IMSAFE

IMSAFE

FAA AC 91-92 4.10 IMSAFE Checklist:

A self-assessment checklist to assist pilots in determining their physical and mental health as part of planning before a flight.

Illness

Medication

Stress

Alcohol

Fatigue

Emotion

The Five Hazardous Attitudes

Anti-authority: "Don't tell me."

This attitude is found in people who do not like anyone telling them what to do. In a sense, they are saying, "No one can tell me what to do." They may be resentful of having someone tell them what to do or may regard rules, regulations, and procedures as silly or unnecessary. However, it is always pilot prerogative to question authority if it seems to be in error.

Impulsivity: "Do it quickly."

This is the attitude of people who frequently feel the need to do something—anything—immediately. They do not stop to think about what they are about to do; they do not select the best alternative; and they do the first thing that comes to mind.

Invulnerability: "It won't happen to me."

Many people believe that accidents happen to others, but never to them. They know accidents can happen, and they know that anyone can be affected. They never really feel or believe that they will be personally involved. Pilots who think this way are more likely to take chances and increase risk.

Macho: "I can do it."

Pilots who are always trying to prove that they are better than anyone else are thinking, "I can do it, I'll show them." Pilots with this type of attitude will try to prove themselves by taking risks in order to impress others. While this pattern is thought to be a male characteristic, women are equally susceptible.

Resignation: "What's the use?"

Pilots who think, "What's the use?" do not see themselves as being able to make a great deal of difference in what happens to them. When things go well, the pilot is apt to think that it is good luck. When things go badly, the pilot may feel that "someone is out to get me," or attribute it to bad luck. The pilot will leave the action to others, for better or worse. Sometimes, such pilots will even go along with unreasonable requests just to be a "nice guy."

Hazardous Attitude	Antidotes
Macho Steve often brags to his friends about his skills as a pilot and how close to the ground he flies. During a local pleasure flight in his single-engine airplane, he decides to buzz some friends barbecuing at a nearby park.	**Taking chances is foolish.**
Anti-authority Although he knows that flying so low to the ground is prohibited by the regulations, he feels that the regulations are too restrictive in some circumstances.	**Follow the rules. They help prevent accidents.**
Invulnerability Steve is not worried about an accident since he has flown this low many times before, and he has not had any problems.	**It could happen to me.**
Impulsivity As he is buzzing the park, the airplane does not climb as well as Steve had anticipated, and without thinking, he pulls back hard on the yoke. The airspeed drops, and the airplane is close to stalling as the wing brushes a power line.	**Not so fast. Think first.**
Resignation Although Steve manages to recover, the wing sustains minor damage. Steve thinks to himself, "It doesn't really matter how much effort I put in—the end result is the same whether I really try or not."	**I'm not helpless. I can make a difference.**

The effects of alcohol and drugs, and their relationship to flight safety.

Lesson Objective

To know why you can’t drink and fly

The Why

The influence of alcohol drastically reduces the chances of completing a flight without incident.

Even in small amounts, alcohol can:

Impair judgment

Decrease sense of responsibility

Affect coordination

Constrict visual field

Diminish memory

Reduce reasoning ability

Lower attention span

Decrease the speed and strength of muscular reflexes

Lessen the efficiency of eye movements while reading

And the next day…

While experiencing a hangover, a pilot is still under the influence of alcohol.

Although a pilot may think he or she is functioning normally, motor and mental response impairment is still present.

Considerable amounts of alcohol can remain in the body for over 16 hours, so pilots should be cautious about flying too soon after drinking.

My thoughts

Most people when they drink want to ‘feel it’ even if they are good about monitoring intake.

If you ‘feel it’ everything you do physically and mentally will be a bit/a lot slower.

Legally you drink one drop and you are ‘done’ for 8 hours.

Now why the .04 % rule? Cause obviously someone drank so much that 8 hours was not enough and they got into an accident.

The FARs

§ 91.17 Alcohol or drugs.

(a) No person may act or attempt to act as a crewmember of a civil aircraft -

(1) Within 8 hours after the consumption of any alcoholic beverage;

(2) While under the influence of alcohol;

(3) While using any drug that affects the person's faculties in any way contrary to safety; or

(4) While having an alcohol concentration of 0.04 or greater in a blood or breath specimen. Alcohol concentration means grams of alcohol per deciliter of blood or grams of alcohol per 210 liters of breath.

The FARs

§ 61.53 Prohibition on operations during medical deficiency.

(a) Operations that require a medical certificate. Except as provided for in paragraph (b) of this section, no person who holds a medical certificate issued under part 67 of this chapter may act as pilot in command, or in any other capacity as a required pilot flight crewmember, while that person:

(1) Knows or has reason to know of any medical condition that would make the person unable to meet the requirements for the medical certificate necessary for the pilot operation; or

(2) Is taking medication or receiving other treatment for a medical condition that results in the person being unable to meet the requirements for the medical certificate necessary for the pilot operation.

A quick aside…

"…and I have whiskey…"

Any questions I can answer or follow up later on?

Fatigue and stress

Lesson Objective

To develop understanding of how to recognize and manage Fatigue and Stress while in the air

What is Stress really

Stress is the body's response to physical and psychological demands placed upon it.

Blood sugar, heart rate, respiration, blood pressure, and perspiration all increase.

What is Stress really

Stressors

Physical stress (noise or vibration)

Physiological stress (fatigue)

Psychological stress (difficult work or personal situations)

Acute Stress is not so cute

Stress falls into two broad categories:

Acute = short term

Chronic = long term

Acute stress involves an immediate threat that is perceived as danger.

“fight or flight”

Normally, a healthy person can cope with acute stress and prevent stress overload.

Chronic Stress

Chronic stress can be defined as a level of stress that presents an intolerable burden, exceeds the ability of an individual to cope, and causes individual performance to fall sharply.

<u>Causes real or perceived</u>

Loneliness

Financial worries

Relationship or work problems

These produce a cumulative level of stress that exceeds a person’s ability to cope with the situation.

When stress reaches these levels, performance falls off rapidly.

Pilots experiencing this level of stress are not safe and should not exercise their airman privileges.

Fatigue

<u>Effects</u>

Degradation of attention and concentration

Impaired coordination

Decreased ability to communicate

<u>Physical fatigue results from</u>

Sleep loss

Exercise

Physical work

Factors such as stress and prolonged performance of cognitive work result in mental fatigue.

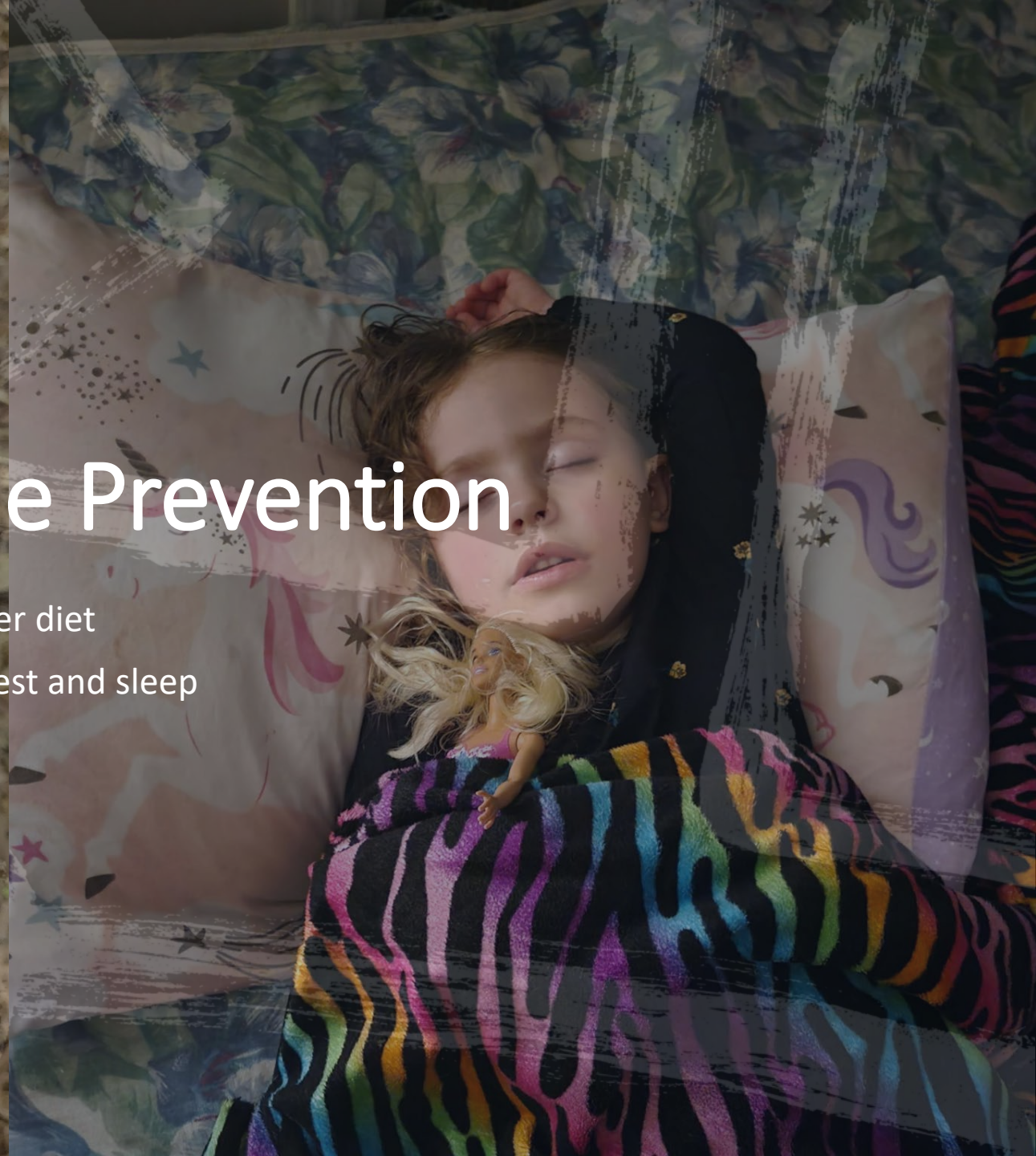
Acute Fatigue Causes

- Mild hypoxia (oxygen deficiency)
- Physical stress
- Psychological stress
- Depletion of physical energy resulting from psychological stress
- Sustained psychological stress

Acute Fatigue Prevention

Proper diet

Adequate rest and sleep



Any questions I can answer or follow up later on?

Hypoxia and Hyperventilation

Lesson Objective

To develop understanding of the causes, symptoms, effects, and corrective action of Hypoxia and Hyperventilation

What is hypoxia?

Reduced oxygen

Not enough oxygen delivered to the major organs

Why do pilots care?

Less oxygen to the brain and the eyes

-> more errors

-> maybe crash

Hypoxic Hypoxia

Also known as altitude hypoxia.

Not enough oxygen in the body as a whole.

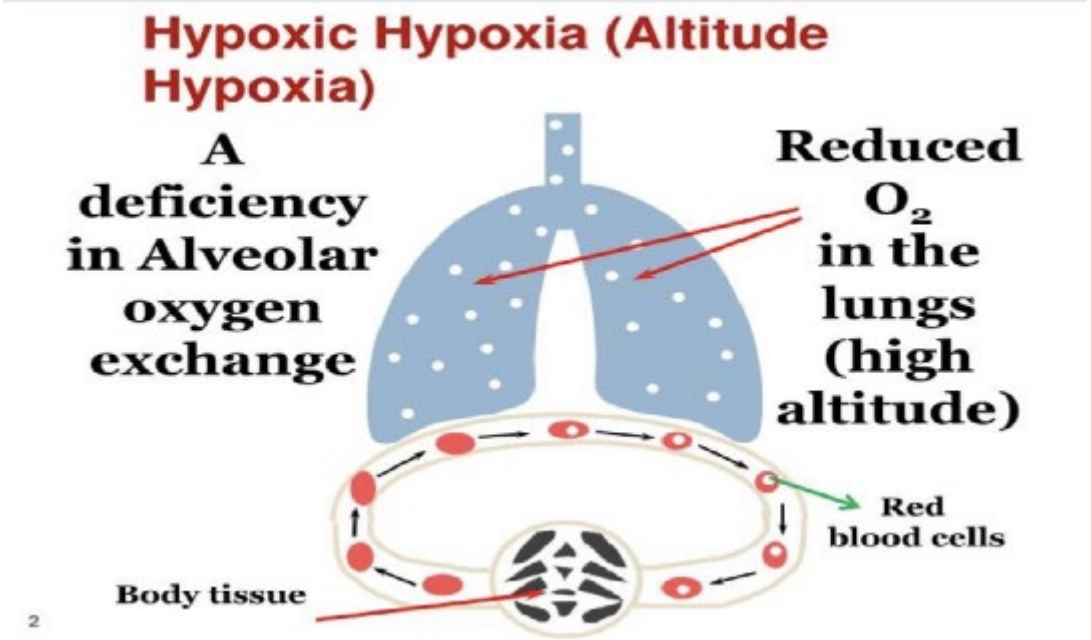
Same percentage in the air but less concentrated.

<u>Why?</u>

High Altitude

A blocked airway

Drowning

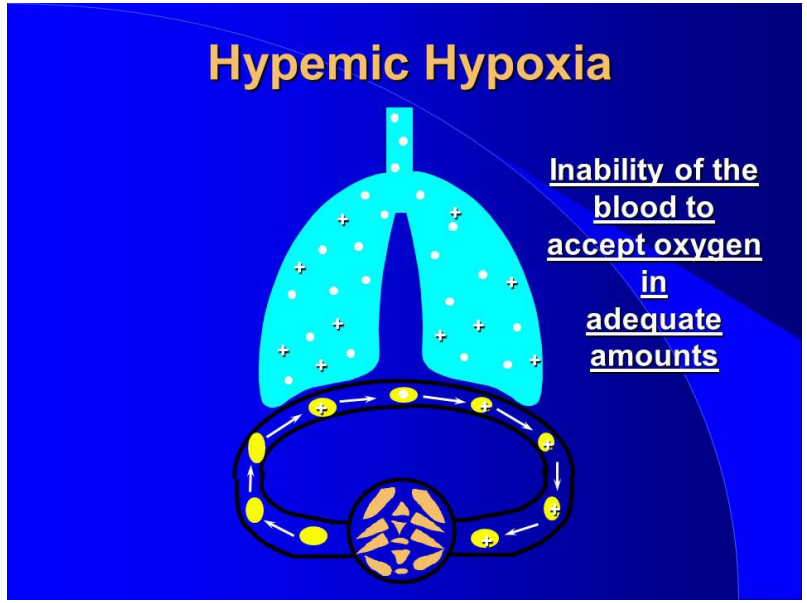


Hypemic Hypoxia

It is pronounced ‘high-pee-mick’ which rhymes with anemic.

Not enough oxygen in the blood.

This type of hypoxia is a result of oxygen deficiency in the blood, rather than a lack of inhaled oxygen.



Why?

CO poisoning

Smoking

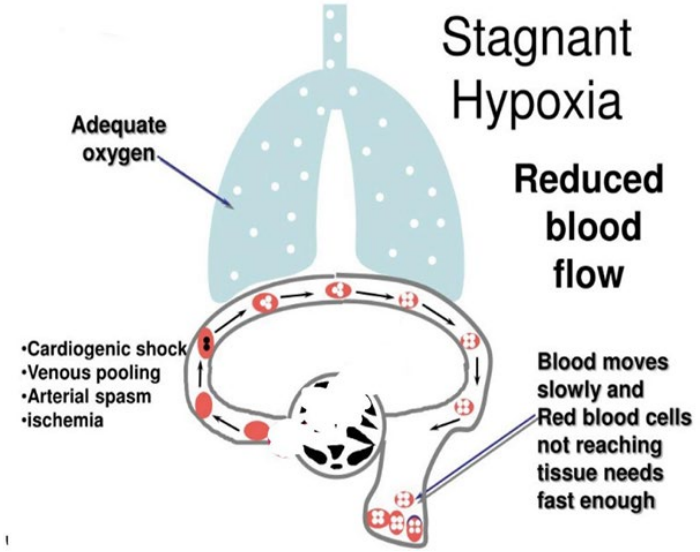
Firewall leak

Stagnant Hypoxia

Oxygen is not moving around correctly.

Stagnant hypoxia results when the oxygen-rich blood in the lungs is not moving, for one reason or another, to the tissues that need it.

An arm or leg “going to sleep” because the blood flow has accidentally been shut off is an example of stagnant hypoxia.



<u>Why?</u>

Excessive acceleration of gravity (over 2Gs)

Heart failure

Histotoxic Hypoxia

Histotoxic hypoxia is the inability of the cells to effectively use oxygen.

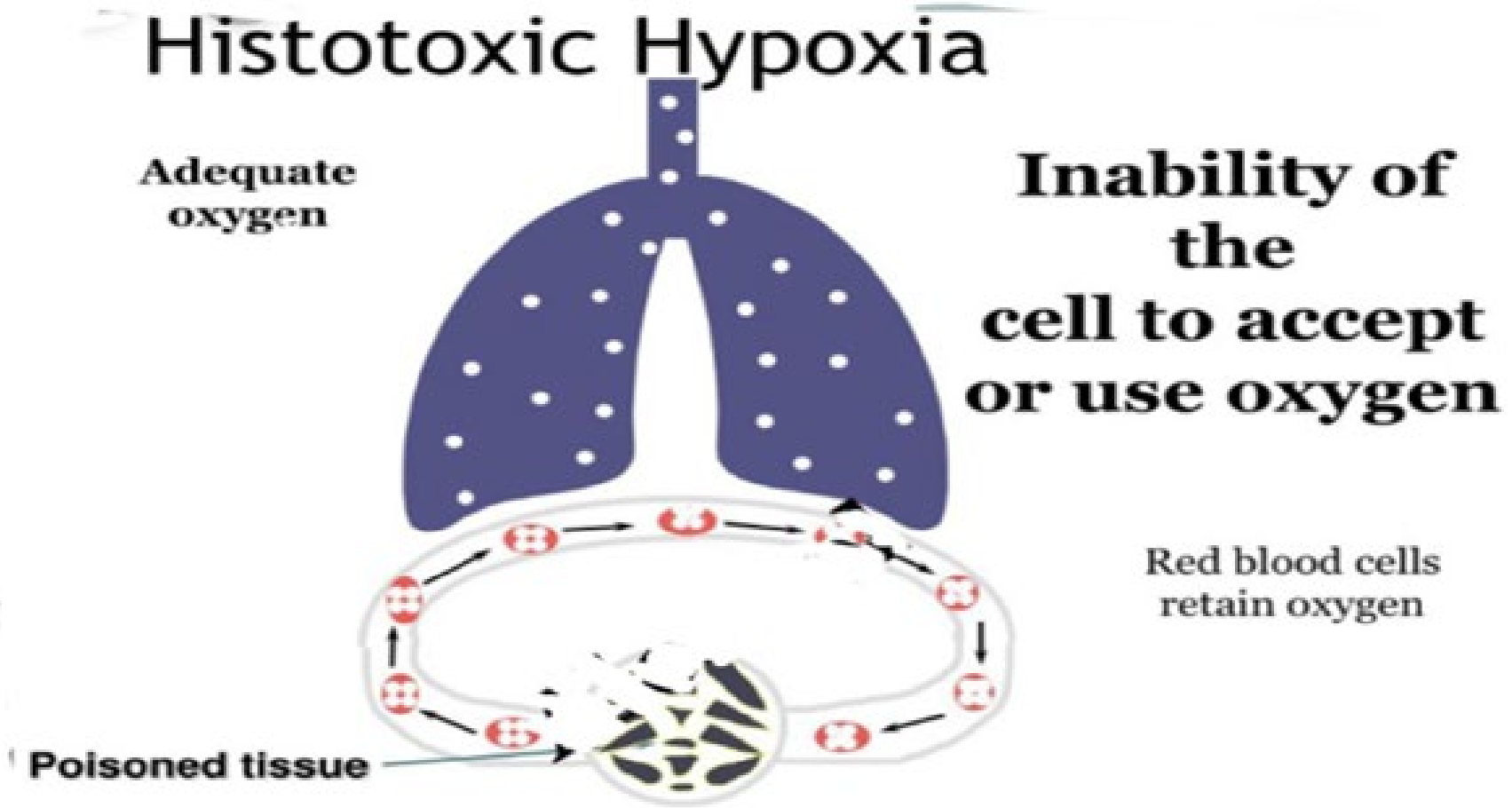
Enough oxygen is being transported to the cells that need it, but they are unable to make use of it.

Why?

Alcohol…1 ounce will add about 2000 feet of physiological altitude

Drugs, such as narcotics and poisons

Histotoxic Hypoxia



TYPES OF HYPOXIA

HYPOXEMIC
Low PaO2

HYPEMIC
Inability to Transport O2

STAGNANT
Poor Blood Flow

HISTOTOXIC
Tissue Can't Utilize O2

Danger!! Symptoms of Hypoxia

- Cyanosis (blue fingernails and lips)
- Headache
- Decreased response to stimuli and increased reaction time
- Impaired judgment
- Euphoria
- Visual impairment
- Drowsiness
- Lightheaded or dizzy sensation
- Tingling in fingers and toes
- Numbness

Danger!! Symptoms of Hypoxia

High-altitude flying can place a pilot in danger of becoming hypoxic.

The first symptoms of hypoxia can include euphoria and a carefree feeling.

With increased oxygen starvation, the extremities become less responsive and flying becomes less coordinated.

Good/bad news is the next time it happens you can usually expect it in the same order.

Trust your instruments…but can you see them ok…

As hypoxia worsens, the field of vision begins to narrow and instrument interpretation can become difficult.

Even with all these symptoms, the effects of hypoxia can cause a pilot to have a false sense of security and be deceived into believing everything is normal.

Treatment of Hypoxia

Descend to lower altitudes if there are not terrain issues

OR

Using supplemental oxygen

The Rules

§ 91.211 Supplemental oxygen.

(a) General. No person may operate a civil aircraft of U.S. registry—

(1) At cabin pressure altitudes above 12,500 feet (MSL) up to and including 14,000 feet (MSL) unless the required minimum flight crew is provided with and uses supplemental oxygen for that part of the flight at those altitudes that is of more than 30 minutes duration;

(2) At cabin pressure altitudes above 14,000 feet (MSL) unless the required minimum flight crew is provided with and uses supplemental oxygen during the entire flight time at those altitudes; and

(3) At cabin pressure altitudes above 15,000 feet (MSL) unless each occupant of the aircraft is provided with supplemental oxygen.

Now plainly one by one…

12501 ft MSL to 14000 ft MSL

Crew needs to use supplemental oxygen if in this area for more than 30 minutes

…and that does not mean cheating by dipping below after 28 minutes

14001 ft MSL to 15000 ft MSL

Crew is required to use supplemental oxygen

Passengers must have option

At Night

Supplemental oxygen is suggested for flights over 5000 feet MSL

What is Hyperventilation

Hyperventilation is rapid or deep breathing, usually caused by anxiety or panic.

This over breathing, as it is sometimes called, may actually leave you feeling breathless.

Hyperventilation is the excessive rate/depth of respiration leading to abnormal loss of carbon dioxide from the blood.

Hyperventilation can lead to unconsciousness due to the respiratory system's overriding mechanism to regain control of breathing. (Body forced reboot)

Common Symptoms of Hyperventilation

- Visual impairment
- Unconsciousness
- Lightheaded or dizzy sensation
- Tingling sensations
- Hot and cold sensations
- Muscle spasms

More

Pilots encountering an unexpected stressful situation may subconsciously increase their breathing rate.

…panic attack

If flying at higher altitudes, either with or without oxygen, a pilot may have a tendency to breathe more rapidly than normal, which often leads to hyperventilation.

Treatment of Hyperventilation

Breathing normally is both the best prevention and the best cure for hyperventilation.

In addition to slowing the breathing rate, breathing into a paper bag or talking aloud helps to overcome hyperventilation.

Recovery is usually rapid once the breathing rate is returned to normal.

Any questions I can answer or follow up later on?

Middle ear and sinus problems

Lesson Objective

To develop understanding of middle ear and sinus problems when it comes to flying

Info

During climbs and descents, the free gas formerly present in various body cavities expands due to a difference between the pressure of the air outside the body and that of the air inside the body.

If the escape of the expanded gas is impeded, pressure builds up within the cavity and pain is experienced.

Trapped gas expansion accounts for ear pain and sinus pain, as well as a temporary reduction in the ability to hear.

Info

Imagine someone blowing up a ballon in your head

And the ballon blocks some things

Hope this works

Try pinching the nostrils shut, close the mouth and lips, and blow slowly and gently into the mouth and nose.

Bad news is it also causes a temporary reduction in hearing sensitivity.

Sprays

It may not be possible to equalize the pressure in the ears if a pilot has a cold, an ear infection, or sore throat.

If experiencing minor congestion, nose drops or nasal sprays may reduce the risk of a painful ear blockage.

Before using any medication, check with an AME to ensure that it will not affect the ability to fly.

For more in depth of how it all works in your head

For more info see PHAK FAA-H-8083-25B 17-5

Any questions I can answer or follow up later on?

Motion sickness, CO poisoning, Dehydration

Lesson Objective

To develop understanding of three aeromedical issues: Motion sickness, CO poisoning, Dehydration

Motion sickness

A pilot may experience motion sickness during initial flights, but it generally goes away within the first few lessons.

Anxiety and stress might be the root cause.

Symptoms of motion sickness include general discomfort, nausea, dizziness, paleness, sweating, and vomiting.

How to alleviate

- Opening fresh air vents
- Crack open the window
- Focus on objects outside the airplane
- Don’t move your head

Carbon Monoxide Poisoning

Aircraft heater vents and defrost vents may provide CO a passageway into the cabin, particularly if the engine exhaust system has a leak or is damaged.

If a strong odor of exhaust gases is detected, assume that CO is present.

However, CO may be present in dangerous amounts even if no exhaust odor is detected.

Disposable, inexpensive CO detectors are widely available.

Carbon MO Effects

- Headache
- Blurred vision
- Dizziness
- Drowsiness
- Loss of muscle power

Carbon MO Corrections

01

Turn off the heater

02

Open fresh air vents and windows

03

Use supplemental oxygen, if available

Don’t smoke

Tobacco smoke also causes CO poisoning.

Smoking at sea level can raise the CO concentration in the blood and result in physiological effects similar to flying at 8,000 feet.

Dehydration

Dehydration is the term given to a critical loss of water from the body.

Causes

Hot flight decks

Hot ramps

Wind

Humidity

Coffee, tea, alcohol, and caffeinated soft drinks…southern favs

Signs

Headache

Fatigue

Cramps

Sleepiness

Dizziness

Try to prevent

Drink two to four quarts of water every 24 hours

Since each person is physiologically different, this is only a guide

My Advice

In the summer it is more important to remember to bring a bottle of water with you

Most of the small planes we fly do not have AC

If you are holding short of the runway at KPDK waiting on 3 planes to land and 3 planes in front of you to take off, drink some water to deal with the sweating

You could be out on the ramp pumping gas in the summer…no shade at the top of the ladder

Any questions I can answer or follow up later on?

Spatial disorientation

Lesson Objective

To develop understanding spatial disorientation in flight

What is Spatial Disorientation

Defines our natural ability to maintain our body orientation and/or posture in relation to the surrounding environment at rest and during motion.

Humans are designed to maintain spatial orientation on the ground.

The 3D environment of flight is unfamiliar to the human body, creating sensory conflicts and illusions that make spatial orientation difficult.

Statistics show that between 5 to 10% of all general aviation accidents can be attributed to spatial disorientation, 90% of which are fatal.

Spatial Orientation in Flight

Spatial orientation in flight is difficult to achieve because numerous sensory stimuli (visual, vestibular, and proprioceptive) vary in magnitude, direction, and frequency.

Any differences or discrepancies between visual, vestibular, and proprioceptive sensory inputs result in a sensory mismatch that can produce illusions and lead to spatial disorientation.

Spatial Orientation in Flight

Good spatial orientation relies on the effective perception, integration and interpretation of visual, vestibular and proprioceptive sensory information.

vestibular = organs of equilibrium located in the inner ear

proprioceptive = receptors located in the skin, muscles, tendons, and joints

What is Spatial Disorientation

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

Unless a pilot has many hours of training in instrument flight, flight should be avoided in reduced visibility or at night when the horizon is not visible.

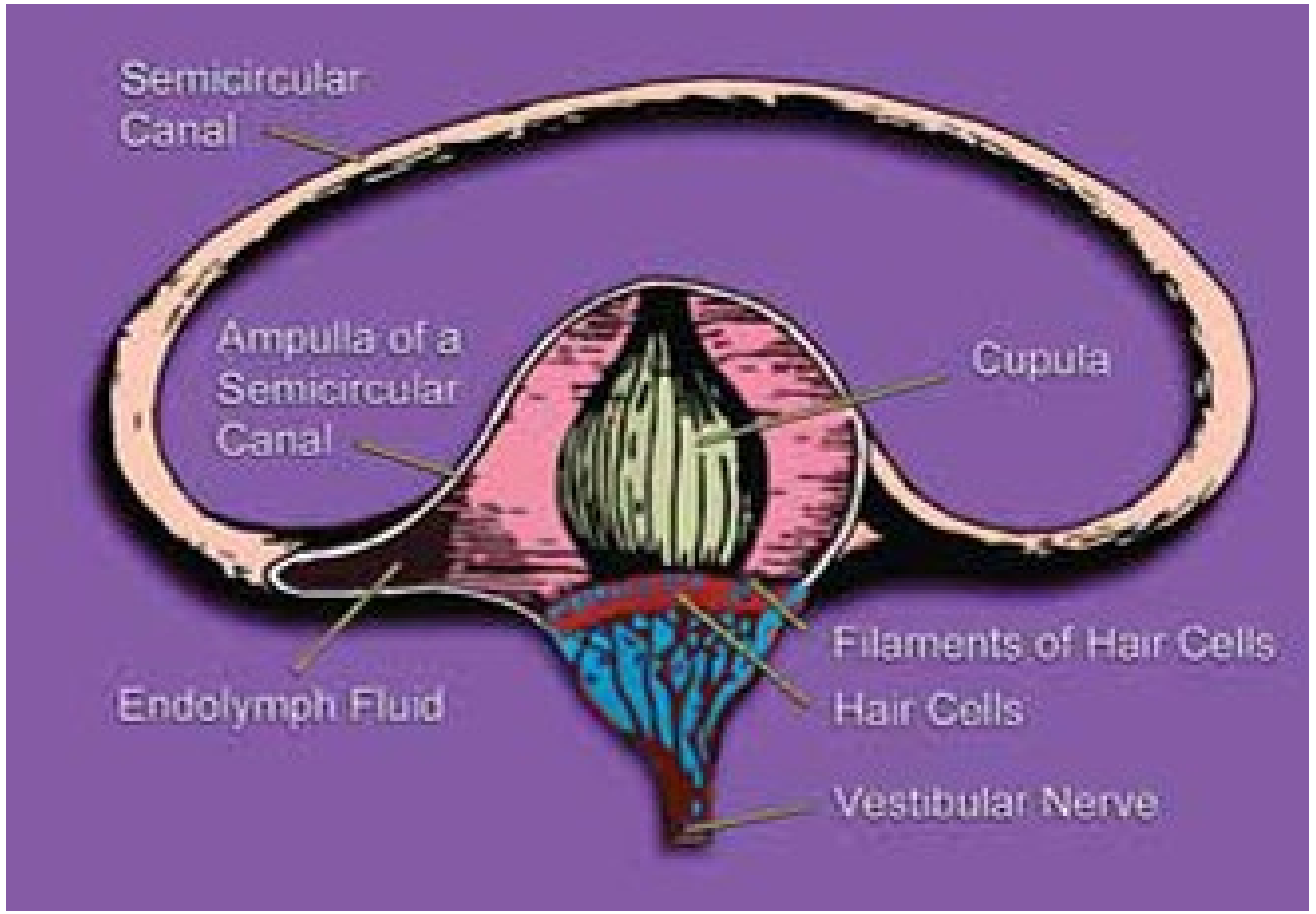
Vestibular Aspects of Spatial Orientation

The inner ear contains the vestibular system, which is also known as the organ of equilibrium.

About the size of a pencil eraser, the vestibular system contains two distinct structures:

The semicircular canals, which detect changes in angular acceleration.

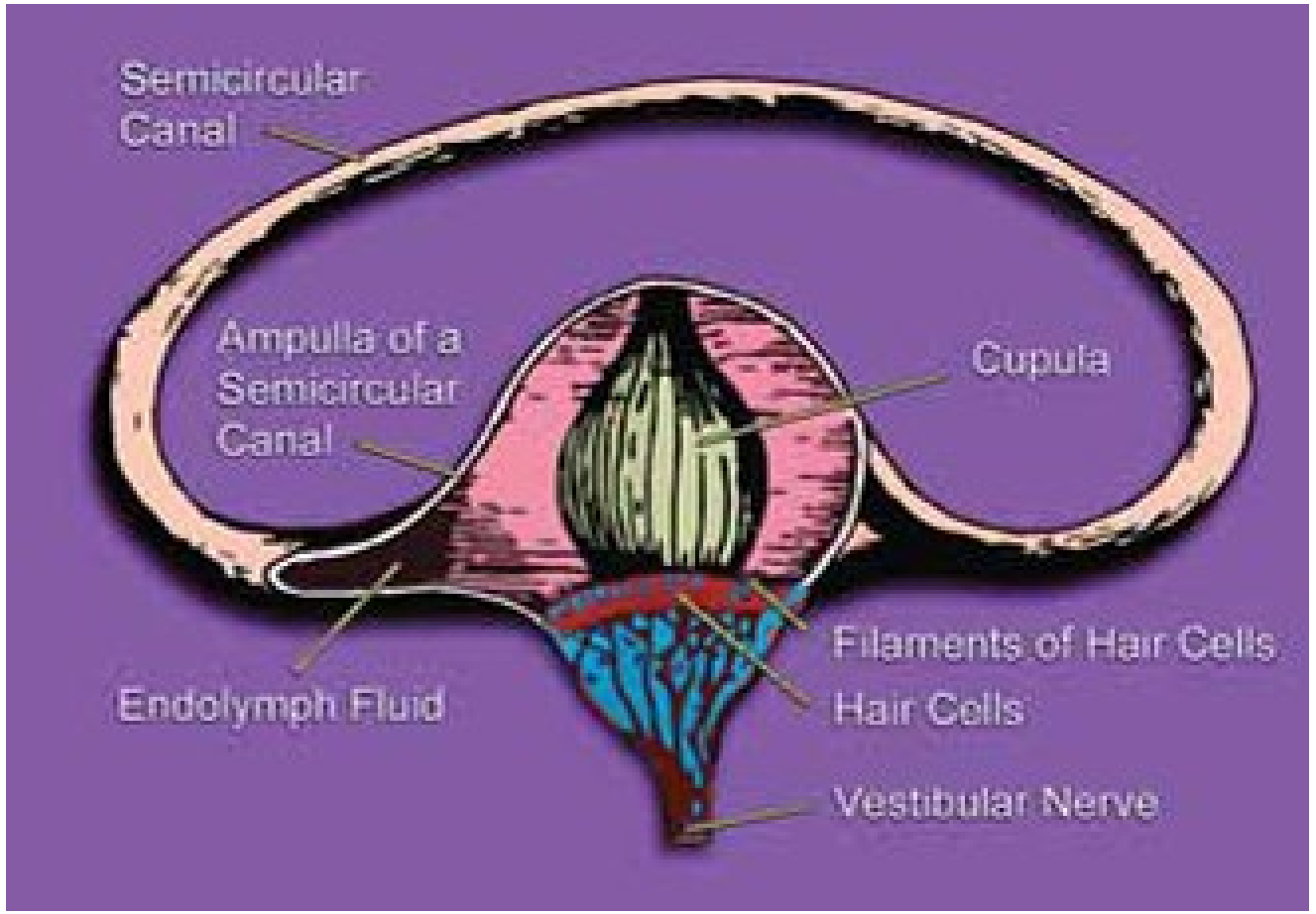
The otolith organs (the utricule and the saccule), which detect changes in linear acceleration and gravity.



Vestibular Aspects of Spatial Orientation

Both the semicircular canals and the otolith organs provide information to the brain regarding our body's position and movement.

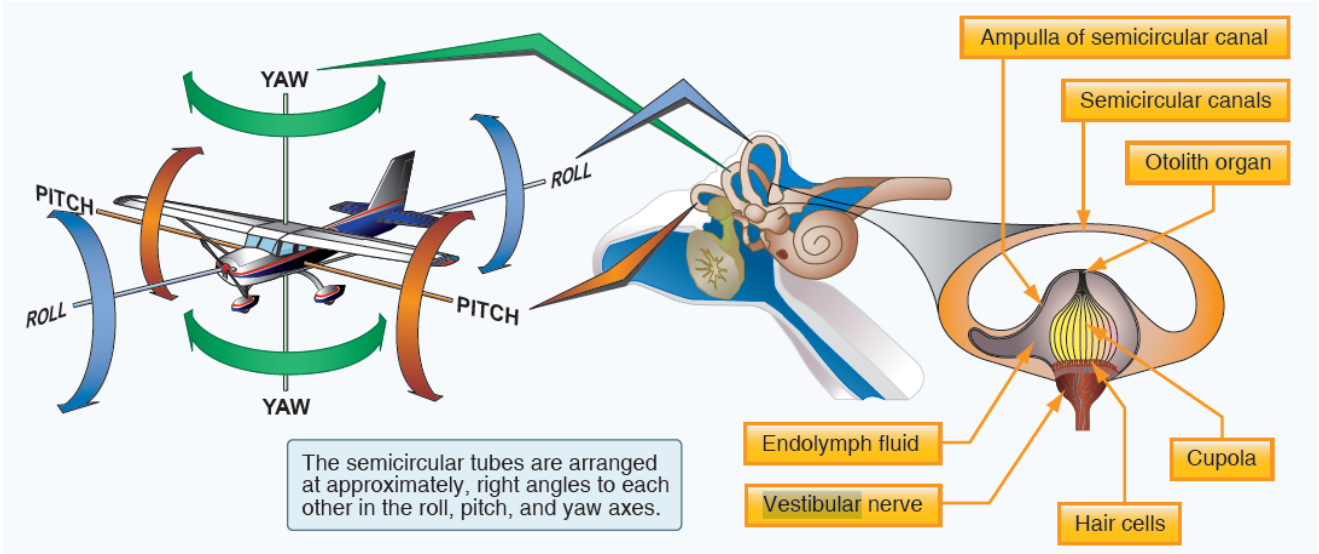
A connection between the vestibular system and the eyes helps to maintain balance and keep the eyes focused on an object while the head is moving or while the body is rotating.



The Semicircular Canals

The semicircular canals are three half-circular, interconnected tubes located inside each ear that are the equivalent of three **gyroscopes** located in three planes perpendicular (at right angles) to each other.

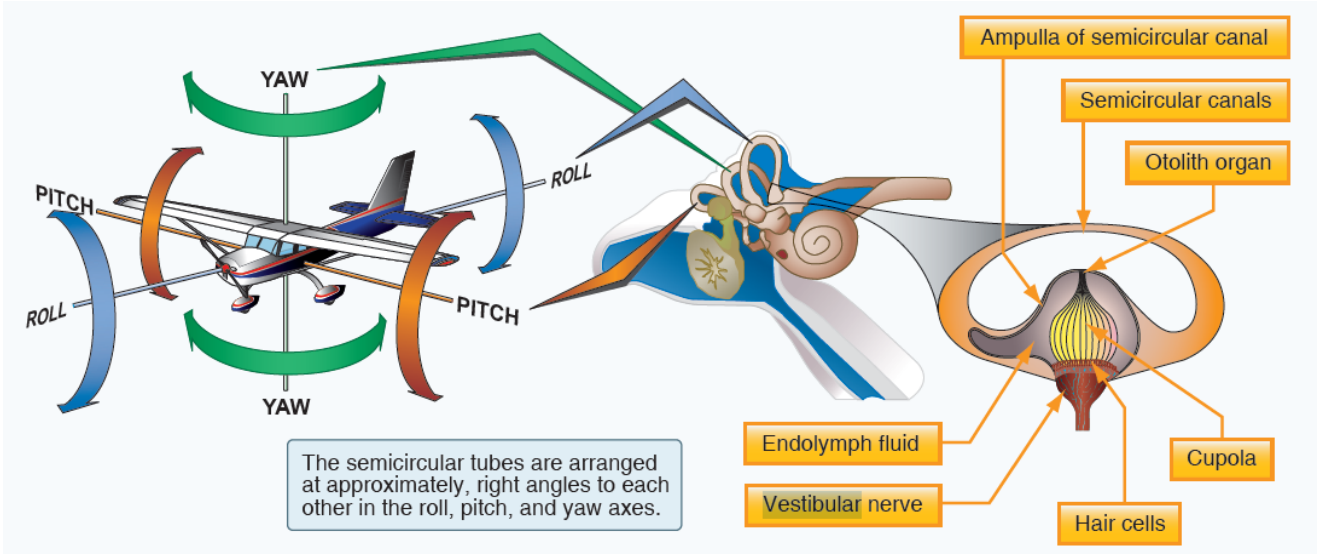
Each plane (not airplane) corresponds to the rolling, pitching, or yawing motions of an aircraft.



The Semicircular Canals

Each canal is filled with a fluid called endolymph and contains a motion sensor with little hairs whose ends are embedded in a gelatinous structure called the cupula.

The cupula and the hairs move as the fluid moves inside the canal in response to an angular acceleration.



The Semicircular Canals

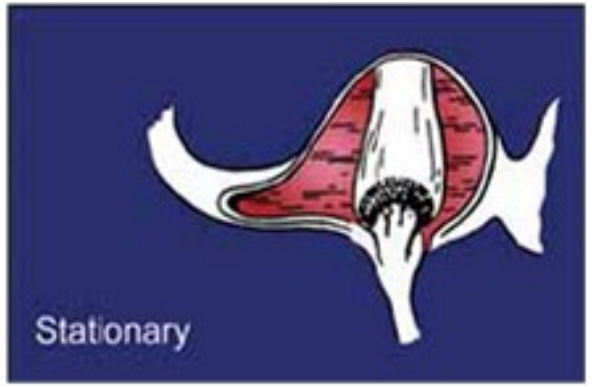
The movement of the hairs is similar to the movement of seaweed caused by ocean currents or that of wheat fields moved by wind gusts.

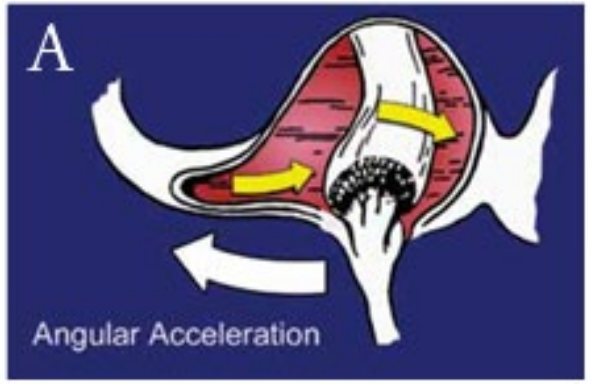
When the head is still and the airplane is straight and level, the fluid in the canals does not move and the hairs stand straight up, indicating to the brain that there is no rotational acceleration (a turn).

The Semicircular Canals

If you turn either your aircraft or your head, the canal moves with your head, but the fluid inside does not move because of its inertia.

As the canal moves, the hairs inside also move with it and are bent in the opposite direction of the acceleration by the stationary fluid (A). This hair movement sends a signal to the brain to indicate that the head has turned.



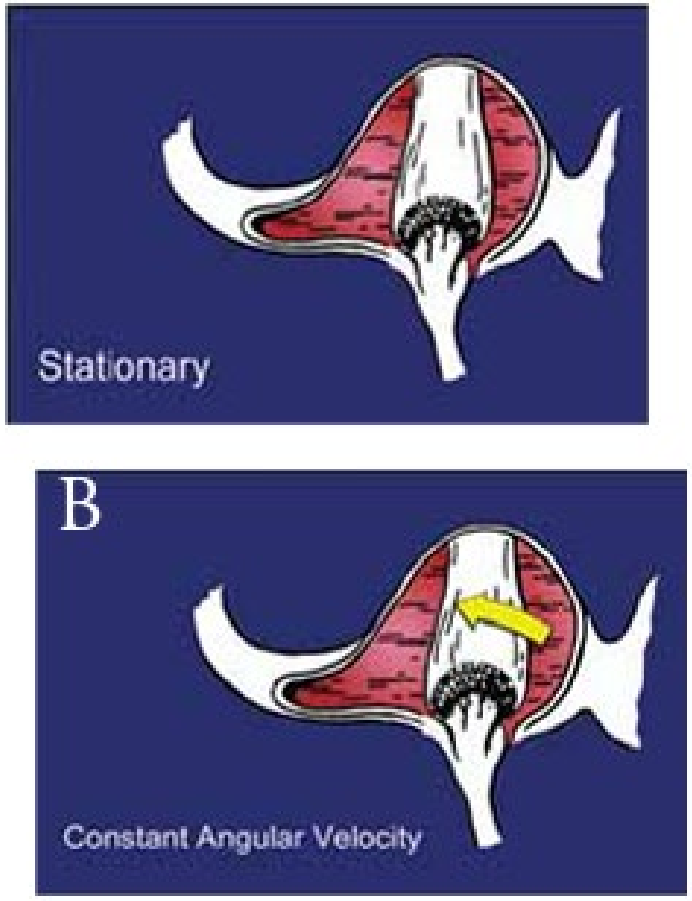


The Semicircular Canals

The problem starts when you continue turning your aircraft at a constant rate (as in a coordinated turn) for more than 20 seconds.

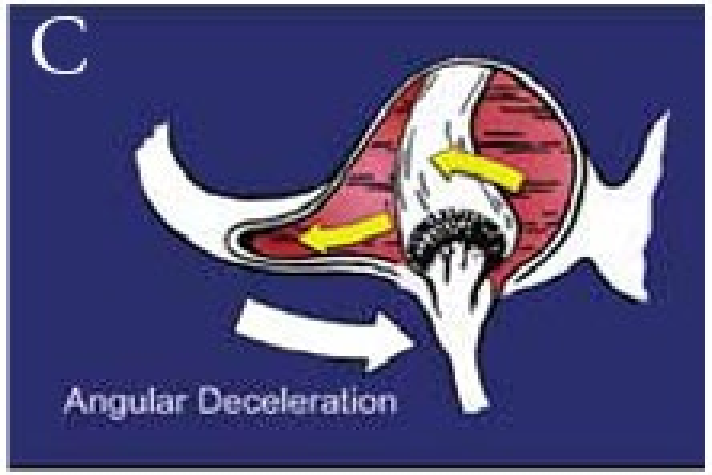
In this kind of turn, the fluid inside the canal starts moving initially, then friction causes it to catch up with the walls of the rotating canal (B).

When this happens, the hairs inside the canal will return to their straight up position, sending an erroneous signal to the brain that the turn has stopped–when, in fact, the turn continues.



The Semicircular Canals

If you then start rolling out of the turn to go back to level flight, the fluid inside the canal will continue to move (because of its inertia), and the hairs will now move in the opposite direction (C), sending an erroneous signal to the brain indicating that you are turning in the opposite direction, when in fact, you are actually slowing down from the original turn.



Otolith Organs

The otolith organs are small sacs at the base of the semicircular canals.

They are embedded with sensory hairs and contain a gelatinous membrane with chalklike crystals – called otoliths.

As the head or body moves, the movement of the membrane against the sensory hairs registers gravity.

The forces of acceleration and deceleration also stimulate the otoliths and, without visual reference, the body can’t tell the difference between the inertial forces resulting from acceleration and the force of gravity.

Thus, acceleration may give the sensation of tilting backwards.

Deceleration may give the perception of pitching forward.

Somatosensory System

Also called the proprioceptive system, this system is comprised of nerves in the skin, muscles, joints, and internal organs, along with hearing.

The nerves sense pressure differentials.

This system remains relatively unnoticed on the ground. But while flying, pilots can feel changes in G-forces and pressure as the inertia of their bodies reacts to the motion of the airplane.

These sensations are most acutely felt where the body and the airplane meet, namely on the seat, and the ability to correctly interpret these sensations is the source of the term “seat-of-the-pants” flying.

Hearing -> Subliminal Thinking

Our binaural hearing can determine our position relative to a sound source.

In the air our hearing can also identify conditions such as an overspeeding propeller, air rushing against the airframe, or an engine suddenly going quiet.

The Leans

This is the most common form of spatial disorientation.

It results from a pilot's failure to detect angular, or banking, motion.

The leans causes a false sensation of banking in one direction after a gradual, prolonged turn followed by a return to level flight.

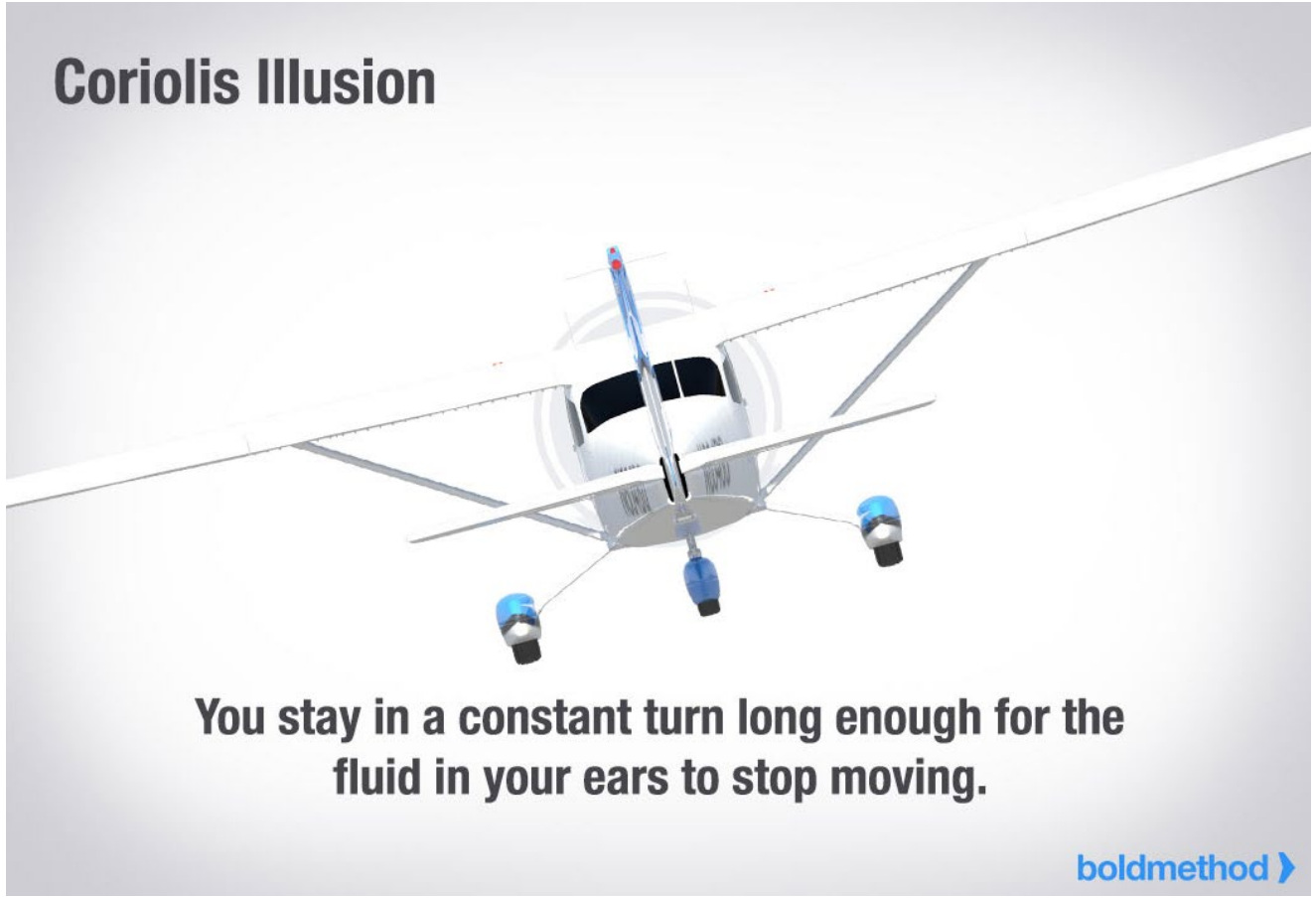
If a bank is entered slowly or is maintained long enough for fluid in the semicircular canals to stabilize, and the aircraft is quickly returned to straight and level, the motion of the fluid in the canal will give the sensation that the aircraft is banking in the opposite direction, and the pilot will tend to **bank the aircraft into an attitude erroneously perceived to be straight and level**.

Coriolis Illusion

Abrupt movements of the head can set the fluid in the semicircular canals moving in such a way as to create an overwhelming sensation of tumbling head over heels.

The sensation can be so strong as to lead pilots to lose control of the aircraft.

Looking down, as you might when searching for a chart in the cockpit, and then looking up can cause **vertigo**.



Graveyard Spiral

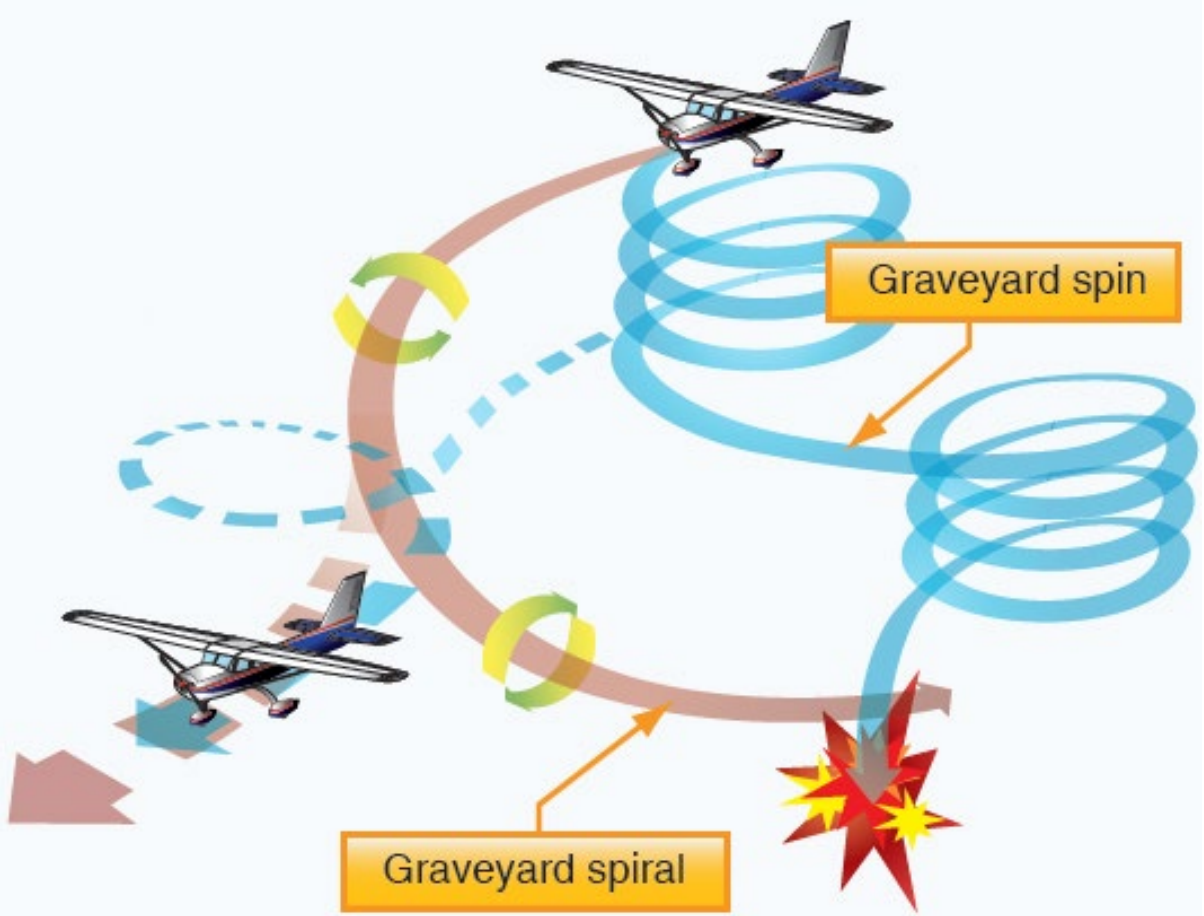
This is a high speed, tight descending turn (not a spin, because the wing never stalls) entered as a result of a failure to detect rolling motion.

Since any bank rate of less than two degrees per second is not felt, the wing may drop, and the plane may begin a turn without the pilot realizing it.

As the plane spirals downward and its descent accelerates, the pilot **senses the descent but not the turn**.

The natural **tendency is for the pilot to pull back on the yoke** to arrest the altitude loss.

But with the bank angle having gradually increased, this control input only tightens the turn and increases the descent rate.



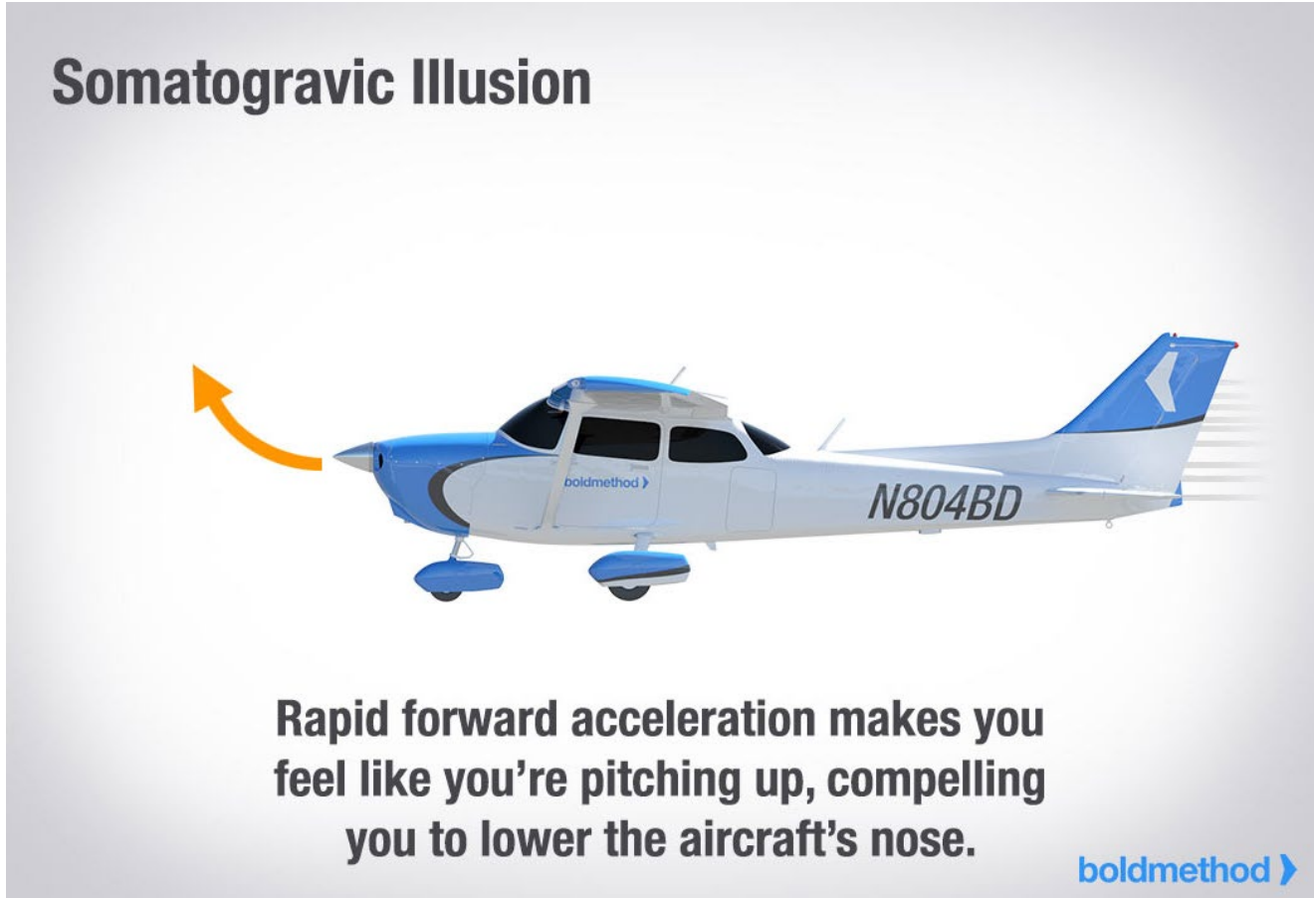
Somatogravic Illusion

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 of being in a nose-up attitude**, especially in conditions with poor visual references.

The disoriented pilot **may push the aircraft into a nose-low** or dive attitude.

A rapid deceleration by quick reduction of the throttle(s) can have the opposite effect, with the disoriented pilot pulling the aircraft into a nose-up or stall attitude.



Inversion Illusion

An abrupt change from climb to straight-and-level flight can stimulate the otolith organs enough to create the **illusion of tumbling backward**s, known as inversion illusion.

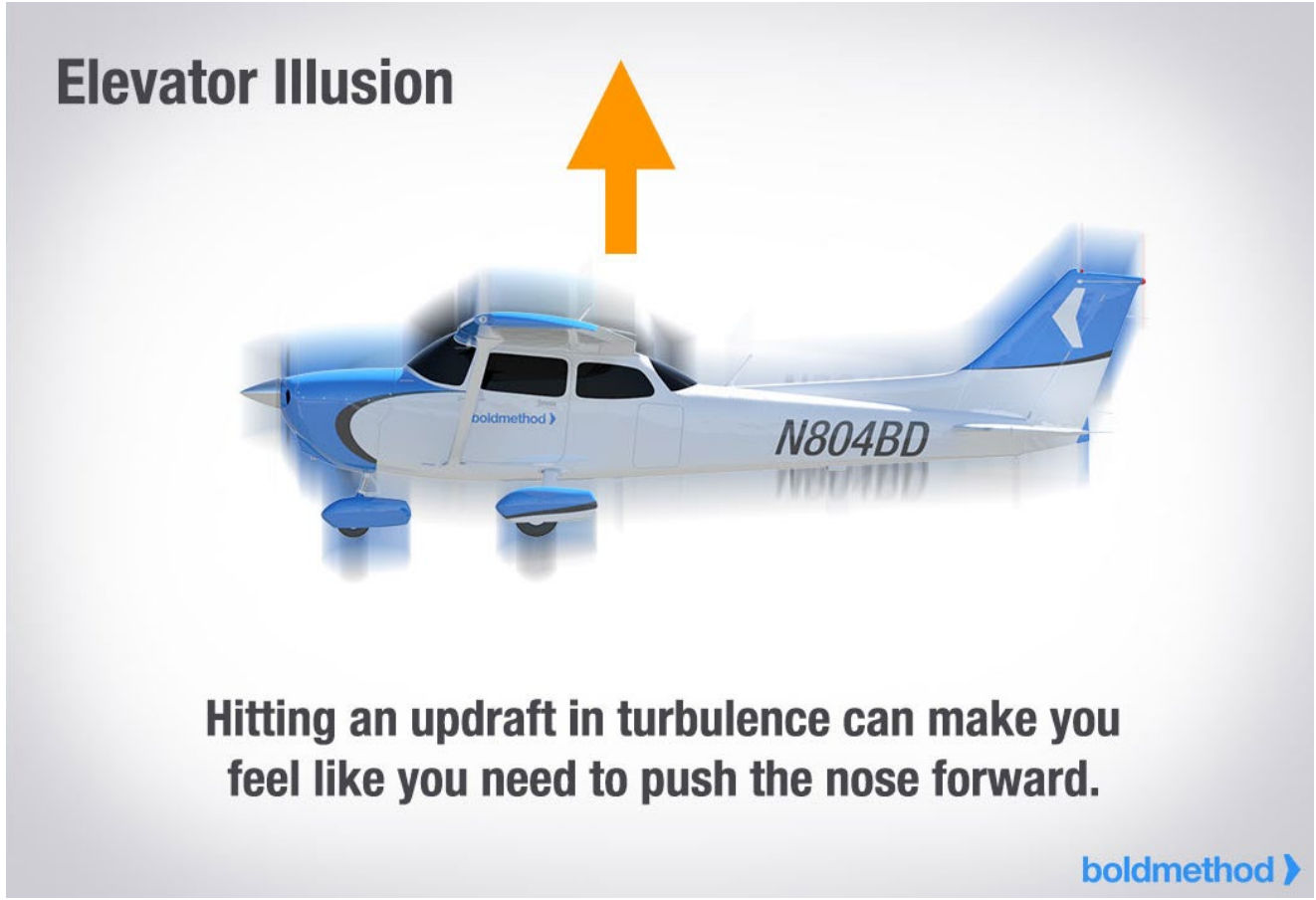
The disoriented pilot **may push the aircraft abruptly into a nose-low attitude**, which may intensify this illusion

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**.

The disoriented pilot **may push the aircraft into a nose-low attitude**.

An abrupt downward vertical acceleration, usually in a downdraft, has the opposite effect with the disoriented pilot pulling the aircraft into a nose-up attitude.



How do we minimize these issues?

A pilot can reduce susceptibility to disorienting illusions through **training and awareness** and learning to rely totally on flight instruments.

Develop an **instrument cross-check** or scan that involves minimal head movement.

Take care when retrieving charts and other objects in the flight deck—if something is dropped, retrieve it with **minimal head movement**.

Any questions I can answer or follow up later on?

Scuba Diving and Flying

Task A: Aeromedical Factors #5

Lesson Objective

To develop understanding of the effect of nitrogen excesses incurred during scuba dives and how this affects pilots and passengers during flight.

Info

Scuba diving subjects the body to increased pressure, which allows more nitrogen to dissolve in body tissues and fluids.

The reduction of atmospheric pressure that accompanies flying can produce physical problems for scuba divers.

Wait Before Flying

The recommended waiting time before going to flight altitudes of up to 8,000 feet is at least 12 hours after diving that does not require controlled ascent (nondecompression stop diving).

At least 24 hours after diving that does require controlled ascent (decompression stop diving).

The waiting time before going to flight altitudes above 8,000 feet should be at least 24 hours after any scuba dive.

These recommended altitudes are actual flight altitudes above mean sea level (MSL) and not pressurized cabin altitudes.

Any questions I can answer or follow up later on?