



Visual Observer Training Officer Brandon Karr



City of Pearland, Texas

Visual Observer Definition

A person or persons who's sole responsibility during a flight operation is to maintain visual line of sight (VLOS) of the sUAS to assist in the safe and legal operation of flight.



Visual Observer's Role

- After take off, keep a direct line of sight with the UAS
- Work with the pilot to ensure a safe flight
- Keep open communication with the pilot
- Identify and mitigate any unsafe conditions
- Keep the pilot informed of any obstacles:
 - Light poles
 - Wires
 - Trees
 - Airplanes / helicopter
 - Any other objects in the flight path
 - People
 - Birds



VO Quiz

A person whose sole task is watching the sUAS to report hazards to the rest of the crew is called

- a) Visual observer
- b) Remote-PIC
- c) Person manipulating the controls

Who is ultimately responsible for preventing a hazardous situation before an accident occurs?

- a) The visual observer (VO)
- b) The Remote Pilot in Command (Remote PIC)
- c) The person manipulating the controls



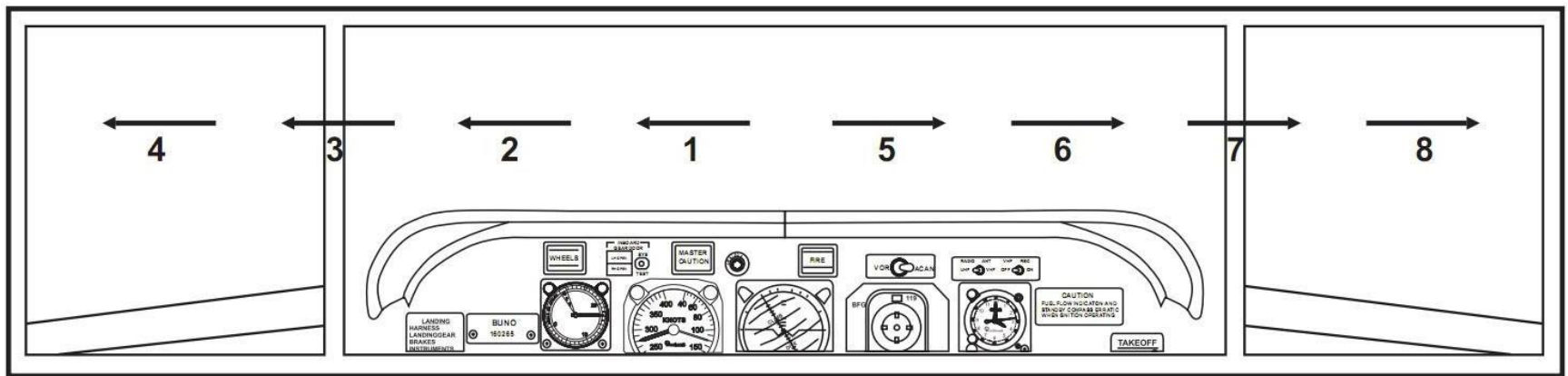
Near miss with helicopter

Birds and Drones

Drone vs Plane



Scanning for Aircraft/Hazards



Visual Observer Communication

Information needed:

- **Immediate action**

- Planes/Helicopters
- Unprotected Persons
- Birds

- **Caution**

- Approaching Obstacle
- Losing Line of Sight
 - Next Visual Observer notification of acquiring line of sight.



VO Communication

- **Hazard location in relation to the drone**
 - East of the drone, North of the drone, Ect.
- **VO's suggested action to avoid collision or violation**
 - Climb, descend, maneuver east, terminate



VO Quiz

The common procedure for scanning for hazards of flight is to:

- a) Scan the air from left to right, quickly multiple times.
- b) Scan the air from right to left in a circular pattern,
- c) Scan the air from center to left, then center to right in sectors, checking each sector carefully

The Visual Observer may use binoculars to assist in the ability to maintain visual line of sight.

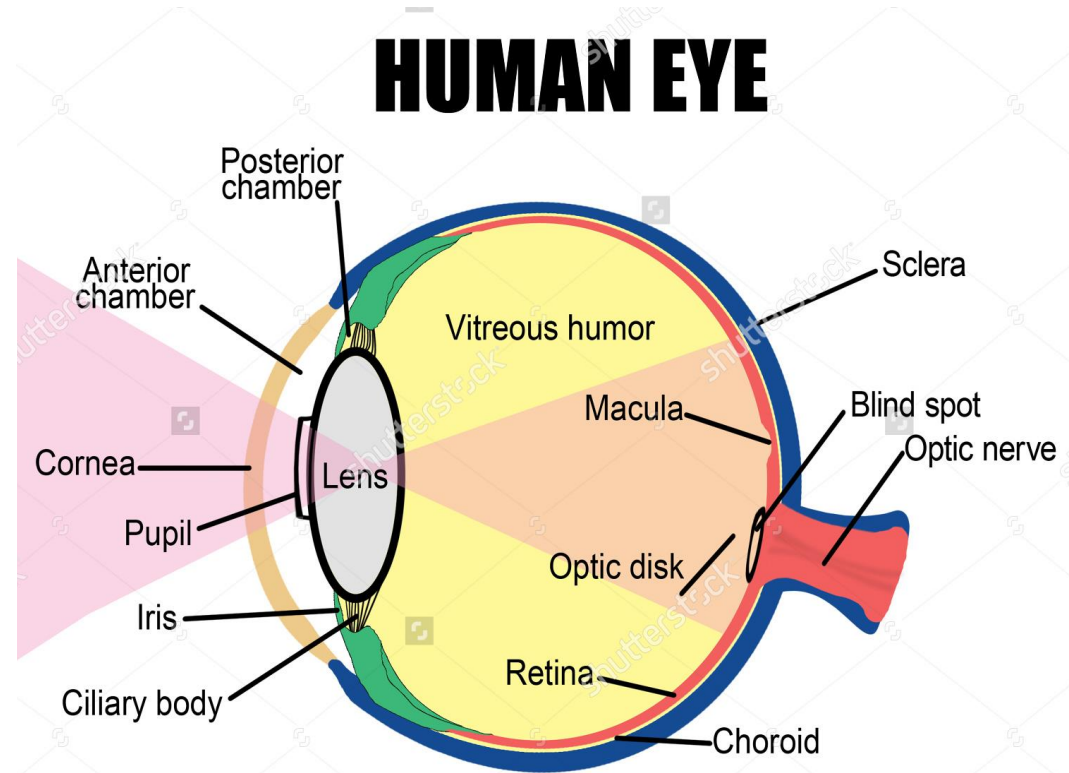
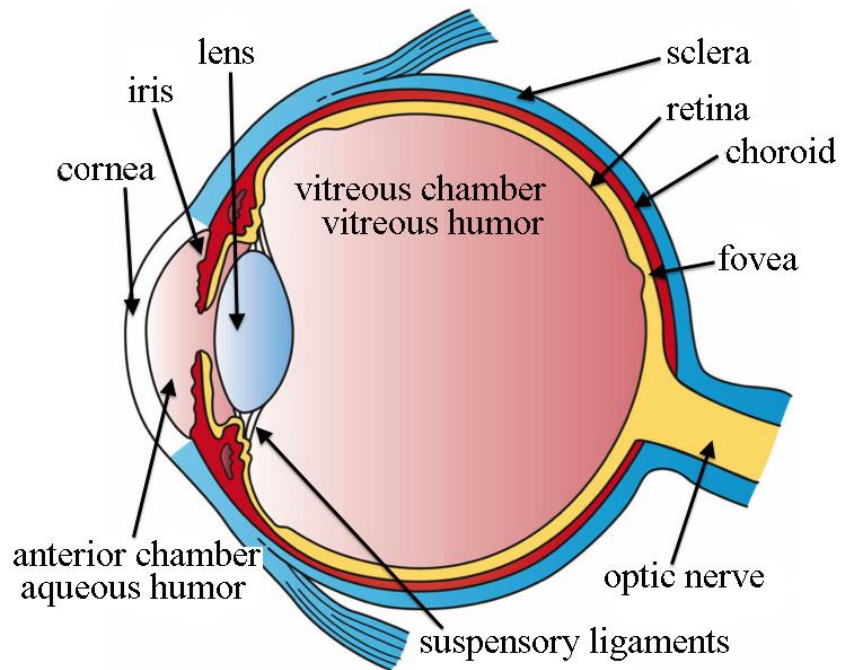
- a) True
- b) False



Night sUAS Operations



The Human Eye



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The Human Eye

- **As light enters the eye it passes through the lens and strikes the retina. The retina contains millions of Rods and Cones.**
 - **Rods**
 - Outnumber Cones 17:1
 - Used for low light image processing as well as peripheral vision.
 - **Cones**
 - We use cones to see motion, detail, and color.
 - Cones require a high level of illumination to function.
 - Decrease in density from the center of the eye to the edge of the retina.
 - The fovea is completely covered in only cones.



VO Quiz

The Cones in your eye are used for:

- a) Detail
- b) Peripheral images
- c) Low light images

The Rods in your eye are used for:

- a) Low light image processing
- b) Detail
- c) Color



Factors that Affect Night Vision

- Night Vision Processing
- Two blind spots
- Lack of color vision
- Reduced acuity
- Reduced depth perception



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- Night myopia

Night Vision Processing

- Process requires about 30 min
- Rods become adjusted to darkness
- Off-center viewing important during night flights
- Smoking, carbon monoxide, hypoxia, certain drugs adversely affect night vision
- Avoid bright lights to preserve night vision
- Red light preserves night vision but severely distorts colors



Two Blind Spots

- **Physiological blind spot**
 - Occurs due to the Optic nerve bundle entering the eye called the Optic Disk
 - Not observed due to the other eye compensating.
- **Central blind Spot**
 - Due to there not being any rods in the Fovea
 - Look approximately 15 degrees off to see detail.



VO Quiz

The two blind spots in the eye are due to the optic nerve and the lack of rods in the fovea

- a) True
- b) False

Red light preserves night vision

- a) True
- b) False



Lack of Color Vision

- Due to the lack of light, rods cannot function properly. Thus, the ability to see color is decreased



Reduced Acuity

- **Central vision blindness at night**
- **High rod-to-optic nerve fiber ratio reduces acuity**
 - Again due to the ability to process light



Night Myopia

- Near sightedness occurs during dark focus
- Periodically change focus distance



VO Quiz

At night your ability to see color is:

- a) Increased
- b) Decreased
- c) Neither

Night Myopia is the night effect on the eye that causes near sightedness.

- a) True
- b) False



Visual Hypoxia

- The retina of the eye is more sensitive to hypoxia than any part of our body
- One of the first symptoms of hypoxia is a decrease in night vision
- Effects most noticeable starting at 5000' above ground level to which you are acclimated
- Smokers are much more susceptible to hypoxia due to the build-up of carbon monoxide in their blood



Night Blindness

- Functionally blind due to pigment deficiency in rods
- Night blindness induced within 60 days on diet lacking vitamin A



Effects of Aging

- Pupil size decreases
- Range of eye focus is reduced
- Visual acuity is reduced
- Color discrimination becomes more difficult
- It takes longer to process visual information in general
- Sensitivity to glare increases
- Takes longer to read under dim light conditions



Night Illusions & Limitations

Illusions

- Autokinesis (objects appear to shift)
- False reference (stars or lights near horizon)
- Venus and sirius (false aircraft)
- Night myopia (dilation, inability to focus)
- Somatogravic (acceleration with pitch)

Limitations

- Night blind spot (rods & cones, stars, etc)
- Light to dark adaptation (30min)



Focused Scan Problems at Night

- **Night blind spot**
 - center portion of eye is blind at night
- **Night Scan**
 - look 10-15⁰ away from what you try to see
 - night vision is affected by altitude
 - drugs, alcohol, smoking and fatigue adversely affect night and day vision



VO Quiz

The night illusion autokinesis is when objects appear to shift when the observer stares directly at the object.

- a) True
- b) False

The night illusion False Reference is when the observer cannot discern where the horizon is located due to ground lighting creating the illusion to be stars.

- a) True
- b) False



End

Questions, Comments, Concerns

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