



# VISUAL SCANNING AND COLLISION AVOIDANCE

# Lesson Outline

## LESSON OBJECTIVE

To determine that the student exhibits proficient knowledge of the elements related to visual scanning and collision avoidance by describing the elements on the following slide.

## LESSON SOURCE(S)

Airplane Flying Handbook  
*FAA-H-8083-3*

Advisory Circular 90-48  
Aeronautical Information Manual



# Lesson Outline

## LESSON ELEMENTS

Environmental Conditions that Degrade Vision  
Vestibular and Visual Illusions  
“See and Avoid” Concept  
Proper Visual Scanning Procedure  
Proper Clearing Procedures  
Aircraft Blind Spots  
Aircraft Speed Differentials  
Situations with Collision Risk

## TIMEFRAME

**35-40 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

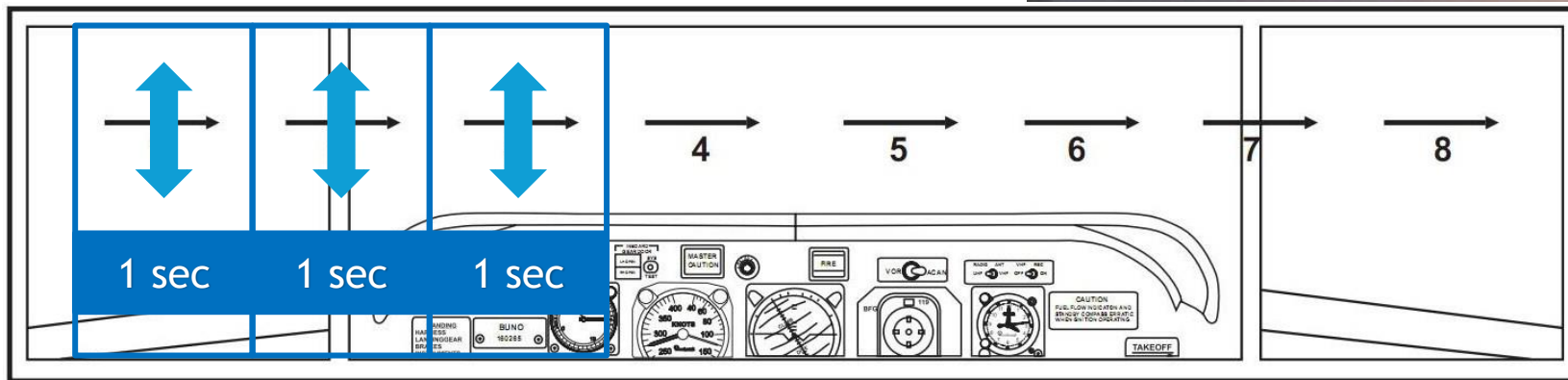
## COMPLETION STANDARDS

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.

# Scanning for Traffic

## Proper Technique

Scanning for traffic is more effective when you move your eyes in a series of short, regularly spaced eye movements. In doing so, you should bring that area into your central focus for at least 1 second.



# General Right of Way Rules

## Reference

FAR 91.113

## Aircraft in Distress



## Balloon



## Glider



## Aircraft Towing



## Airship



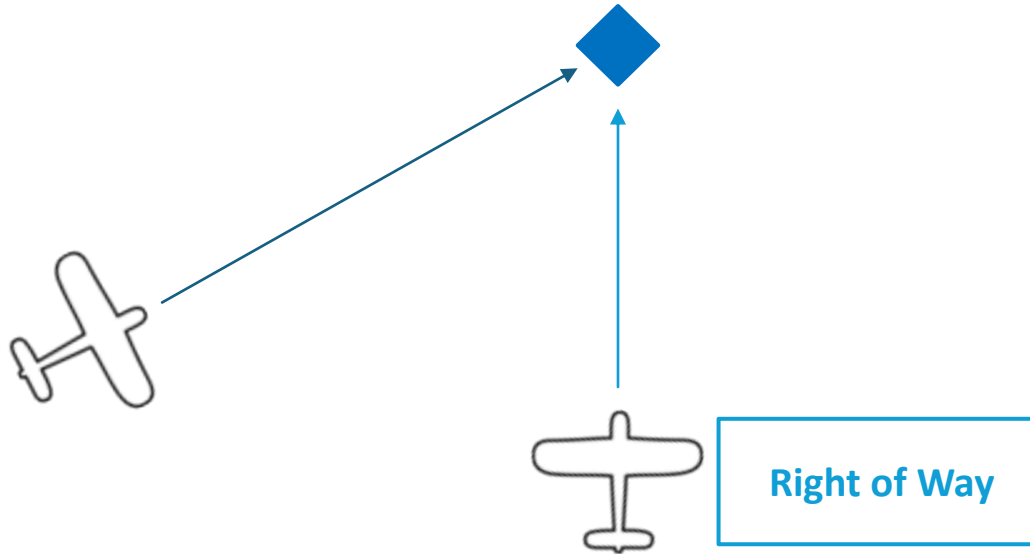
## Airplane and Helicopter



# Situational Right of Way Rules

## Aircraft Converging to a Point

The aircraft to the RIGHT has the Right of Way.



## See and Avoid

Pilots should always be vigilant to "See and Avoid" other aircraft, even if they legally have the Right of Way.



# Situational Right of Way Rules

## Approaching Head On

When aircraft are approaching head-on, or nearly so, each pilot shall alter course to the RIGHT.



## See and Avoid

Pilots should always be vigilant to "See and Avoid" other aircraft, even if they legally have the Right of Way.



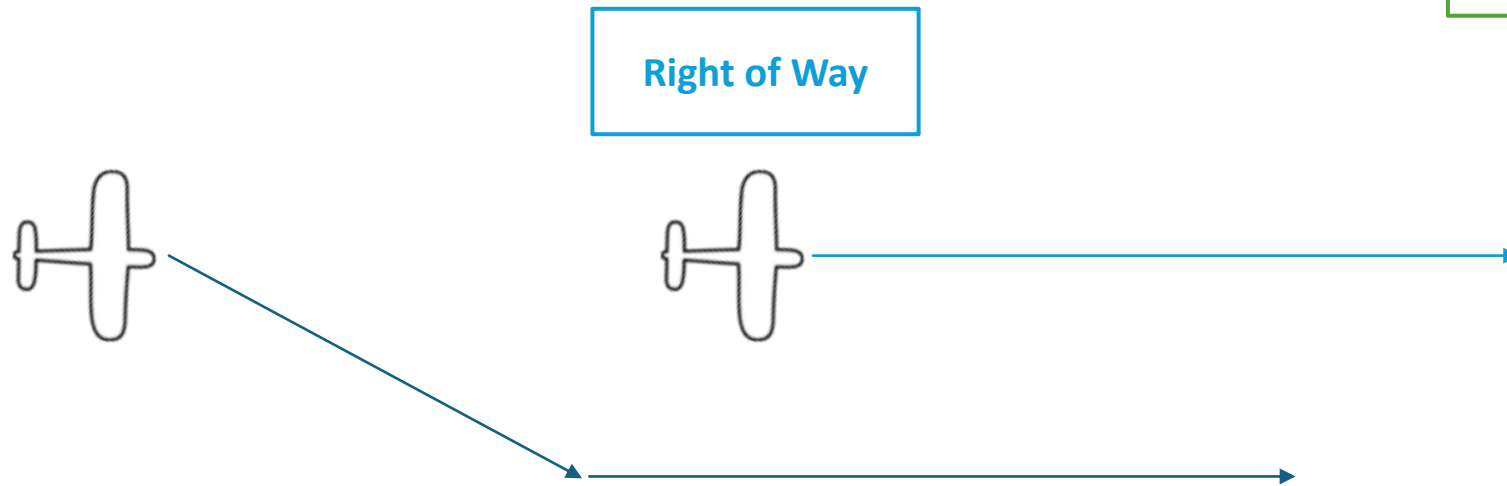
# Situational Right of Way Rules

## Overtaking Another Aircraft

Each aircraft that is being overtaken has the Right of Way and pilots of the overtaking aircraft shall alter course to the RIGHT to pass well clear.

## See and Avoid

Pilots should always be vigilant to “See and Avoid” other aircraft, even if they legally have the Right of Way.



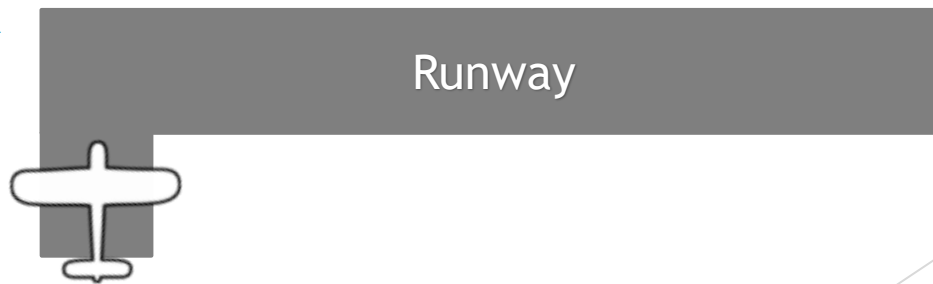
# Situational Right of Way Rules

## Final Approach and Landing

Aircraft on final approach to land (or while landing), have the Right of Way over the other aircraft in flight or operating on the surface.



Right of Way



Runway

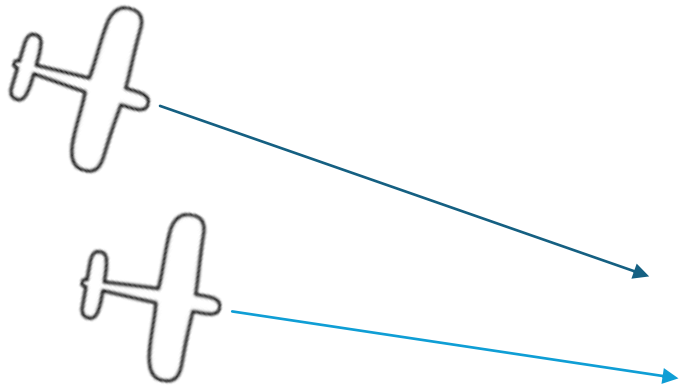
## See and Avoid

Pilots should always be vigilant to “See and Avoid” other aircraft, even if they legally have the Right of Way.

# Situational Right of Way Rules

## Final Approach and Landing

When two or more aircraft are approaching an airport for the purpose of landing, the aircraft at the LOWER ALTITUDE has the Right of Way. Other pilots shall not take advantage of this rule to gain the Right of Way.



## See and Avoid

Pilots should always be vigilant to “See and Avoid” other aircraft, even if they legally have the Right of Way.

# Aircraft Blind Spots

## Low Wing Aircraft

The blind spots are below the pilot.



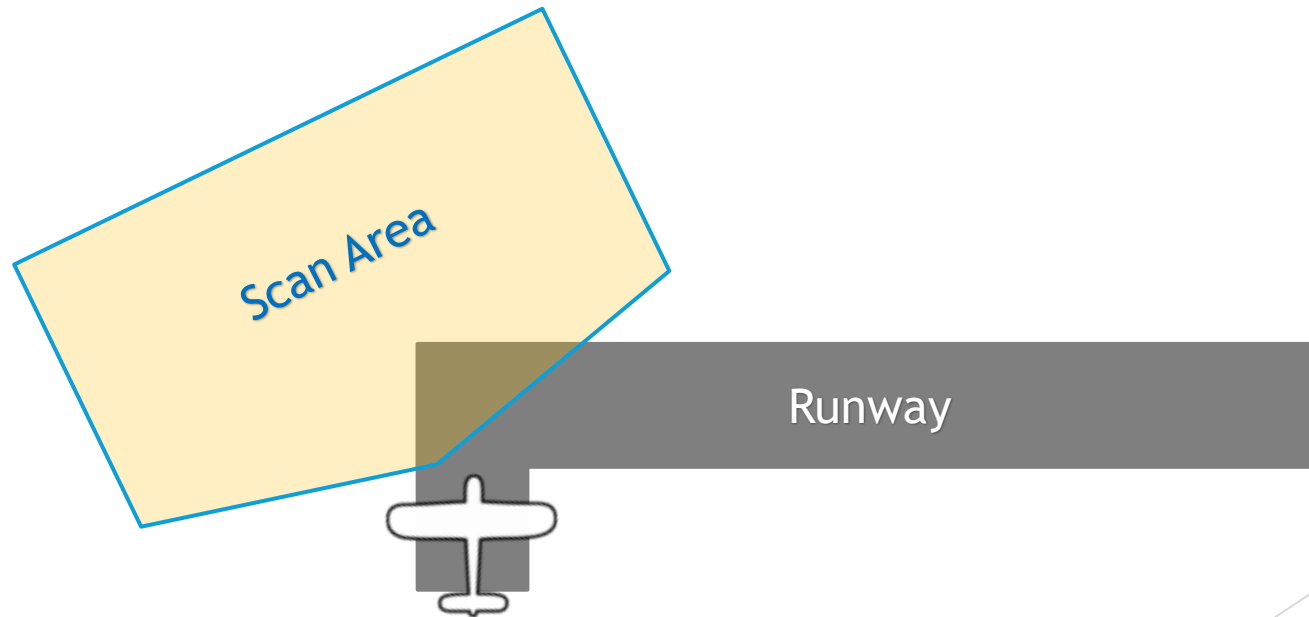
## High Wing Aircraft

The blind spots are above the pilot.

# Clearing Procedures

## Before Takeoff

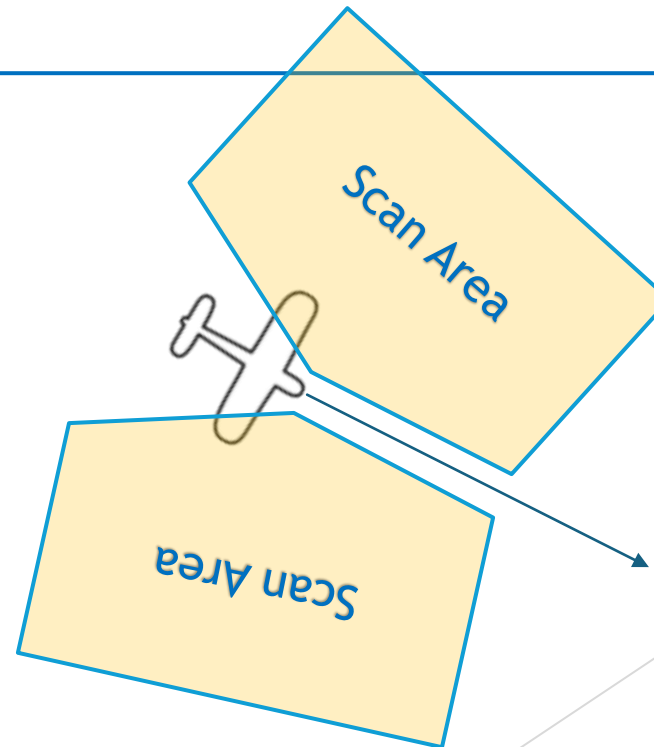
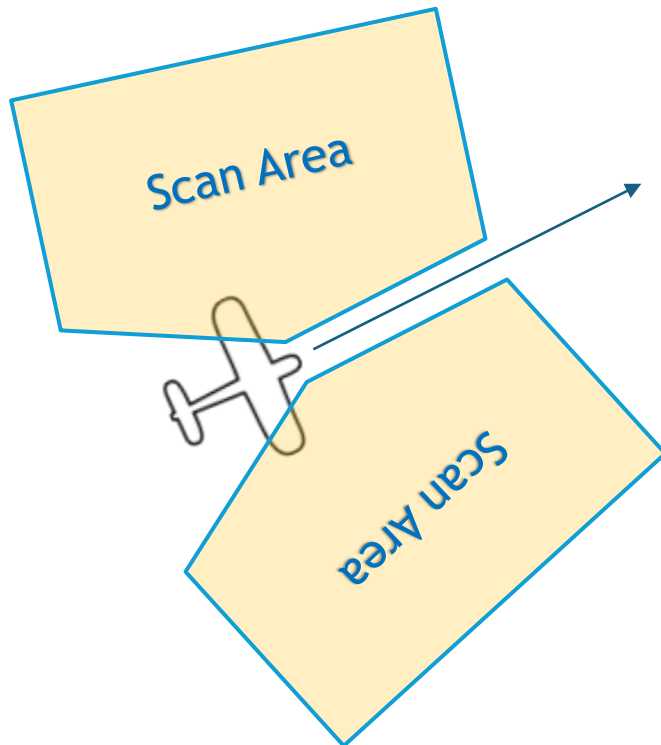
Prior to taxiing onto a taxiway or runway, pilots need to clear the area. Scan for traffic approaching the airport or in the traffic pattern.



# Clearing Procedures

## Climbs and Descents

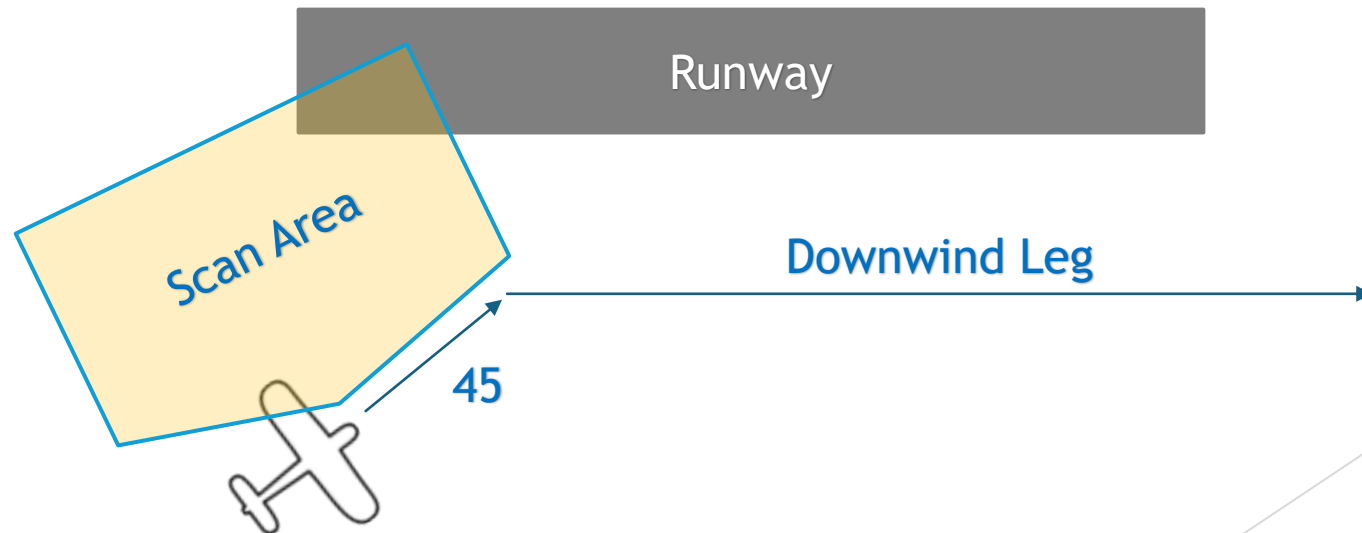
During climbs and descents when you cannot see the airspace you are flying into, make gentle left and right turns to scan for traffic on either side.



# Clearing Procedures

## Entering the Traffic Pattern

Enter the traffic pattern while descending should be avoided. It is best for pilots to enter the traffic pattern on a 45 degree angle to the Downwind Leg.

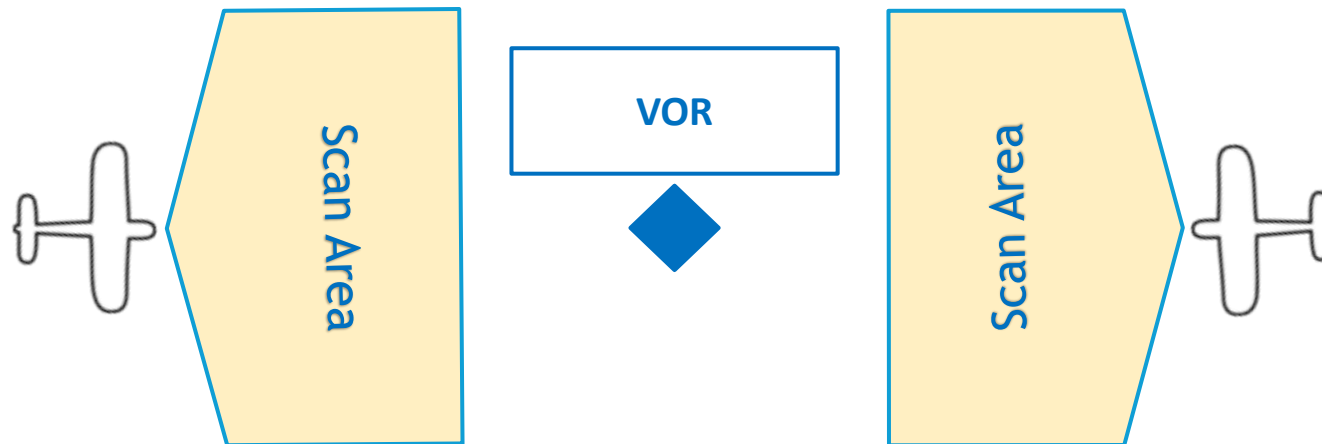




# Clearing Procedures

## VOR Sites

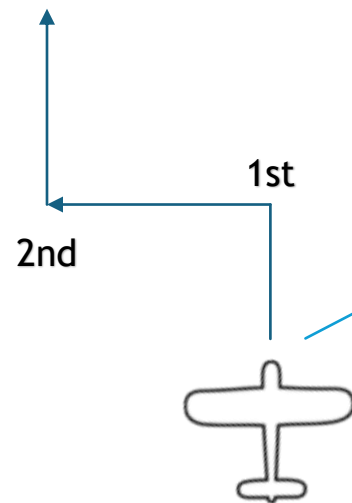
Due to converging and heavy trafficked areas, be extra diligent around VOR sites and intersections.



# Clearing Procedures

## Training Operations

Clearing procedures should be used when training and practicing flight maneuvers. It is often best, when performing clearing turns, to make your first clearing turn to the LEFT as aircraft that may be overtaking you from behind would be overtaking from the Right.



“Clear left, clear right, above, and below.”

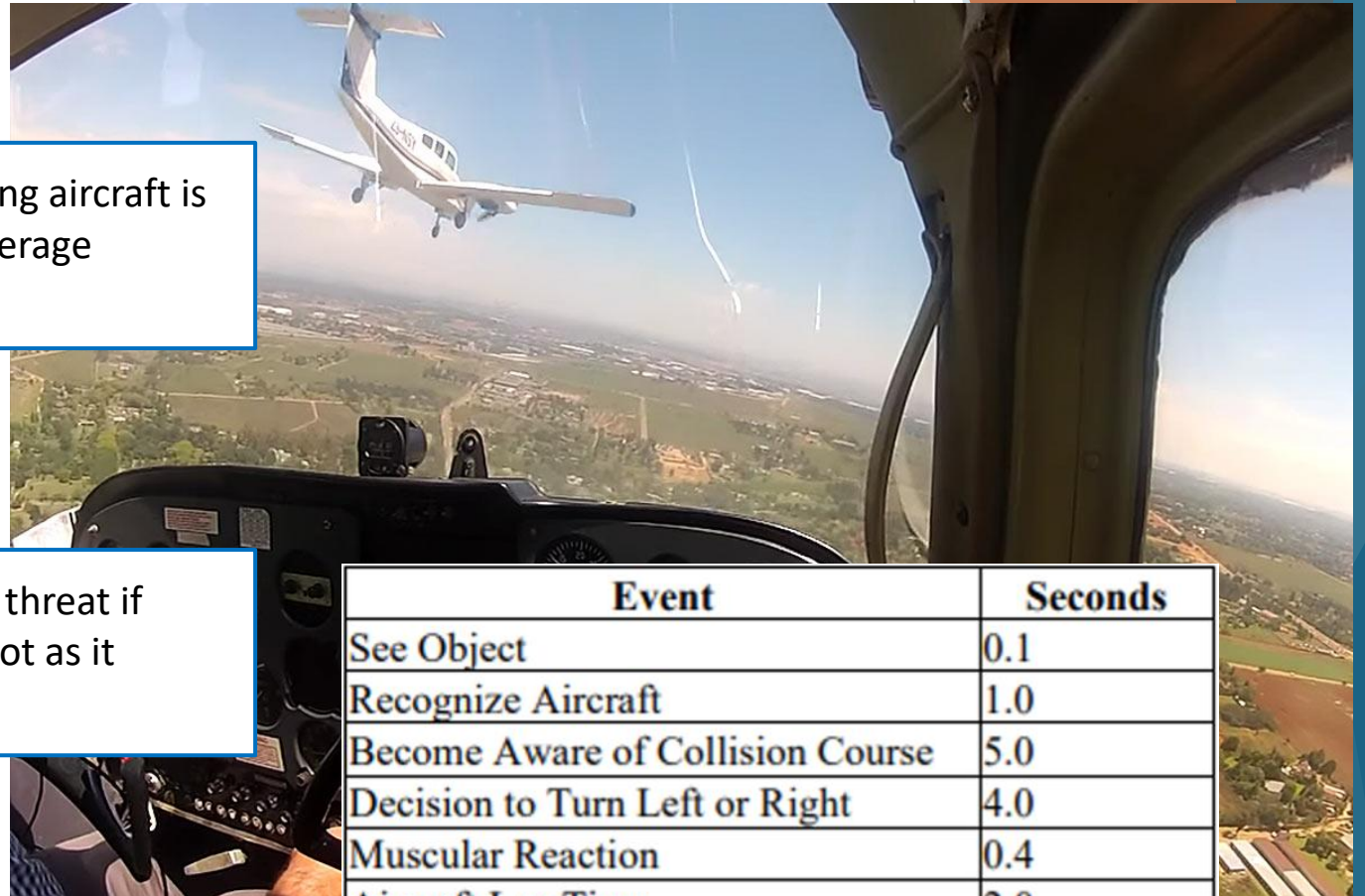
# Aircraft Speed Differentials

## Increased Collision Risk

The risk of a collision can greatly increase when a fast flying aircraft is involved in the situation. Research has shown that the average person has a reaction time of 12.5 seconds.

## Reaction Time to See and Avoid

This means that a high speed object could pose a serious threat if some means of detection are not being utilized by the pilot as it would take too long to react to avoid a collision.



Event	Seconds
See Object	0.1
Recognize Aircraft	1.0
Become Aware of Collision Course	5.0
Decision to Turn Left or Right	4.0
Muscular Reaction	0.4
Aircraft Lag Time	2.0
<b>TOTAL</b>	<b>12.5</b>

# Pilot Deviations

## Approved Deviations

Regulations authorize a pilot to deviate from ATC instructions under the following circumstances: Response to a Traffic Alert and Collision Avoidance System and in an Emergency.

## Unapproved Deviations

Example of unapproved deviations include: straying from heading or altitude, entering airspace without approval, taxiing, taking off, or crossing a runway without proper instructions, and more.



"We've got a number for you to call."

# Pilot Deviations

## How to Avoid Deviations

- Plan each flight carefully.
- Talk and squawk.
- Give plenty of room to other aircraft.
- Avoid Runway Incursions.
- Ask ATC for assistance when unsure.
- Review NOTAMs and TFRs.
- Write down ATC instructions.
- Practice “Sterile Cockpit” during critical phases of flight.



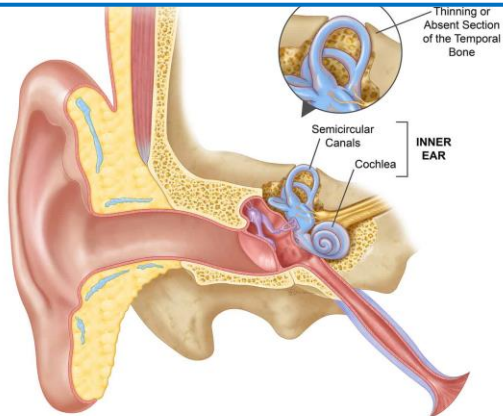


# Spatial Disorientation

Spatial Disorientation specifically refers to the lack of orientation with regard to the position, attitude, or movement of the airplane in space.

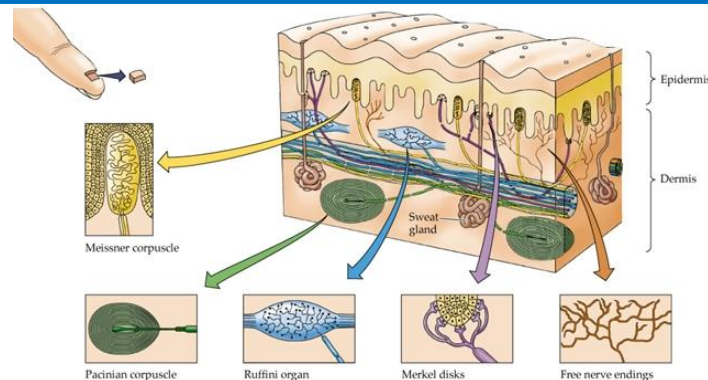
## Vestibular System

Organs found in the inner ear that sense position by the way we are balanced.



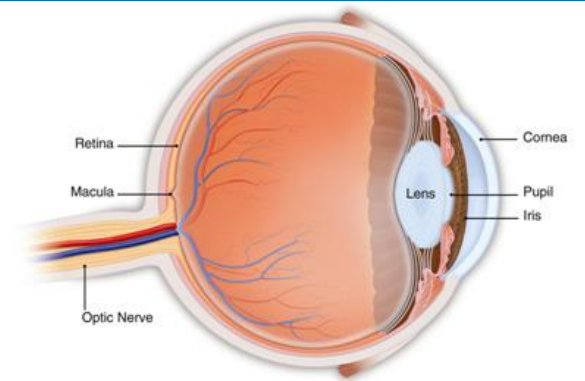
## Somatosensory System

Nerves in the skin, muscles, and joints that sense position based on gravity and feeling.



## Visual System

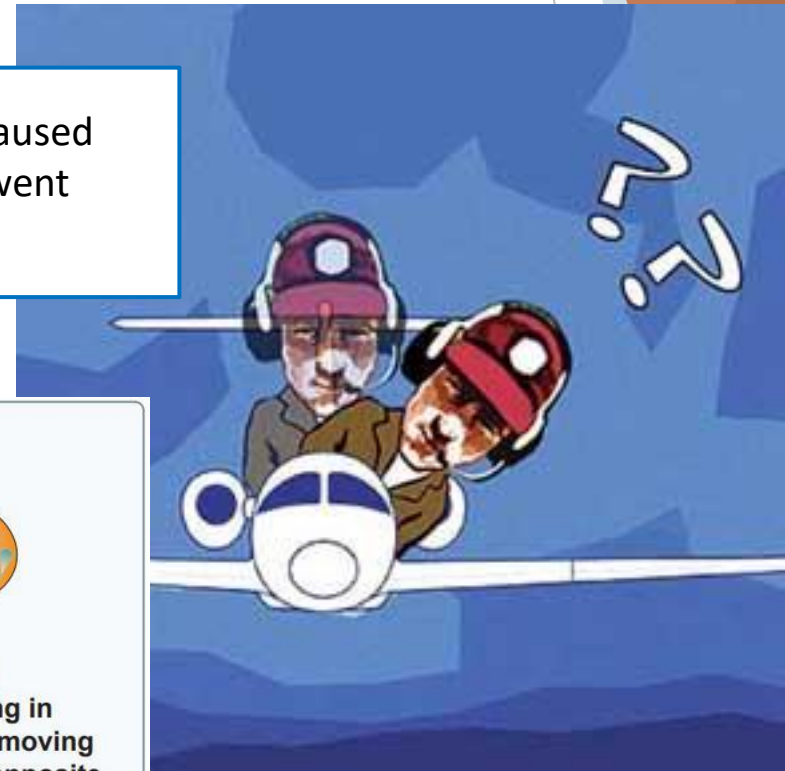
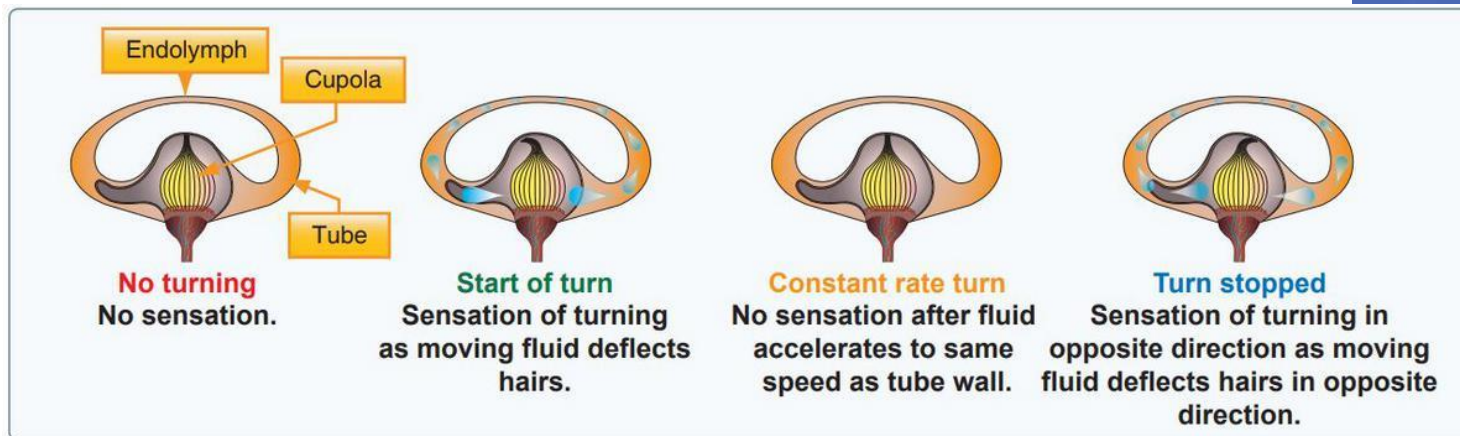
Eyes – which sense position based on what is seen.



# Vestibular Illusions

## The Leans

A condition called The Leans is the most common illusion during flight and is caused by a sudden return to level flight following a gradual and prolonged turn that went unnoticed by the pilot.

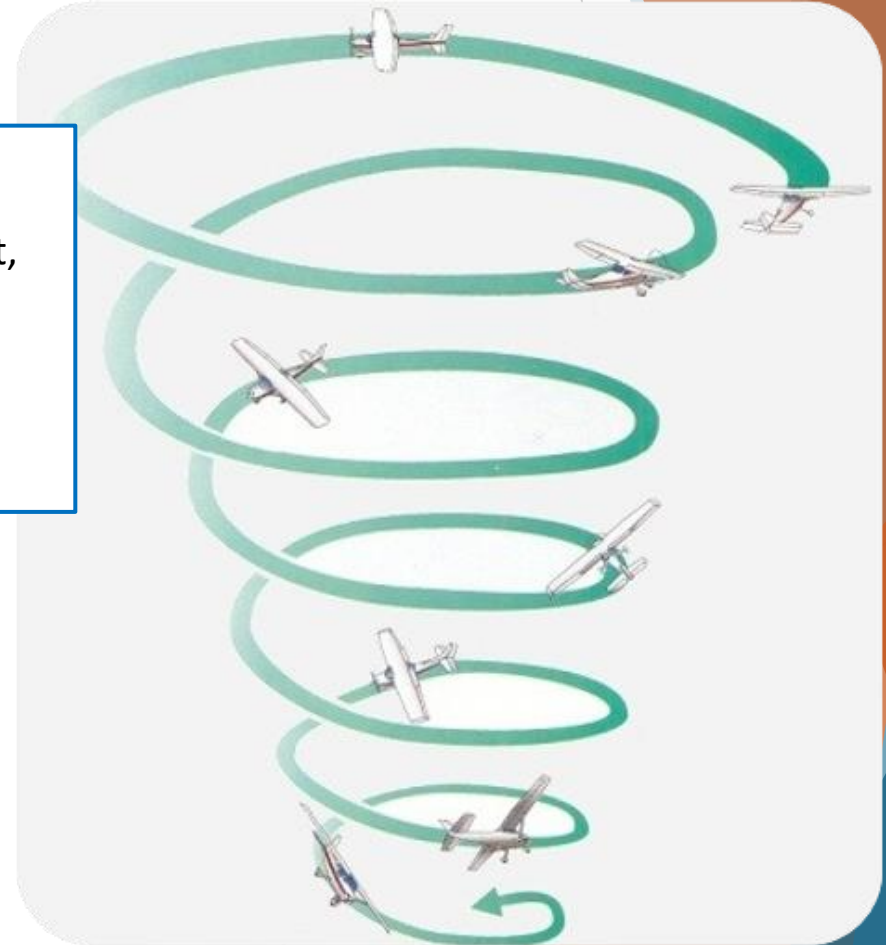




# Vestibular Illusions

## Graveyard Spiral

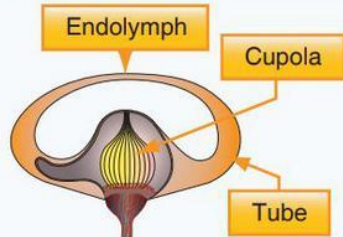
As in other illusions, a pilot in a prolonged coordinated, constant-rate turn may experience the illusion of not turning. During the recovery to level flight, the pilot will then experience the sensation of turning in the opposite direction causing the disoriented pilot to return the aircraft to its original turn. This gradual turn is often accompanied by a loss in lift and altitude.



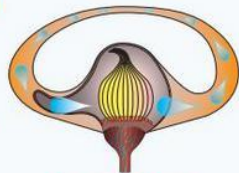
# Vestibular Illusions

## Coriolis Illusion

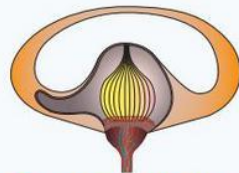
This occurs when a pilot has been in a turn long enough for the fluid in the ear canal to move at the same speed as the canal. A movement of the head in a different plane, such as looking at something in a different part of the flight deck, may set the fluid moving, creating the illusion of turning or accelerating on an entirely different axis.



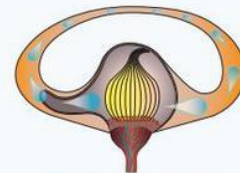
**No turning**  
No sensation.



**Start of turn**  
Sensation of turning  
as moving fluid deflects  
hairs.



**Constant rate turn**  
No sensation after fluid  
accelerates to same  
speed as tube wall.



**Turn stopped**  
Sensation of turning in  
opposite direction as moving  
fluid deflects hairs in opposite  
direction.

# Vestibular Illusions

## Somatogravic Illusion

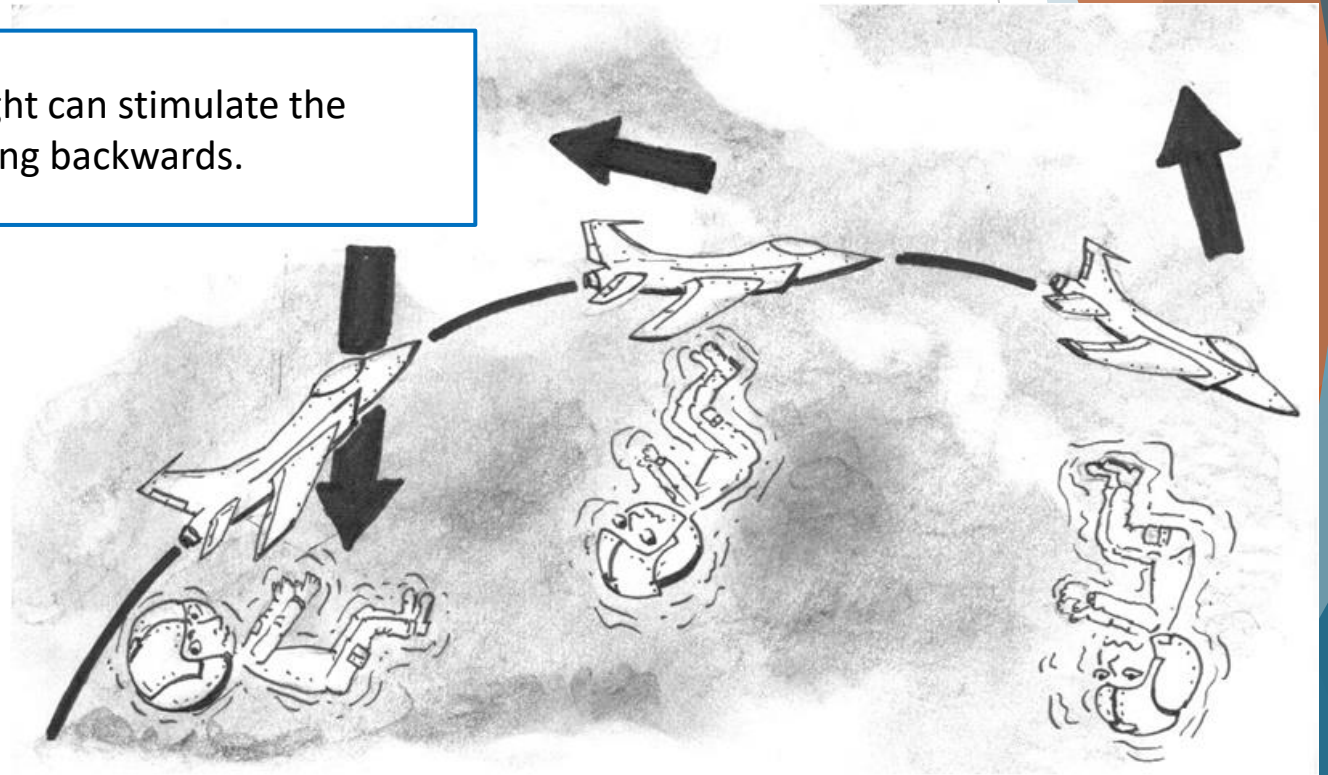
A rapid acceleration, such as experienced during takeoff, stimulates the otolith organs in the same way as tilting the head backwards. This action may create what is known as the Somatogravic Illusion. The reverse happens in a rapid deceleration.



# Vestibular Illusions

## Inversion Illusion

An abrupt change from climb to straight and level flight can stimulate the otolith organs enough to create the illusion of tumbling backwards.



# Vestibular Illusions

## Elevator Illusion

An abrupt upward vertical acceleration, as can occur in an updraft, can stimulate the otolith organs to create the illusion of being in a climb.

An abrupt downward vertical acceleration, usually a downdraft, can create the illusion of being in a nose low attitude.



# Visual 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.

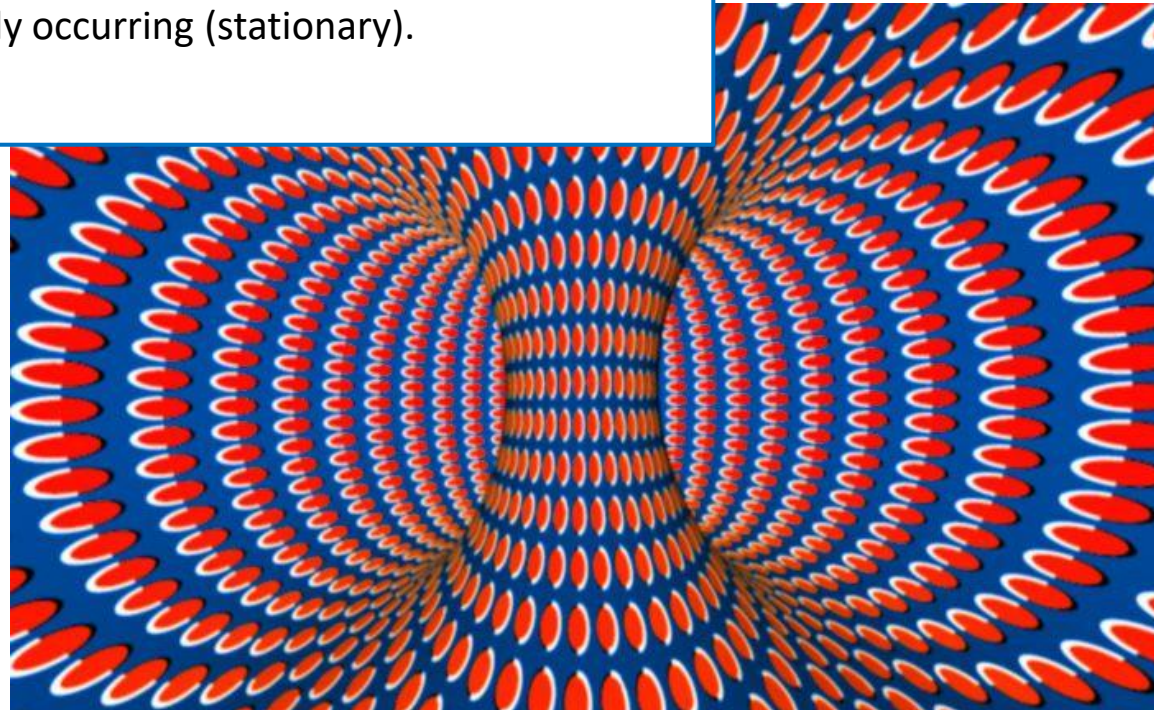




# Visual Illusions

## 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).

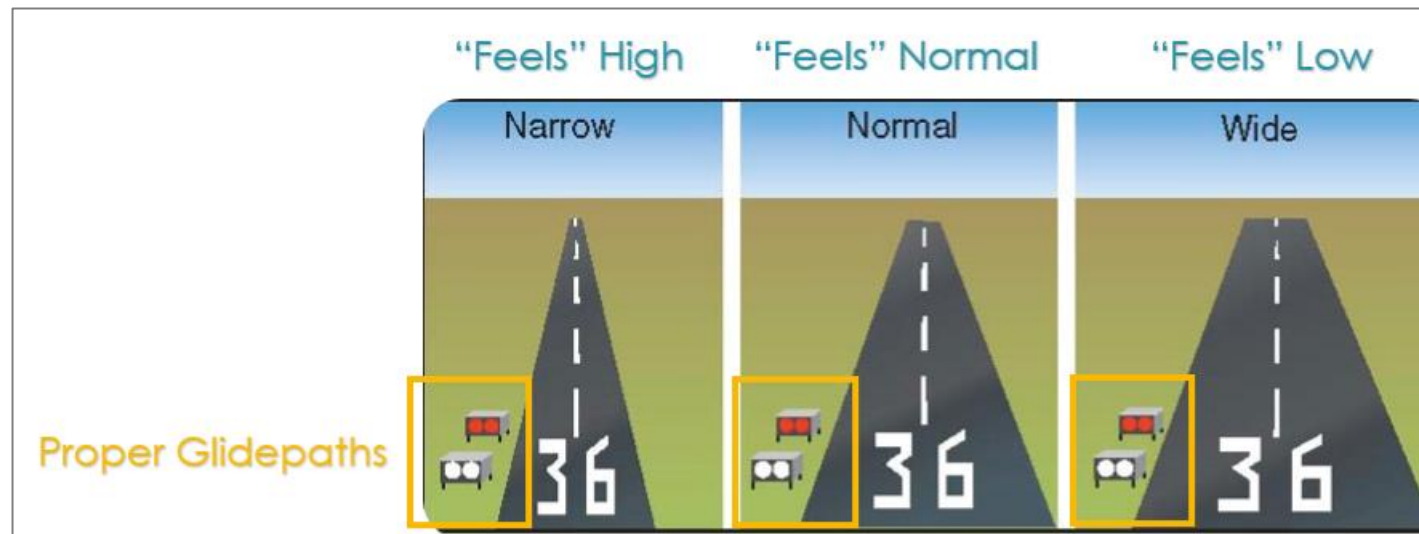




# Visual Illusions

## Runway Width Illusion

A narrower-than-usual runway can create an illusion that the aircraft is at a higher altitude than it actually is. A wider-than-usual runway can have the opposite effect with the risk of the pilot leveling out the aircraft high and landing hard or overshooting the runway.



# Visual Illusions

## Runway Slope Illusion

An upsloping runway, upsloping terrain, or both can create an illusion that the aircraft is at a higher altitude than it actually is. Downsloping runways will have the opposite effect.



## Runway slope illusion

- A downsloping runway can create the illusion that the aircraft is lower than it actually is, leading to a higher approach.
- An upsloping runway can create the illusion that the aircraft is higher than it actually is, leading to a lower approach.

# Visual Illusions

## Featureless Terrain, Water Refraction, and Haze

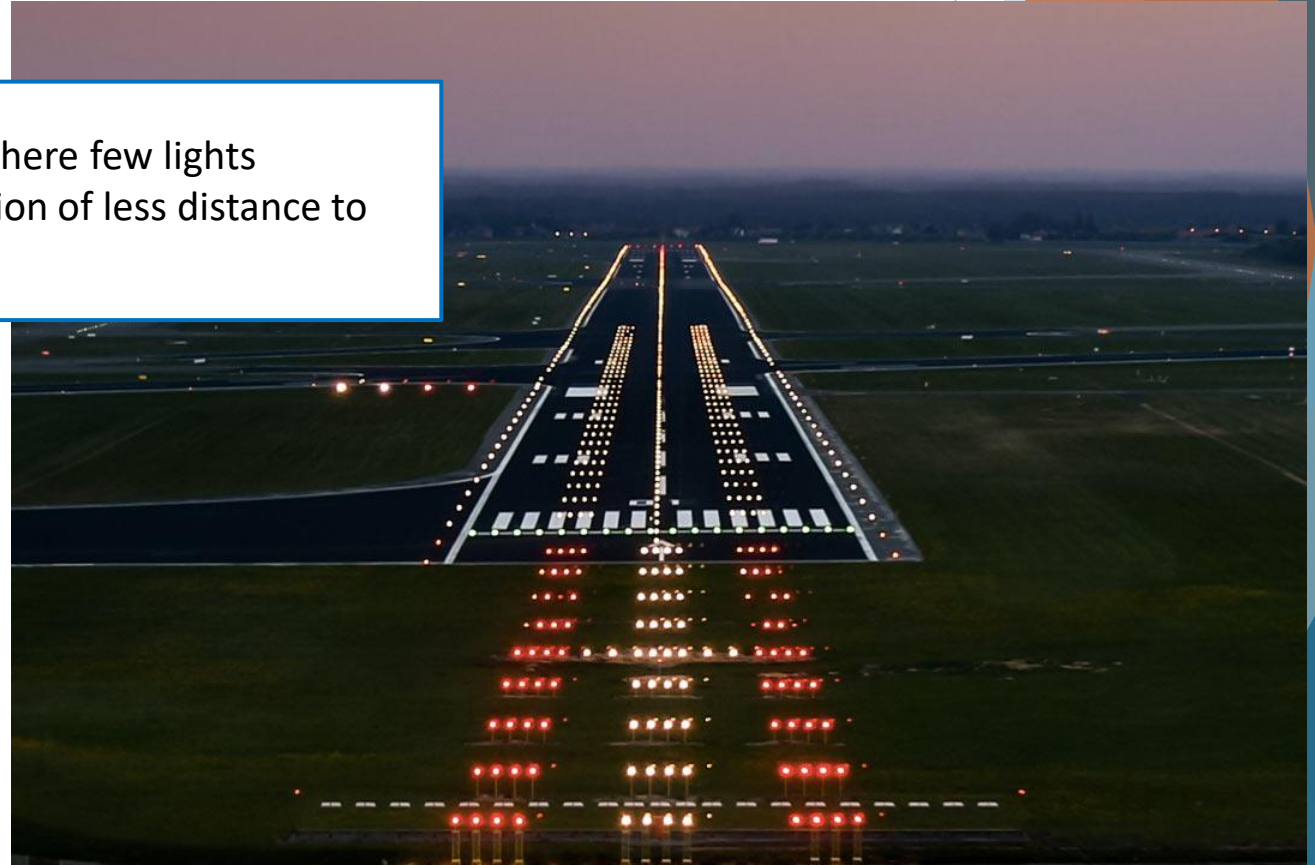
All of these phenomena can make the pilot feel higher and/or further away from objects and from the surface. This is due to the pilot's lack of being able to see details.



# Visual 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.



# Lesson Summary

In this lesson we discussed proper scanning techniques, the “see and avoid” concept, aircraft right of way rules, how to properly scan in different scenarios, aircraft speed differentials, and visual and vestibular illusions pilots may encounter in flight.

RESULTS SENT TO THIS EMAIL

TAKE LESSON QUIZ

## VISUAL SCANNING AND COLLISION AVOIDANCE QUIZ

Send your quiz results to your Flight Instructor's Email by filling out the fields below (optional).

Results will be sent to this email

