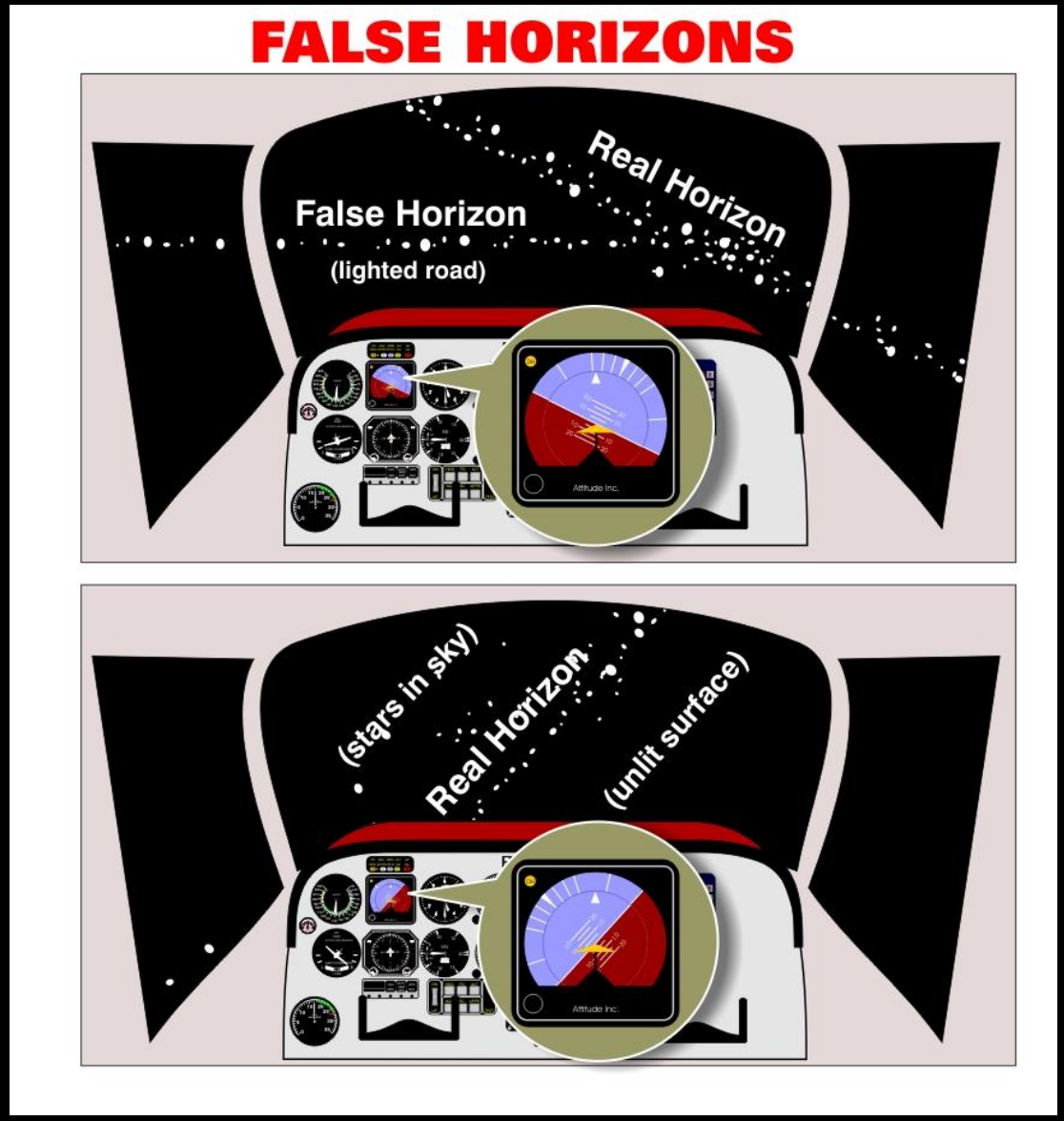
- Distractions and problems can result from a flickering light in the flight deck, anti-collision light, or other aircraft lights
- Possible physical reactions can be nausea, dizziness, grogginess, unconsciousness, headaches, or confusion

Black-Hole Approach

- Occurs when the landing is made from over water or non-lighted terrain where the runway lights are the only source of light
- Without peripheral visual cues to help orientation is difficult
- The runway can seem out of position (down-sloping or up-sloping) and can result in landing short of the runway
- Use electronic glide slope or visual approach slope indicator if available

False Horizons Illusion

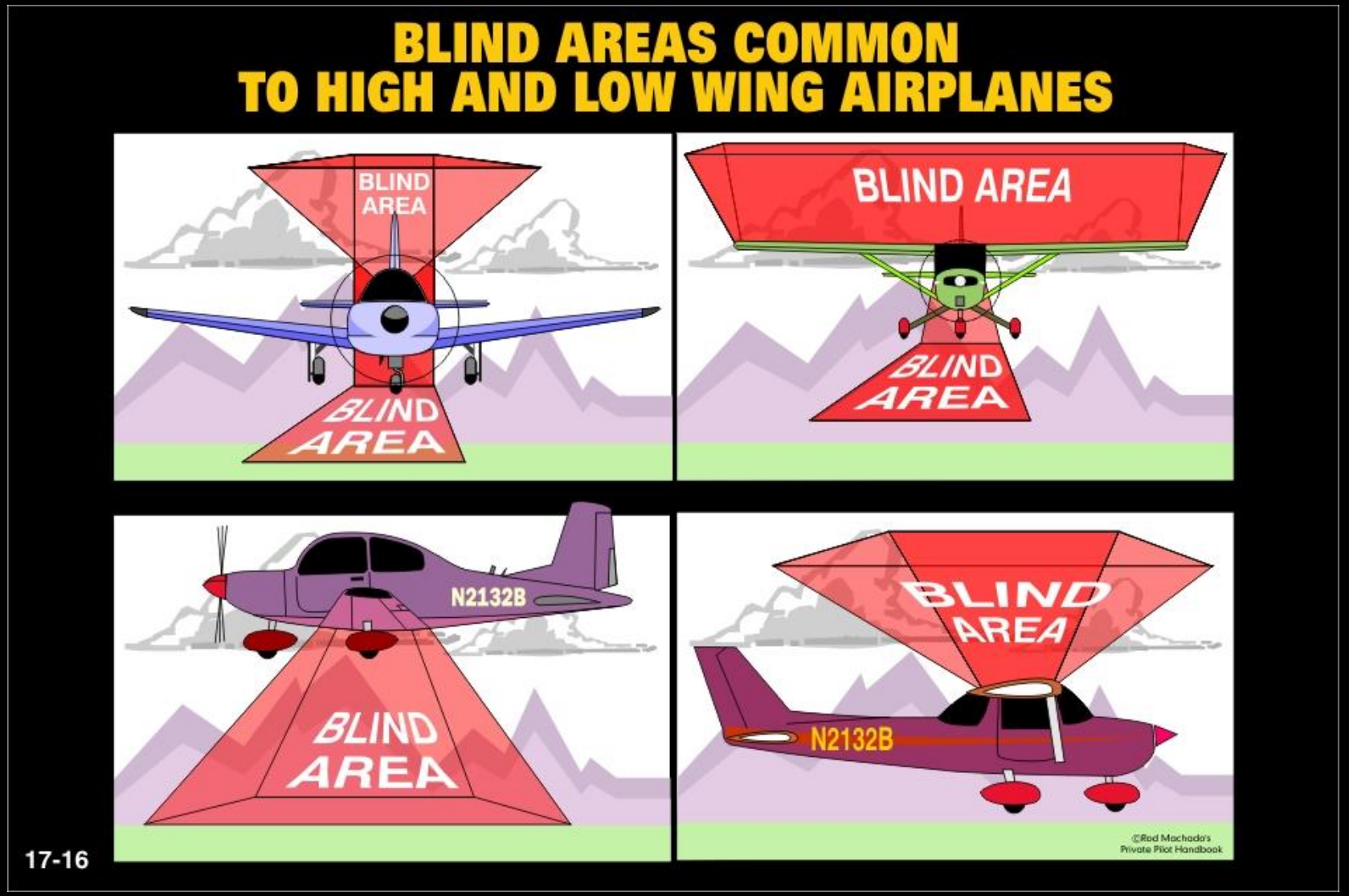
- Sloping cloud formations, an obscured horizon, a dark scene spread with ground lights and stars, or certain geometric patterns of ground light can create illusions of not being aligned correctly with the actual horizon
- The disoriented pilot will place the aircraft in a dangerous position



Collision Avoidance

- Prior to starting each maneuver, pilots should visually scan the entire area for collision avoidance
- The FAA Near Mid-Air Collision Report indicates that 81% of the incidents occurred in clear skies and unrestricted visibility conditions
- Any aircraft that appears to have no relative motion and stays in one scan quadrant is likely to be on a collision course

Blind Areas


BLIND AREAS COMMON
TO HIGH AND LOW WING AIRPLANES
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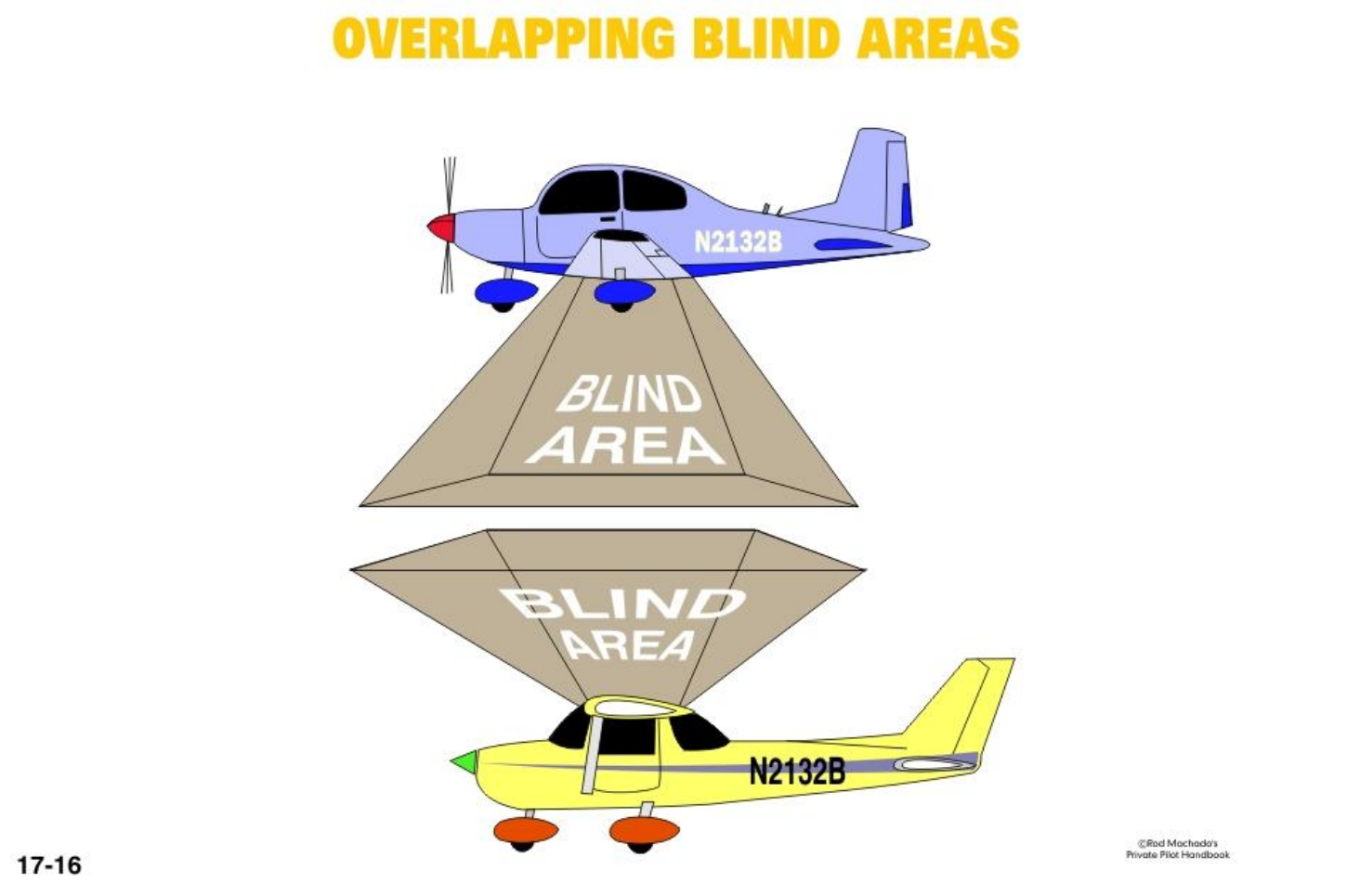
Overlapping Blind Areas

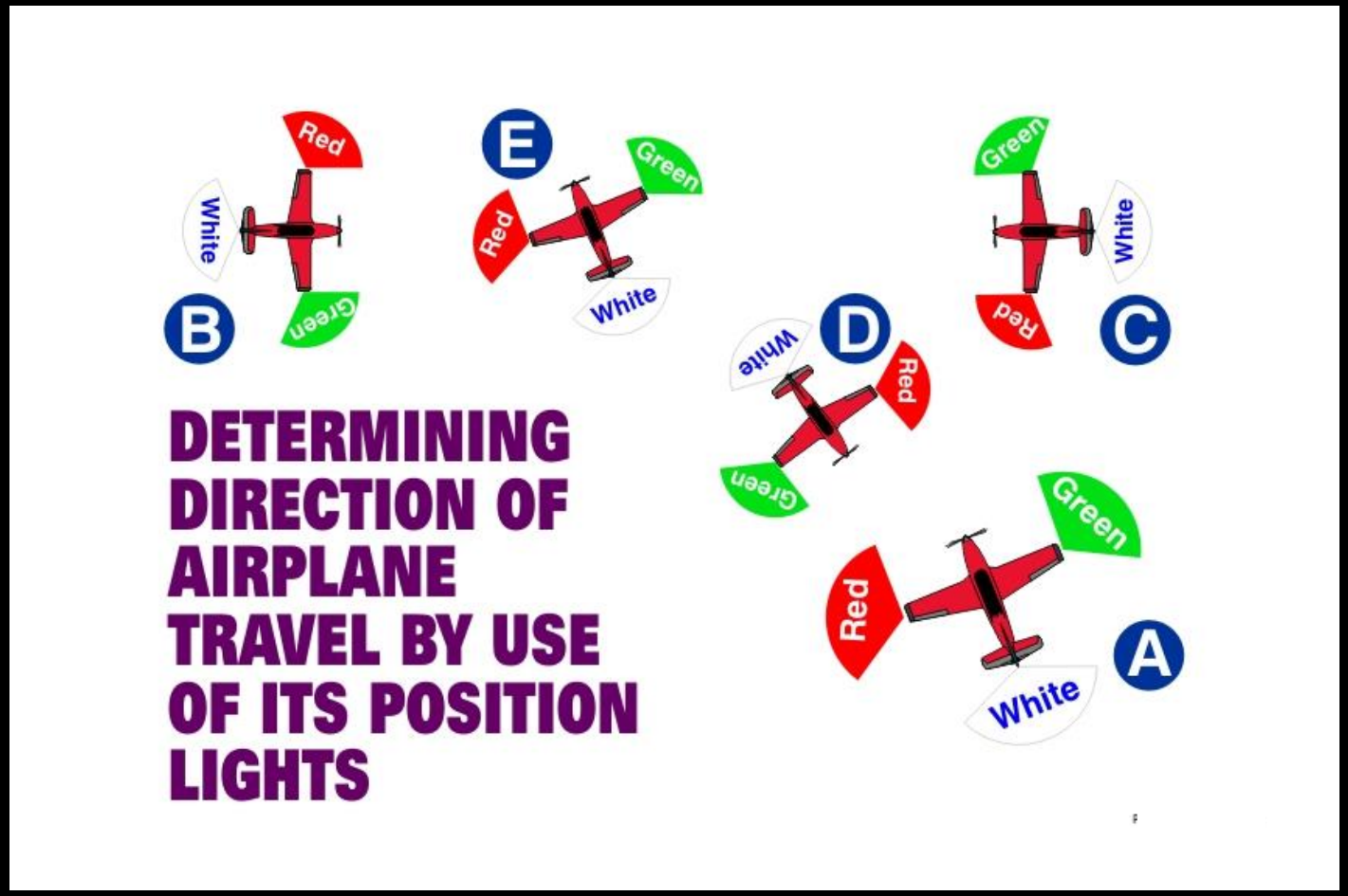


Night Lighting

Night Flying

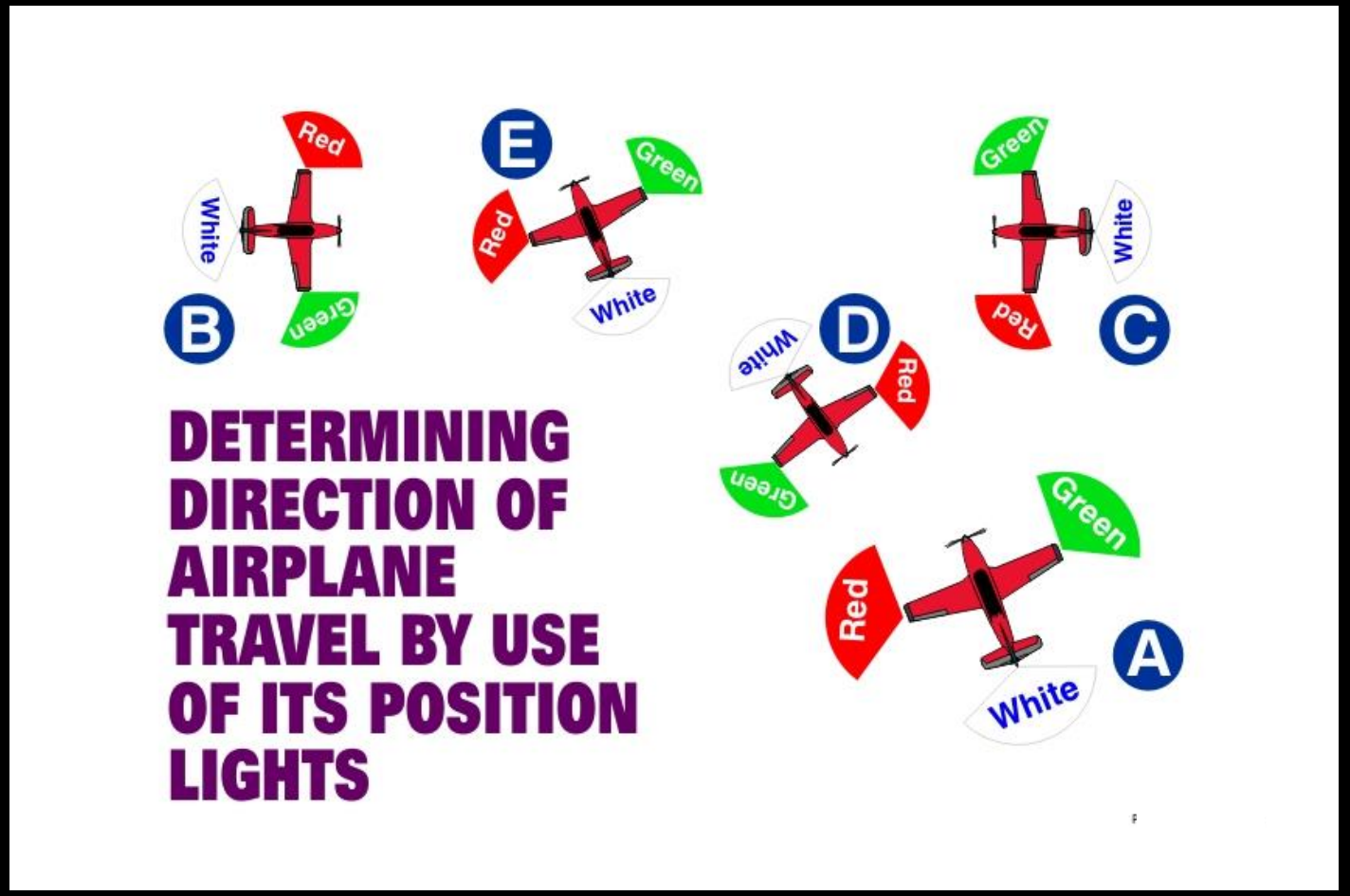
Aircraft Lighting

- Position lights are a visual clue as to the direction in which airplanes are moving at night
- An aircraft must display lighted position lights from sunset to sunrise.
- A flashing white or red anticollision light(s) is also required to be on when the airplane is in operation



Aircraft Lighting

- You are in airplane A
- Airplane D is moving toward you, since you see green and red lights but no white light
- Airplane E is moving away from you, since you see a white light



Airport and Navigation Lighting Aids

- Lighting systems used for airports, runways, obstructions, and other visual aids at night are other important aspects of night flying
- Lighted airports located away from congested areas are identified readily at night by the lights outlining the runways
- Airports located near or within large cities are often difficult to identify as the airport lights tend to blend with the city lights
- Must know the exact location of an airport relative to the city, and be able to identify these airports by the characteristics of their lighting patterns

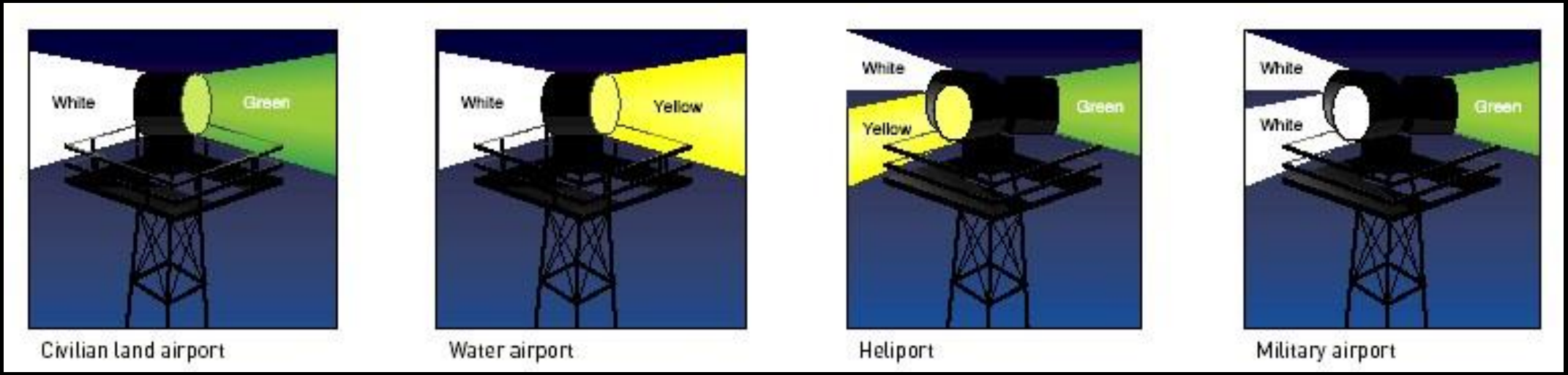
Airport and Navigation Lighting Aids

- Prior to a night flight check the availability and status of lighting systems at the destination airport
- Can be found on aeronautical charts and in the Chart Supplements
- The status of each facility can be determined by reviewing pertinent NOTAMs

Rotating Beacons

- Rotate at a constant speed producing a series of light flashes at regular intervals
- These flashes consist of a white flash and one or two different colors that are used to identify various types of landing areas
  - Lighted civilian land airports - alternating white and green lights
  - Lighted civilian water airports - alternating white and yellow lights
  - Lighted military airports - alternating white and green lights, but are differentiated from civil airports by dual peaked (two quick) white flashes, then green

Rotating Beacons



Pilot Controlled Lighting

- Intensity of runway edge lights can be activated and adjusted by radio control
- Control system consists of a 3-step control responsive to 7, 5, and/or 3 microphone clicks
- 3-step control turns on lighting facilities capable of either 3-step, 2-step, or 1-step operation
- The 3-step and 2-step lighting facilities can be altered in intensity, while the 1-step cannot
- All lighting is illuminated for 15 minutes from the most recent time of activation and may not be extinguished prior to end of the 15-minute period

Pilot Controlled Lighting

Visual Approach Lighting

- With reduced depth-perception at night, the use of a Precision Approach Path Indicator (PAPI) or Visual Approach Slope Indicator (VASI) is key in judging a normal descent to the runway

Hazard Lighting

- Beacons producing red flashes indicate obstructions or areas considered hazardous to aerial navigation
- Steady-burning red lights are used to mark obstructions on or near airports
- High-intensity, flashing white lights are used to mark some supporting structures of overhead transmission lines that stretch across rivers, chasms, and gorges
- These high-intensity lights are also used to identify tall structures, such as chimneys and towers

Hazard Lighting

Night ADM

Night Flying

Night Emergencies

- Possibility of complete engine failure and the subsequent emergency landing
- Maintain positive control of the airplane and establish the best glide configuration and airspeed
- Turn the airplane towards an airport or away from congested areas

Night Emergencies

- Check to determine the cause of the engine malfunction, such as the position of fuel selectors, magneto switch, or primer
- Announce the emergency situation to ATC or UNICOM
- If the condition of the nearby terrain is known and is suitable for a forced landing, turn towards an unlighted portion of the area and plan an emergency forced landing to an unlighted portion

Night Emergencies

- Consider an emergency landing area close to public access if possible
- Maintain orientation with the wind to avoid a downwind landing
- Complete the before landing checklist, and turn the landing lights ON in sufficient time to illuminate the terrain or obstacles along the flightpath

Night Emergencies

- Landing should be completed in the normal landing attitude at the slowest possible airspeed
- If the landing lights are unusable and outside visual references are not available, the airplane should be held in level-landing attitude until the ground is contacted
- After landing, turn off all switches and evacuate the airplane as quickly as possible

Knowledge Check

What color of flashlight is best to use for a night preflight?

A. Green
B. Amber
C. White
D. Red

Knowledge Check

What color of flashlight is best to use for a night preflight?

~~A. Green~~

~~B. Amber~~

~~C. White~~

D. Red

Knowledge Check

If sunset is at 6:55 pm, what is the latest you can fly passengers without being night current?

A. 6:54 pm
B. 6:55 pm
C. 7:25 pm
D. 7:55 pm

Knowledge Check

If sunset is at 6:55 pm, what is the latest you can fly passengers without being night current?

A. ~~6:54 pm~~
B. ~~6:55 pm~~
C. ~~7:25 pm~~
D. 7:55 pm

Knowledge Check

Large boats on a shipping lane out of the water can create what type of night illusion?

A. Autokinesis
B. False Horizons
C. Black-Hole Approach
D. Blind Spots

Knowledge Check

Large boats on a shipping lane out of the water can create what type of night illusion?

A. ~~Autokinesis~~
B. False Horizons
C. ~~Black-Hole Approach~~
D. ~~Blind Spots~~

Knowledge Check

Which of the following beacons is a public-use land airport?

A. White, White, Green
B. White, Amber, Green
C. White, Green
D. White, Amber

Knowledge Check

Which of the following beacons is a public-use land airport?

~~A. White, White, Green~~

~~B. White, Amber, Green~~

C. White, Green

~~D. White, Amber~~

Knowledge Check

Large dark areas are reasonable locations to glide towards following an engine failure at night?

A. True
B. False

Knowledge Check

Large dark areas are reasonable locations to glide towards following an engine failure at night?

A. ~~True~~
B. False