

# NIGHT OPERATIONS



# Lesson Outline

## LESSON OBJECTIVE

To determine that the student exhibits proficient knowledge of the elements related to night operations by describing the elements on the following slide.

## LESSON SOURCE(S)

Airplane Flying Handbook  
FAA-H-8083-3



# Lesson Outline

## LESSON ELEMENTS

Factors Related to Night Vision  
Disorientation and Optical Illusions  
Proper Adjustment of Interior Lights  
Night Flashlight  
Night Preflight Inspection  
Engine Starting at Night  
Taxiing at Night  
Takeoff and Climbout  
In-Flight Orientation  
Night Emergency Procedures  
Traffic Patterns  
Approach and Landing

## TIMEFRAME

**40 Minutes**

*approximately*

Discuss Objectives  
Present and Review Material  
Student Questions  
Conclusion and Quiz

## EQUIPMENT/TOOLS

Lesson Presentation  
Whiteboard and Markers  
FAA Sources and References

# Lesson Outline

## INSTRUCTOR ACTIONS

Present Objectives and Standards  
Teach Lesson from Presentation  
Ask and Answer Student Questions  
Assign Homework  
Check Student's Post Lesson Quiz

## STUDENT ACTIONS

Participate in Lesson  
Take Notes  
Ask and Respond to Questions  
Pass the Post Lesson Quiz

## COMPLETION STANDARDS

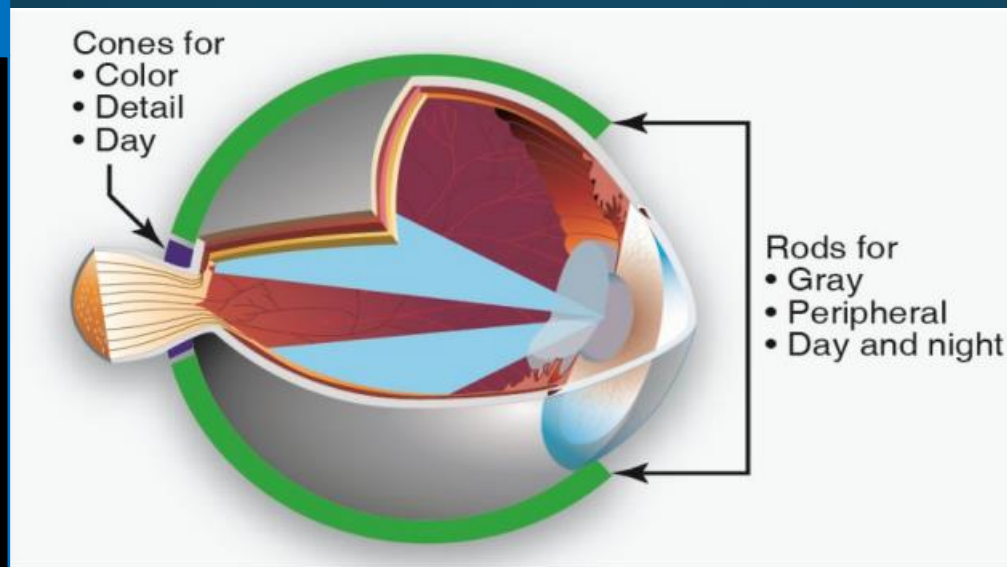
Student is able to understand and differentiate between the different lesson elements. Student is further able to apply this acquired knowledge in flight training/flight operation scenarios effectively and appropriately.

# Night Vision

Due to the physiology of the eye, humans experience diminished vision in low-light conditions. Because vision involves the eyes and brain working together, understanding eye function leads to pilot behaviors that can improve night vision significantly.

## Anatomy: The Cones

The cones are located in higher concentrations than rods in the central area of the retina known as the macula. The cones are used for day or high-intensity light vision. They are involved with central vision to detect detail, perceive color, and identify far-away objects.



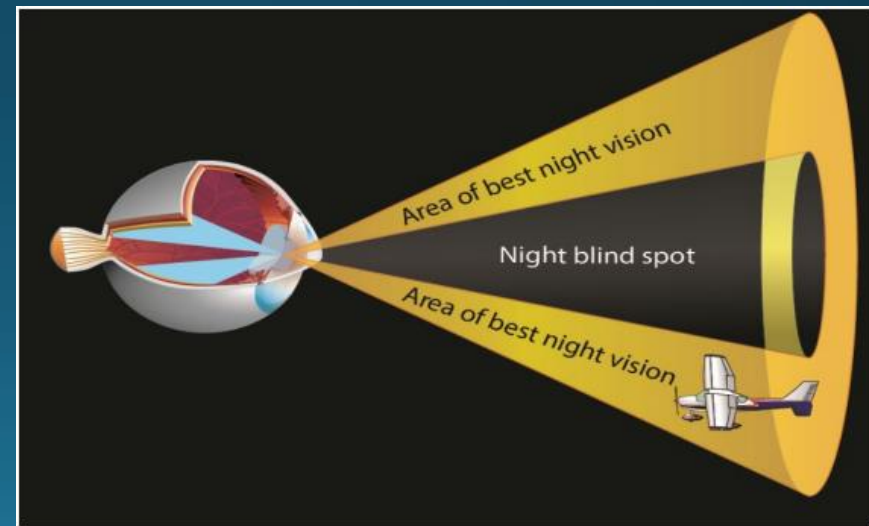
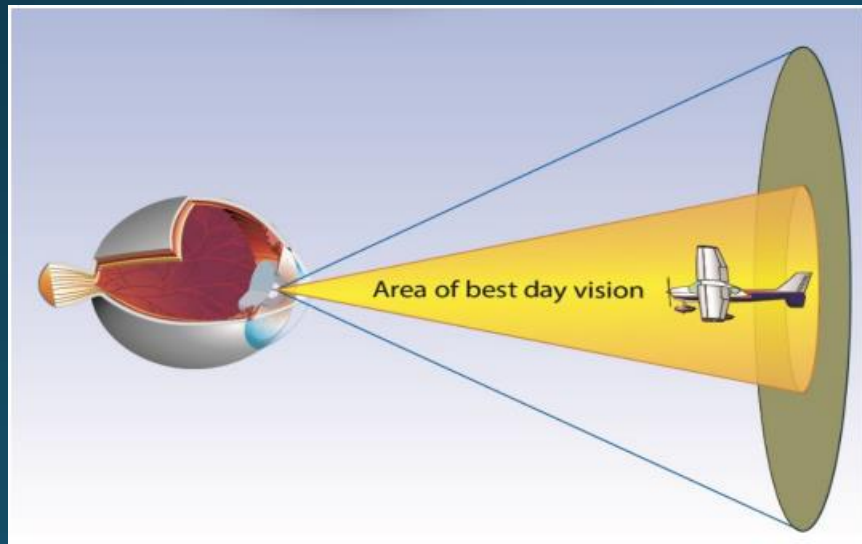
## Anatomy: The Rods

The rods are located mainly in the periphery of the retina. Rods are used for low light intensity or night vision and are involved with peripheral vision to detect position references, including objects (fixed and moving) in shades of gray, but cannot be used to detect detail or to perceive color..

# Night Vision

## The Night Blind Spot

During daytime or high-intensity artificial illumination conditions, the eyes rely on central vision (foveal cones) to perceive and interpret sharp images and color of objects. If an object is viewed directly at night, it may go undetected or it may fade away after initial detection. The night blind spot can hide larger objects as the distance between the pilot and an object increases.



# Night Vision

## Night Adaptation

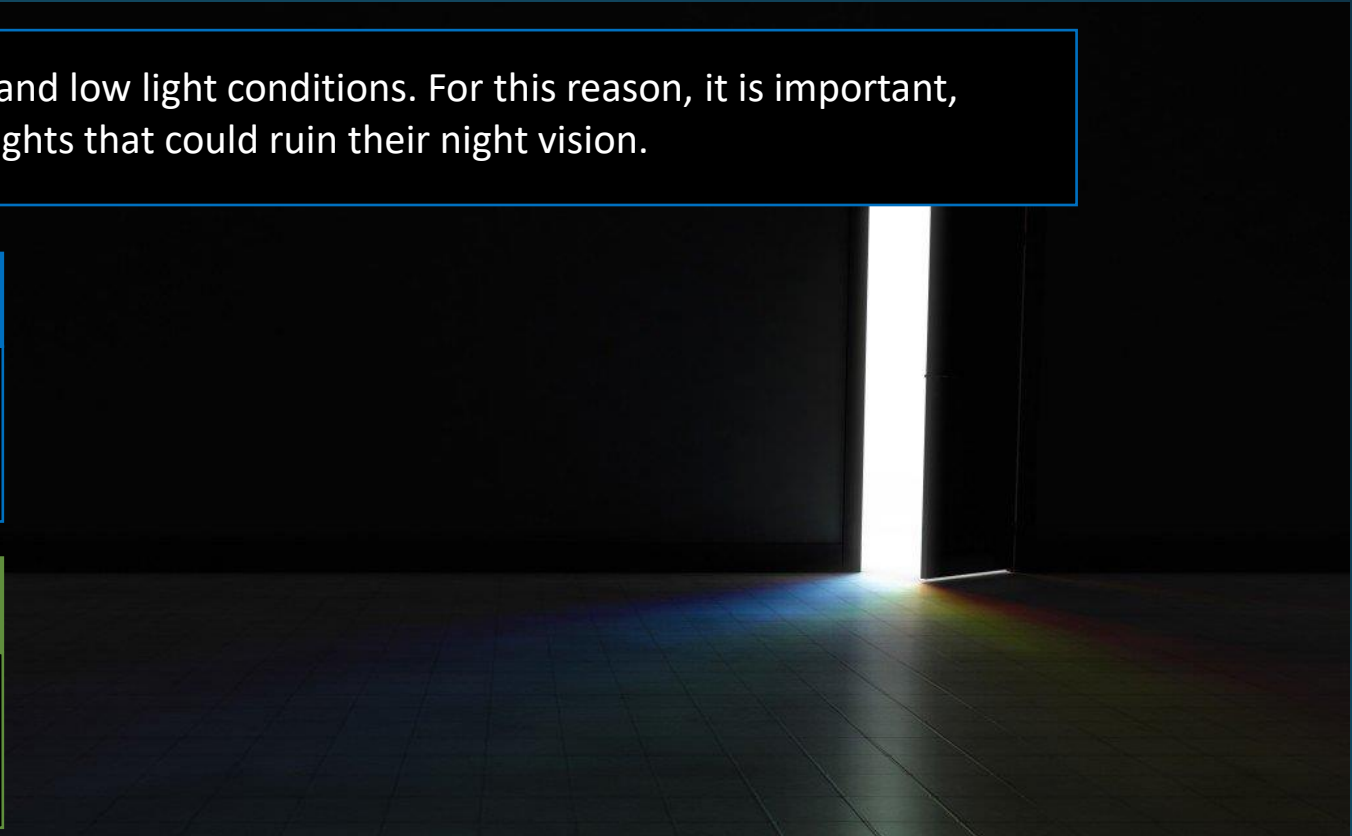
The eyes can take up to 30 minutes to fully adapt to night and low light conditions. For this reason, it is important, that once the eyes have fully adapted, pilots avoid bright lights that could ruin their night vision.

### After 10 Minutes

Eyes become 100X more sensitive to light.

### After 30 Minutes

Eyes become 100,000X more sensitive to light.



# Night Vision

## Night Adaptation

The eyes can take up to 30 minutes to fully adapt to night and low light conditions. For this reason, it is important, that once the eyes have fully adapted, pilots avoid bright lights that could ruin their night vision.

## Interior Lights

Keep the aircraft interior lights to a minimum to help eyes adjust.

## Close an Eye

To help preserve night vision, close one eye when subjected to bright lights at night.

## Flashlight

View charts and in-flight materials using a red light as it is non-glaring.

## Off-Center Viewing

Use off-center viewing techniques when looking for other traffic.





# Night Illusions

## False Horizon Illusion

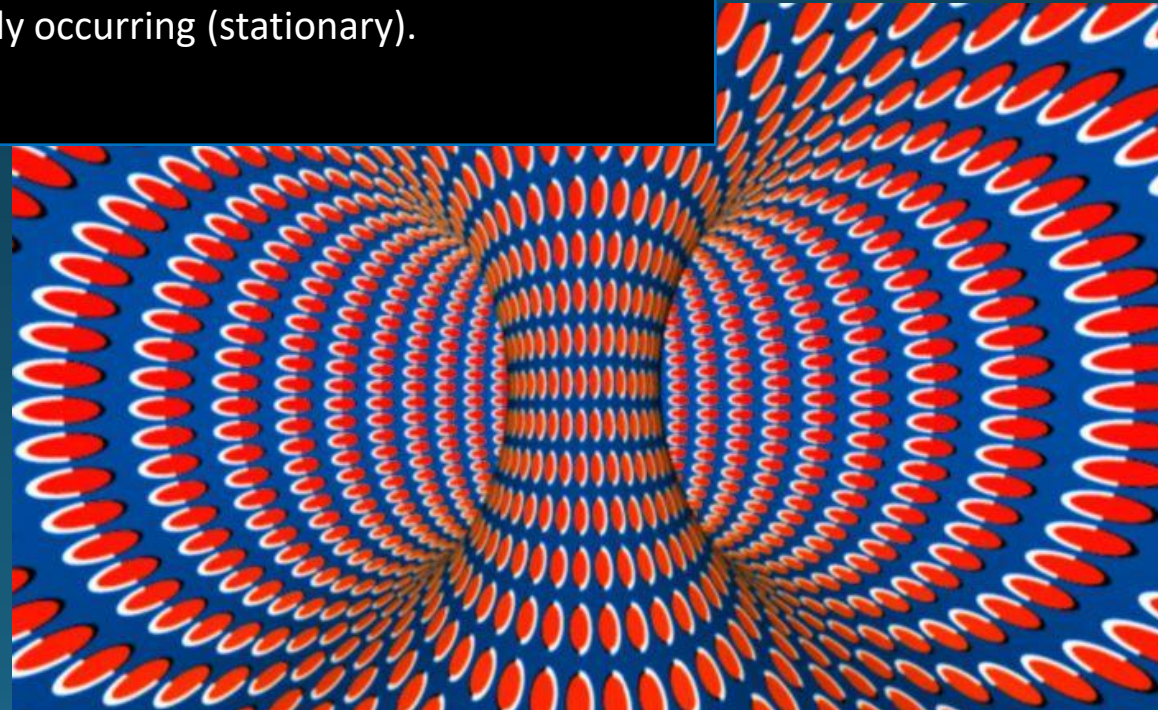
A sloping cloud formation, an obscured horizon, an aurora borealis, a dark scene spread with ground lights and stars, and certain geometric patterns of ground lights can provide inaccurate visual information, or “false horizon,” when attempting to align the aircraft with the actual horizon.



# Night Illusions

## Autokinesis

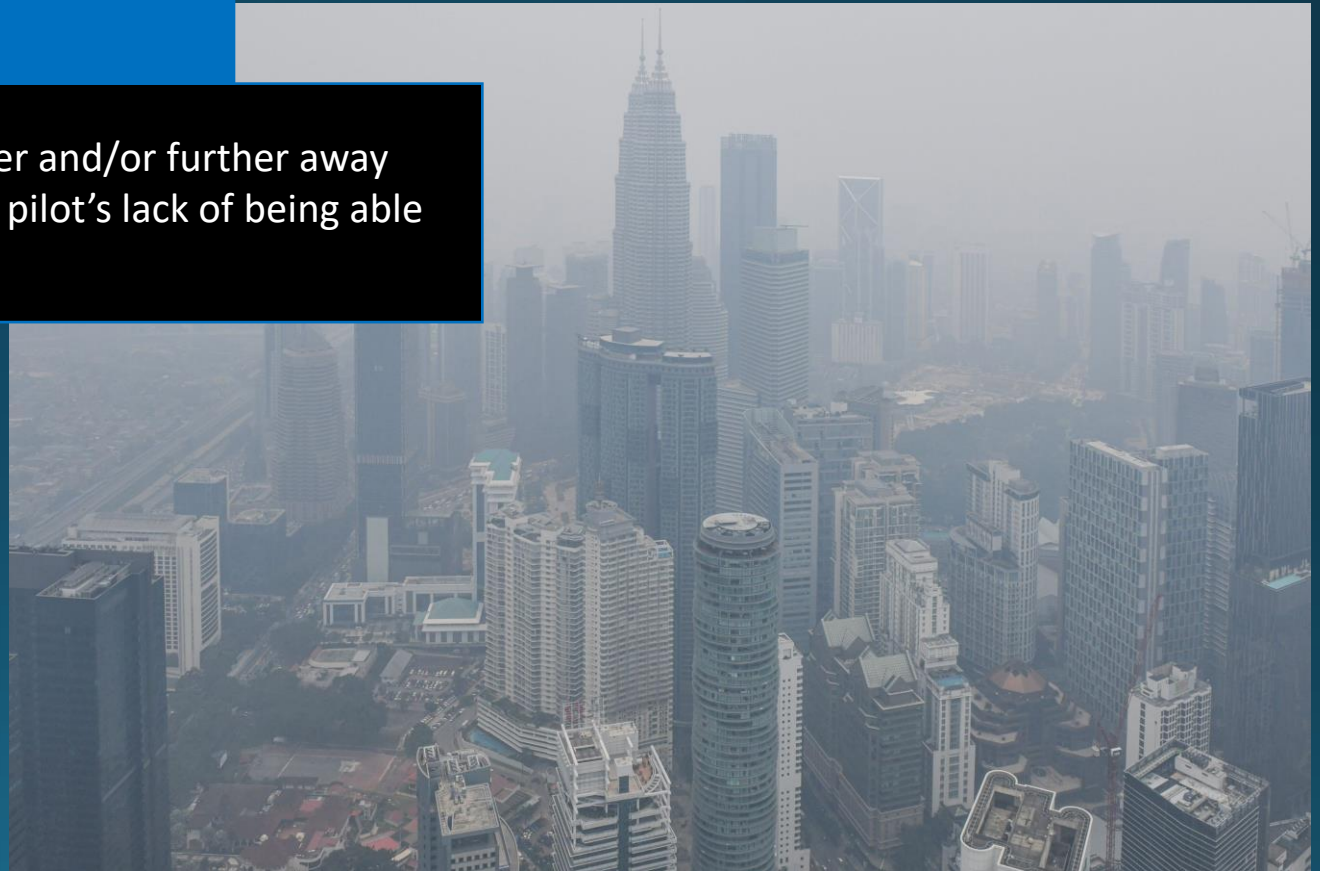
When flying in the dark, a stationary light may appear to move if it is stared at for a prolonged period of time. Autokinesis occurs when our brain sees motion or movement that is not actually occurring (stationary).



# Night Illusions

## Featureless Terrain, Water Refraction, and Haze

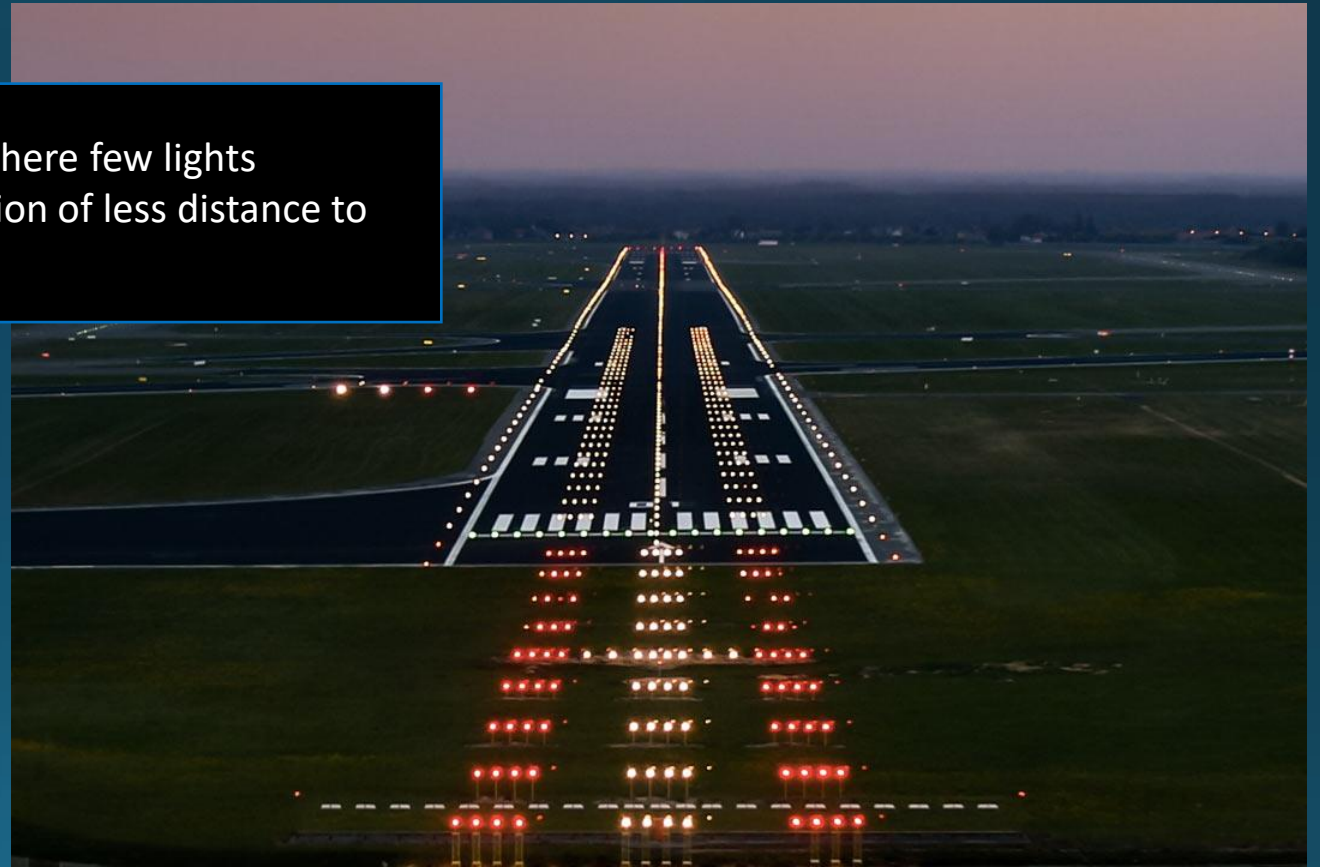
All of these phenomena can make the pilot feel higher and/or further away from objects and from the surface. This is due to the pilot's lack of being able to see details.



# Night Illusions

## Ground Lighting

Bright runway and approach light systems, especially where few lights illuminate the surrounding terrain, may create the illusion of less distance to the runway.



# Night Equipment

## Pilot Equipment

When performing night flights, a pilot should have the following equipment.

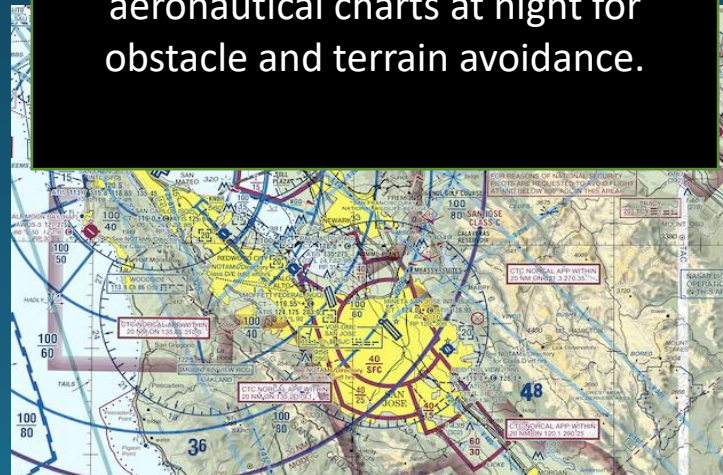
### LED Flashlight

An LED flashlight with red and white variable settings. Red is used in-flight while white is used for pre and post flight procedures.



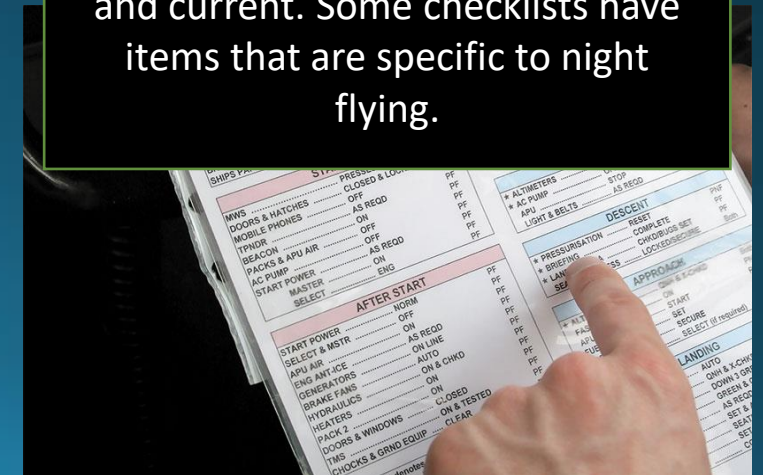
### Current Charts

Pilots should make sure they are using current and appropriate aeronautical charts at night for obstacle and terrain avoidance.



### Checklists

Checklists should be on-board the aircraft and should be accurate and current. Some checklists have items that are specific to night flying.



# Night Equipment

## Airplane Equipment

When performing night flights, the airplane should be equipped according to the FARs.

All Day VFR Equipment

Spare Fuses (if applicable)

Landing Light (for hire)

Anti-Collision Lights

Position Lights

Source of Electricity



# Aircraft Lighting

Exterior aircraft lights make the aircraft easier to see. It is also important that we know when to turn these lights on for night operations.

**Taxi Light**  
Prior to Taxi

**Position Lights**  
Prior to Taxi

**Beacon Light**  
Prior to Engine Start

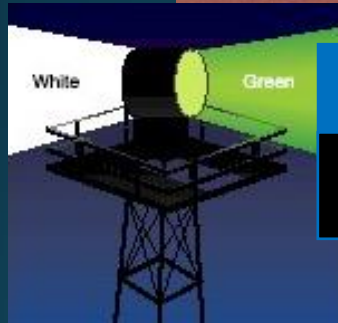
**Strobe Lights**  
Prior to Takeoff/Crossing Runway

**Landing Light**  
Prior to Takeoff/Crossing Runway



# Airport Lighting

Many times it can be difficult to spot an airport while flying at night. Pilots should look for the airport beacon and head in its general direction until closer.



## Civilian Airport

1 White, 1 Green



## Water Airport

1 White, 1 Yellow



## Heliport

1 White, 1 Yellow, 1 Green



## Military Airport

2 White, 1 Green



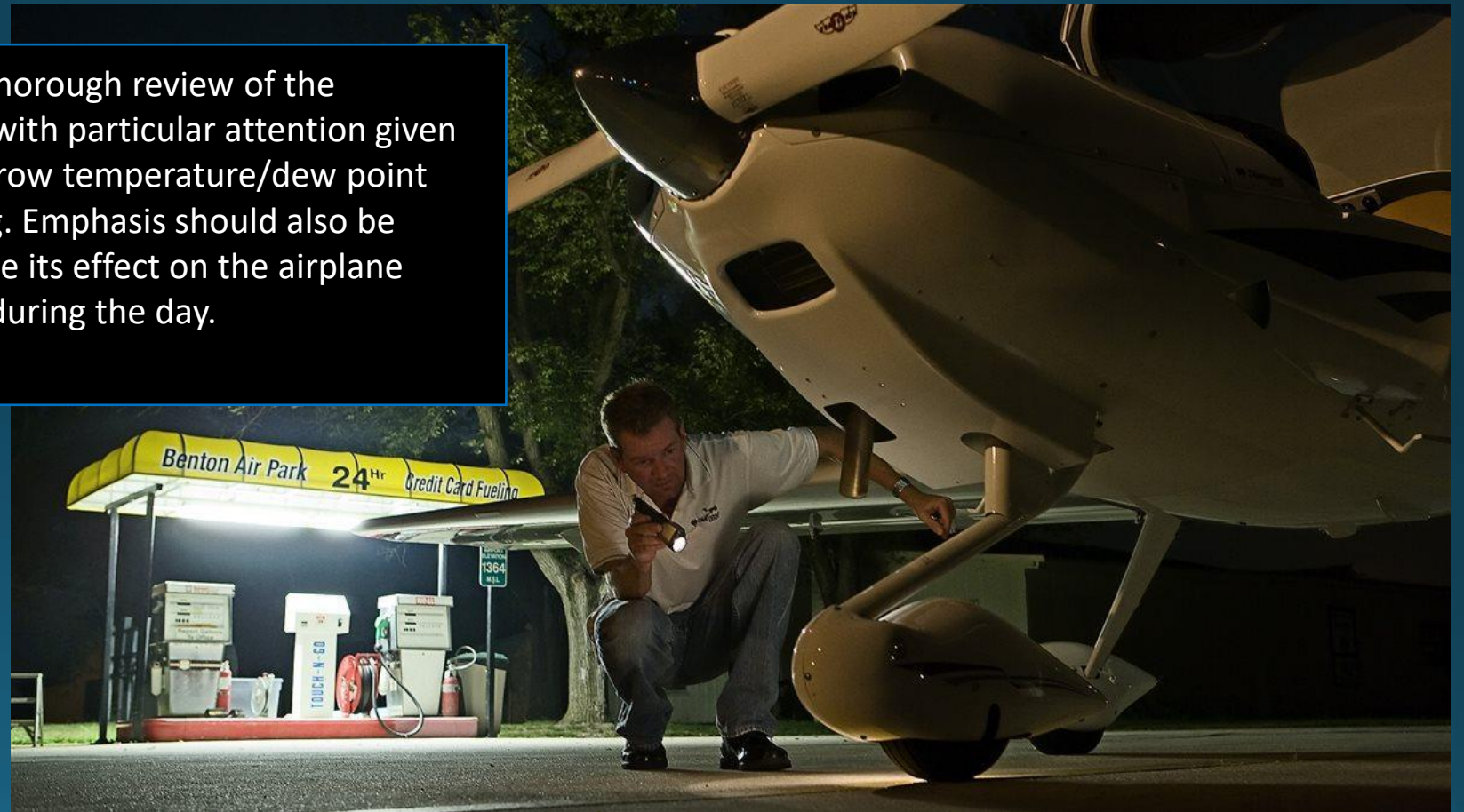
# Taxi Lighting



# Night Flight Considerations

## Night Preflight

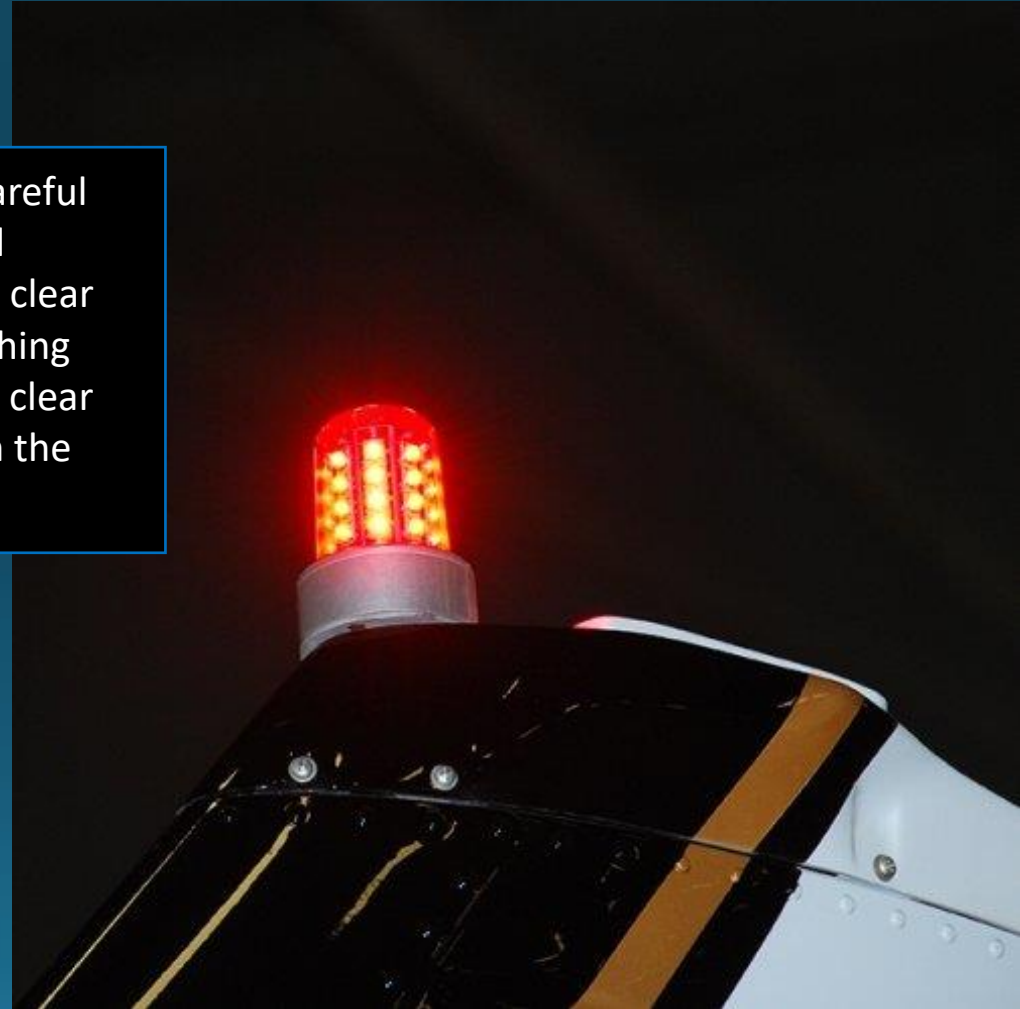
Preparation for a night flight includes a thorough review of the available weather reports and forecasts with particular attention given to temperature/dew point spread. A narrow temperature/dew point spread may indicate the possibility of fog. Emphasis should also be placed on wind direction and speed, since its effect on the airplane cannot be as easily detected at night as during the day.



# Night Flight Considerations

## Engine Starting

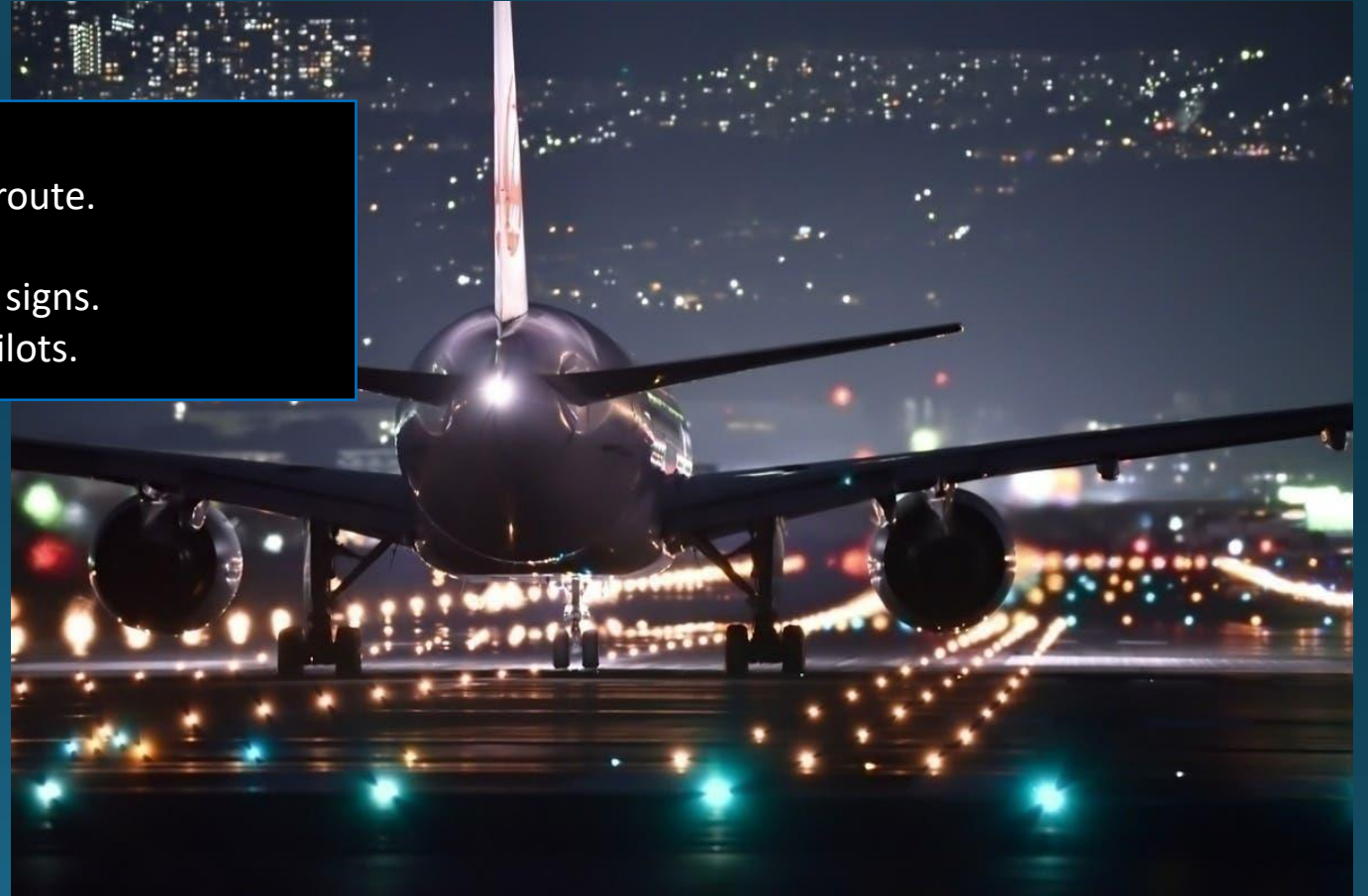
Once seated in the airplane and prior to starting the engine, a careful pilot will organize and arrange all items and materials to be used during the flight. The pilot should also take extra care at night to clear the propeller area. While turning the rotating beacon ON or flashing the airplane position lights helps alert persons nearby to remain clear of the propeller, the pilot should carefully and methodically scan the area around the aircraft.



# Night Flight Considerations

## Taxiing at Night

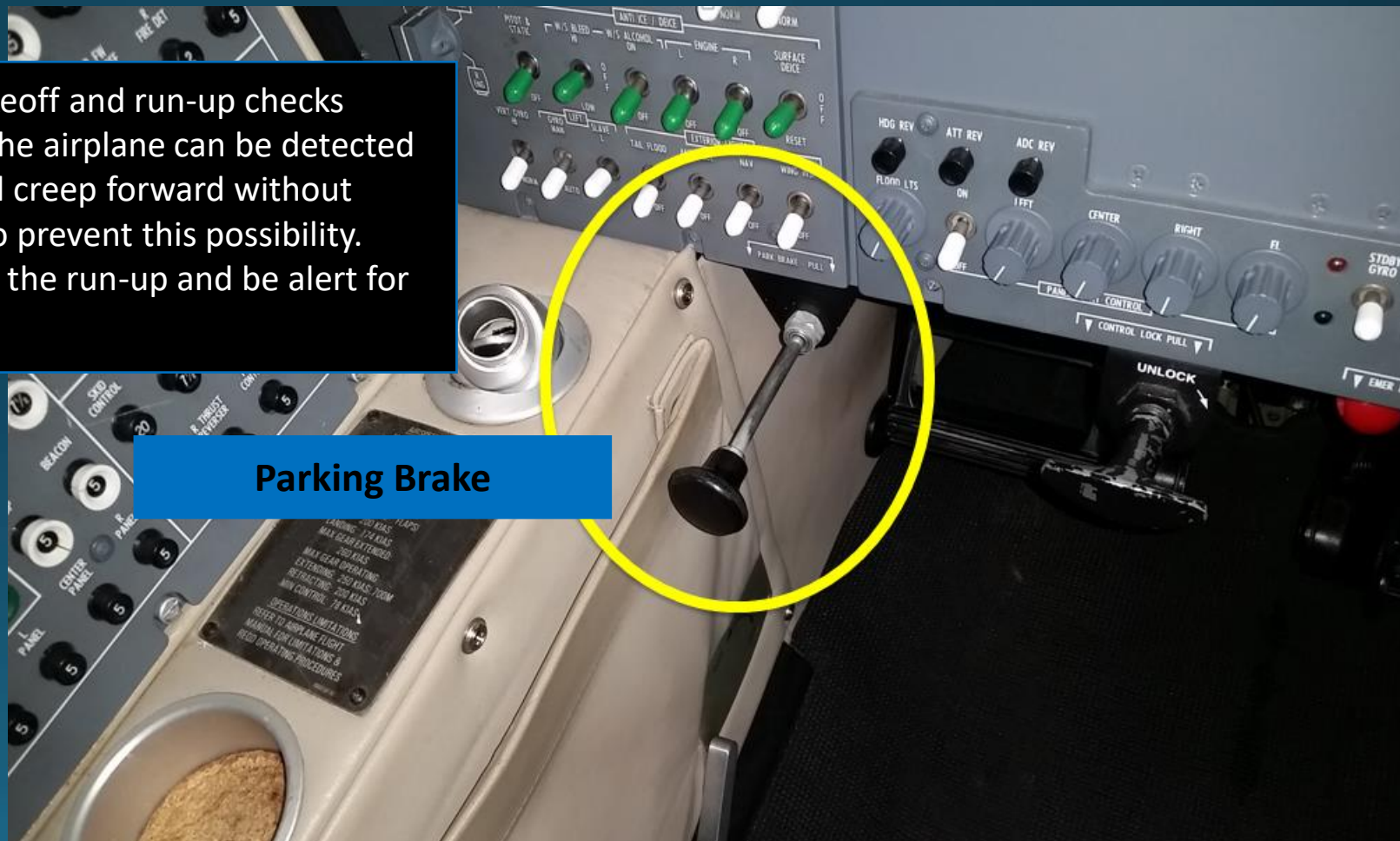
- Be more cautious due to reduced visibility.
- Maintain situational awareness and stay on your route.
- Taxi at a slower speed.
- Look closely at taxiway and runway markings and signs.
- Use aircraft exterior lights to be visible to other pilots.



# Night Flight Considerations

## Night Run Up

When using the checklist for the before-takeoff and run-up checks during the day, any forward movement of the airplane can be detected easily. However, at night, the airplane could creep forward without being noticed unless the pilot takes steps to prevent this possibility. Pilots should hold or lock the brakes during the run-up and be alert for any forward movement.



# Night Flight Considerations

## Takeoff and Climbout

The most noticeable difference between daylight and nighttime flying is the limited availability of outside visual references at night. Therefore, flight instruments should be used to a greater degree in controlling the airplane. This is particularly true on night takeoffs and climbs. The pilot should adjust the flight deck lights to a minimum brightness that will allow for reading the instruments and switches but not hinder outside vision.

## Establish Positive Climb

Using Flight Instruments

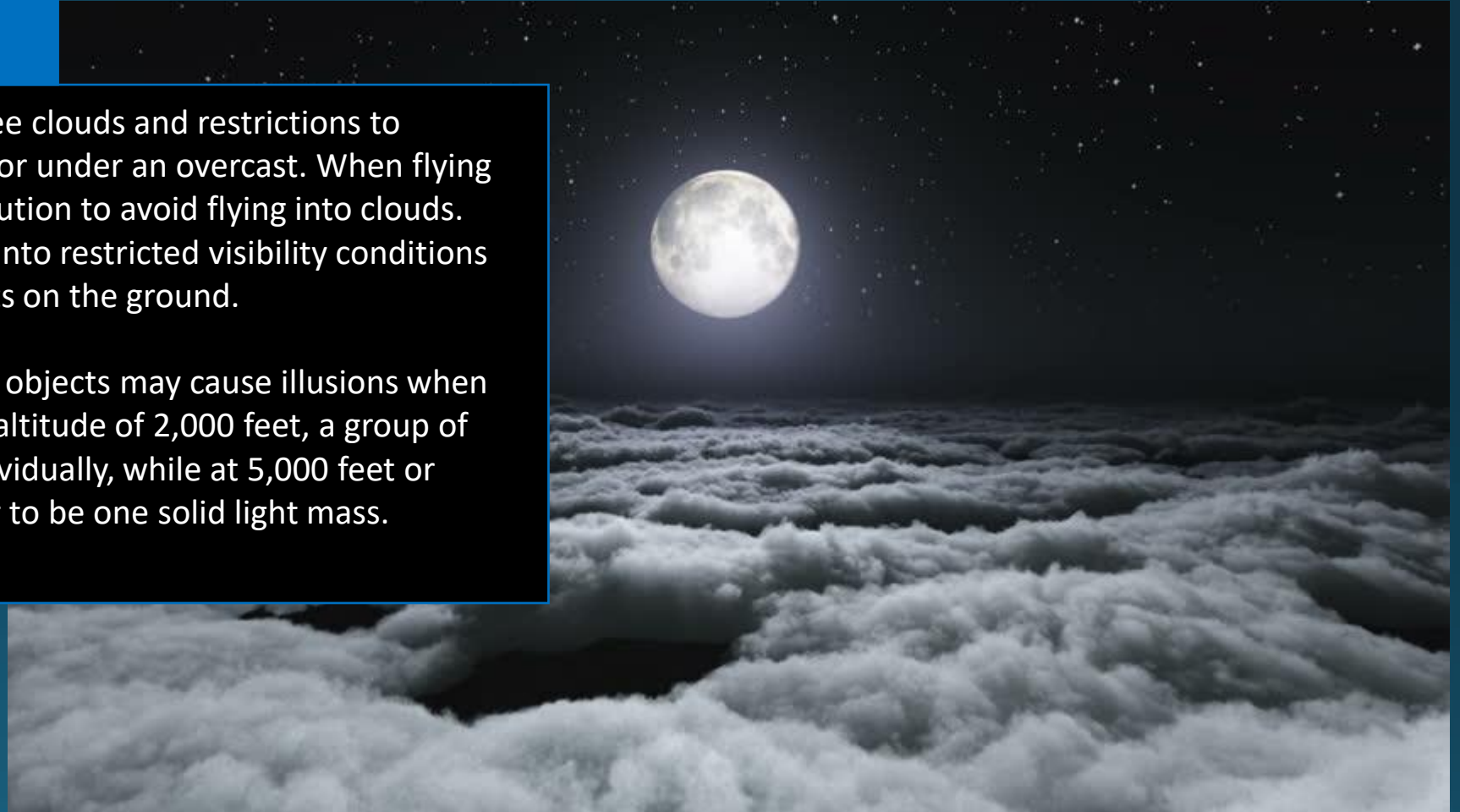


# Night Flight Considerations

## Orientation in Flight

Generally, at night, it is difficult to see clouds and restrictions to visibility, particularly on dark nights or under an overcast. When flying under VFR, pilots should exercise caution to avoid flying into clouds. Usually, the first indication of flying into restricted visibility conditions is the gradual disappearance of lights on the ground.

Lighted runways, buildings, or other objects may cause illusions when seen from different altitudes. At an altitude of 2,000 feet, a group of lights on an object may be seen individually, while at 5,000 feet or higher, the same lights could appear to be one solid light mass.



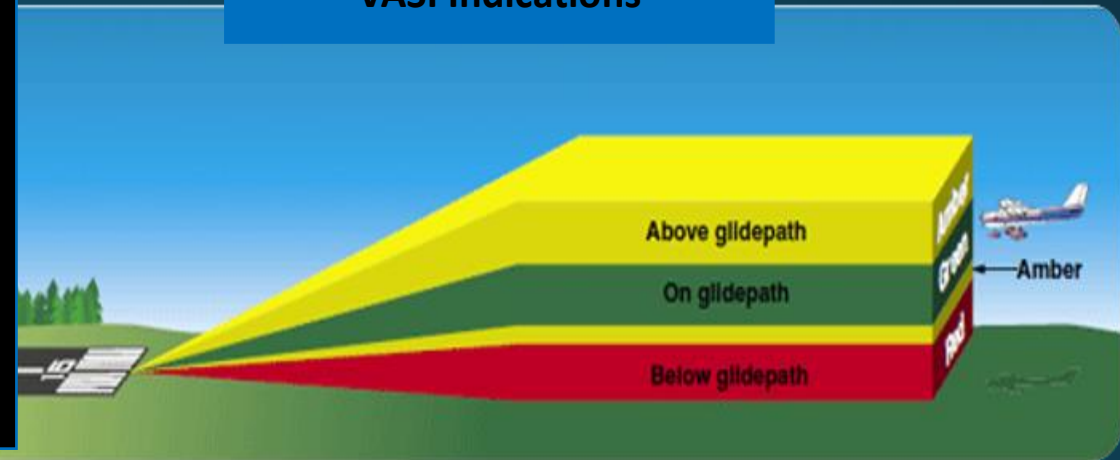
# Night Flight Considerations

## Approach to Landing

When approaching the airport to enter the traffic pattern and land, it is important that the runway lights and other airport lighting be identified as early as possible. If the airport layout is unfamiliar, sighting of the runway may be difficult until very close-in due to the maze of lights observed in the area.

Be sure to never get low on glidepath when flying at night as it may be difficult to see dark obstructions along the approach path.

## VASI Indications



## PAPI Indications



# Night Flight Considerations

## Roundout and Touchdown

The round out and touchdown is made in the same manner as in day landings. At night, the judgment of height, speed, and sink rate is impaired by the scarcity of observable objects in the landing area. An inexperienced pilot may have a tendency to round out too high. Continuing a constant approach descent until the landing lights reflect on the runway and tire marks on the runway can be seen clearly helps identify the point to begin the round out.

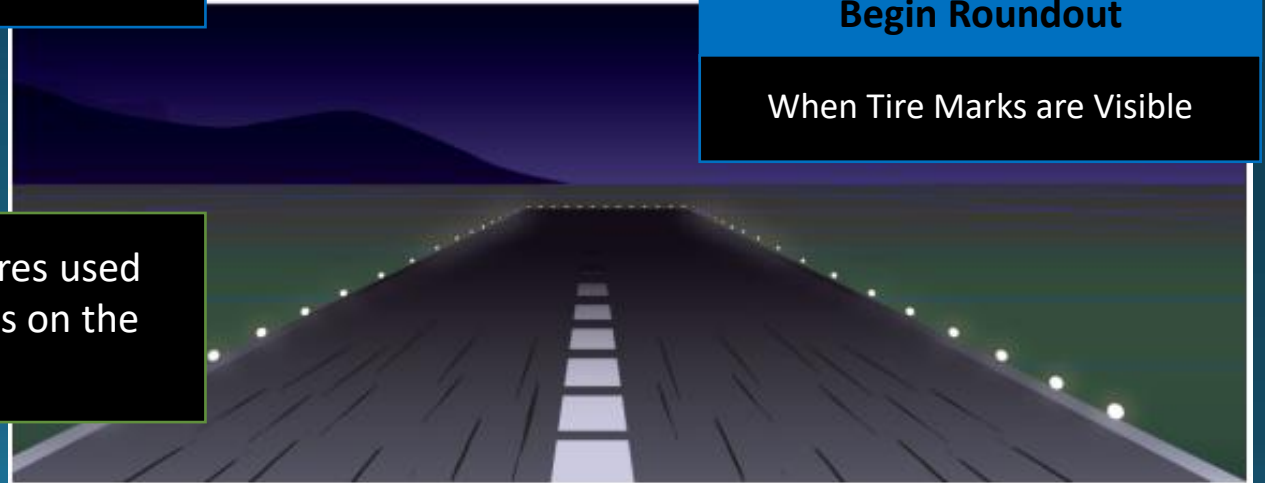


## Begin Roundout

When Tire Marks are Visible

## Go Arouns

Go arounds at night are accomplished with the same procedures used during the day. However, the pilot should place extra emphasis on the flight instruments to avoid an accidental stall.



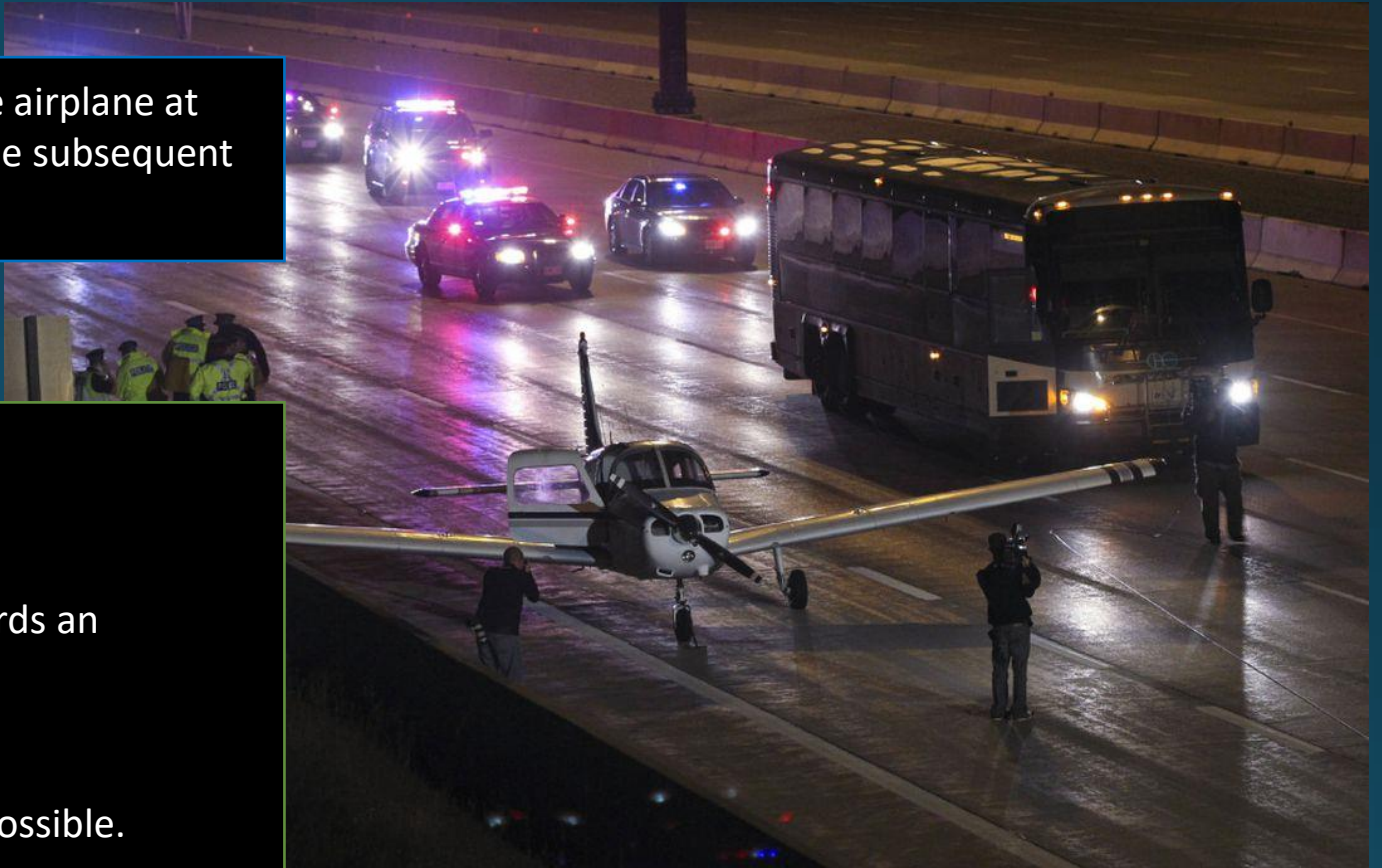
# Night Flight Considerations

## Night Emergencies

Perhaps the greatest concern about flying a single-engine airplane at night is the possibility of a complete engine failure and the subsequent emergency landing.

## Engine Failure Procedures

- Maintain positive control of the airplane.
- Try to determine cause of failure.
- Announce the emergency to ATC.
- If a good landing spot cannot be identified, turn towards an unlighted area.
- Complete the forced landing checklist.
- Avoid landing downwind.
- After landing, shut down and evacuate as quickly as possible.



# Lesson Summary

In this lesson we discussed factors relating to night vision, night disorientation and illusions, pilot and airplane equipment, engine starting, taxiing, run up, takeoff, approach, landing, and night emergency procedures.