
PILOT

- A pilot must continually make decisions about competency, condition of health, mental and emotional state, level of fatigue, and many other variables.

AIRCRAFT

- A pilot frequently bases decisions on evaluation of the airplane, such as performance, equipment, or airworthiness. This task will concentrate on the aircraft (ASEL – Airplane Single Engine Land). Knowledge of aircraft systems will play a key role of knowing when to continue a planned flight or terminate the flight, due to system failures.

ENVIRONMENT

- The environment encompasses many elements that are not pilot or airplane related, including such factors as weather, air traffic control (ATC), navigational aids, terrain, takeoff and landing areas and surrounding obstacles. Weather is one element that can change drastically over time and distance.

EXTERNAL PRESSURES

- The pilot must evaluate the three previous areas to decide on the desirability of undertaking or continuing the flight as planned. It is worth asking why the flight is being made, how critical it is to maintain the schedule, and if the trip is worth the risks.

P – Pilot for the Private Pilot:

Start with I’M SAFE: Illness, medication, stress, alcohol (.04), fatigue (acute and chronic) and eating/emotion factors. If any of these factors apply, you should not fly. As a private pilot, you are required to carry your pilot’s certificate, medical and a government ID. As a private pilot, you are allowed to carry passengers (not for hire) – 61.113, fly when visibility is less than 3 miles (SVFR – Special VFR) and can fly without visual reference to the surface. Special requirements for the Private Pilot are: Must be a Private Pilot to take off and land within (KSFO) Class B Airspace (AIM 3-2-3) and can fly at night. Must maintain currency to carry passengers:

1.) 3 touch-n-go’s during the day and 3 full stop landings at night every 90 days – 61.57. 2.) Complete a BFR (Flight Review) (minimum 1 hour of ground and 1 hour of flight – every 24 calendar months – 61.56. 3.) Have a First Class (valid for 6 months), Second Class (valid for 12 months) or Third Class (valid for 2 years if over 40 years old or 5 years if under 40 years old) medical certificate to be pilot in command.
A – Aircraft for the Private Pilot:

Remember A R O W. Airworthiness Certificate (Has the aircraft had an Annual, 100 hour, Progressive - 91.409, Pitot Static/Transponder check (24 months - 91.411, 91.413), Aircraft has the required equipment – 91.205 if NOT Special Flight Permit 21.197 & 21.199, ELT check - 91.207 and all AD’s have been complied - 91.403 39.3, Registration (Every Three Years) – 47.41, Operating Limits (Section 2 of POH, Pilot’s Operating Handbook) – 91.9 and Weight and Balance (Section 6 of POH). Fuel requirements for all flights (30 minutes Day, 45 minutes Night) - 91.151. The required takeoff and landing distances, runway lengths and weather forecasts - 91.103. Avionics familiarity, density altitude and a current sectional information.

V – Environment for the Private Pilot:

Think of the Airport and weather conditions: Crosswind, Takeoff and Landing distances, Ceiling conditions, visibility and your personal minimums. Plan on the weather for your Departure, En-route and Destination. For example: Current Metar, TAF and FA (Area Forecast), surface analysis chart, radar summary chart, winds and temperature aloft, significant weather prognostic chart, convective outlook chart, Airmets and Sigmets, PIREPs, wind shear reports, icing and freezing levels and AWOS, ASOS and ATIS reports for the route and destination. The pilot wants to make a competent “go/no-go” decision based on available weather information. Reference Weather Information – Task C in RAM Study Guide.

E – External Pressures for the Private Pilot:

Think about “Get there Its.” The determination to reach a destination, combined with hazardous weather, claims the lives of dozens of pilots and their passengers yearly. Think about the hazardous attitudes: Anti-authority, Impulsivity, Invulnerability, Macho and Resignation to see if they may apply to this flight. Allowance for delays and diversions, alternative plans and personal equipment. After you use the PAVE checklist (step 1), use the CARE checklist (Consequences, Alternatives, Reality and External pressures) (step 2) and determine the level and severity of the risk. (Step 3) perform the TEAM checklist. Transfer Risk, Eliminate Risk, Accept Risk and Mitigate Risk.
Hypoxia

Hypoxia is state of Oxygen deficiency, lack of partial pressure, on the body. At cabin altitudes above 10,000 feet: judgment, memory, alertness, and coordination can be impaired. Hypoxia can be suffered at altitudes as low as 5,000 feet at night, due to the oxygen required for your rods in the eye.

**Symptoms:** Tunnel Vision, A blue coloration of the fingernails and lips (Cyanosis), headaches, drowsiness, dizziness, and a sense of well-being (Euphoria).

**Causes:**

1. **Hypoxic Hypoxia** – *Insufficient Partial Pressure of oxygen*. Can occur at Altitudes above 10,000 feet depending on the health of the pilot.
2. **Hypemic Hypoxia** – *Total oxygen content of the blood is reduced*. Carbon monoxide from the exhaust or heavy smoking, inhibits the ability of hemoglobin to release the oxygen bound to it and deliver oxygen to tissues.
3. **Histotoxic Hypoxia** – *Impaired Cellular Respiration*. Small amounts of alcohol and drugs, limit the amount of oxygen that the blood carries to the body tissues.

**Effects:** The effects are quite difficult to recognize, especially when they occur gradually. The ability to take corrective actions is lost in 20 to 30 minutes at 18,000 feet, followed by unconsciousness and death.

**Corrective Actions:** Increase the concentration of oxygen or use supplemental oxygen if able and descend below 10,000 feet.
Hyperventilation

Is the state of breathing faster and/or deeper than necessary, bringing about lightheadedness associated with panic attacks. Hyperventilation reduces the carbon dioxide concentration of the blood to below normal.

**Symptoms:** Light headedness, drowsiness, tingling in the extremities, feeling anxious, yawning, chest pressure, headache, sweating, and vision changes.

**Causes:** Stressful situations encountered during flight. (Cross-wind landings, Turbulent air, Weather, and Night Flying)

**Effects:** Incapacitation can eventually result from in-coordination, disorientation, and painful muscle spasms. Unconsciousness and chest pain can occur.

**Corrective Actions:** Control breathing in a paper bag, breathe through your nose, loosen your clothing, slow/open window and land as soon as possible.

Once air (oxygen) is in your lungs, it is then exchanged for carbon dioxide. Carbon dioxide is a waste product of the cells that form your entire body. The oxygen moves into your blood and carbon dioxide moves out of your blood into your lungs. When you exhale, you are letting out all your carbon dioxide waste. This exchange takes place at the alveoli.
Middle Ear and Sinus Problems

Middle Ear – During ascent, the expanding air in the middle ear pushes the Eustachian tube open, and escapes down to the nasal passages. During a descent, the pilot must periodically open the Eustachian tube to equalize pressure.

Sinus – During ascent and descent, air pressure in the sinuses equalizes the pressure through small openings that connect the sinuses to the nasal passages.

Symptoms: Middle Ear (A) – Pressure can build up to a level that will hold the Eustachian tube closed. Commonly referred to as, “Ear Block.”

Symptoms: Sinus Problems (B) – Can occur in the frontal sinuses, located above each eyebrow or upper cheek and produce excruciating pain.

Causes: Flying with a cold, allergies, and respiratory infection.

Effects: Middle Ear – Severe pain and hearing loss. Rupture of the ear drum can occur in flight or after landing.

Effects: Sinus Block – Usually on descents, can cause severe pain over the sinus area and can make the upper teeth ache.

Corrective Actions: Middle Ear–Swallowing, yawning and the Valsalva maneuver.

Corrective Actions: Sinus Block – Do not fly with infections. Adequate protection is usually not provided by decongestants, which may have side effects that can impair pilot performance.
Spatial Disorientation

Spatial Disorientation is a condition in which the pilot’s perception of direction does not agree with reality. Spatial Disorientation from illusions can only be prevented by fixed points on the ground or by reference to the flight instruments.

**Symptoms:** During flight, most of the senses are “fooled” by centrifugal force, and indicate to the brain that “down” is at the bottom of the cockpit no matter the actual attitude of the aircraft. The inner ear contains semicircular canals, which contain fluid called “Endolymph” and small hairs called “Cilia” which provide information to the brain of pitch, roll, and yaw. Errors develop in the brain’s estimate of rate and direction of turn in each axis.
Spatial Disorientation

Causes: Typically a temporary condition resulting from flight into poor weather conditions with low or no visibility.

Effects: Drift in the inner ear produce errors about the axes. Errors will build to a point that control of the aircraft is lost, usually in a steep, diving turn known as graveyard spiral. During the entire time, leading up to and well into the maneuver the pilot remains unaware that the aircraft is turning, believing that they are in straight and level flight.

Illusions in flight

Illusions involving the semicircular canals of the vestibular system of the ear occur primarily under conditions of unreliable or unavailable external visual references and result in false sensations of rotation. These include the leans, the graveyard spin and spiral, and the Coriolis illusion.
Spatial Disorientation

Illusions Leading to Landing Errors

Landing errors from these illusions can be prevented by aerial visual inspections of unfamiliar airports, using the electronic glide slope, and maintaining optimum proficiency in landing procedures.

1) Runway width Illusion:
2) Terrain Illusion:
3) Featureless Terrain:
4) Atmospheric Illusions:
5) Ground lighting Illusions:

Corrective Actions: Illusions in Flight – Visual reference to reliable fixed points on the ground and the Flight Instruments.

Corrective Actions: Illusions leading to Landing Errors – Use the electronic glide slope when able. Red and White = You’re Alright. White and White = you’ll fly all night. Red and Red = Your Dead.
Motion Sickness

Motion sickness occurs when the central nervous system receives conflicting messages from the body (including the inner ear, eyes, and muscles) affecting balance and equilibrium.

**Symptoms:** Dizziness, fatigue, cold sweating, headaches, and confusion are the most common symptoms.

**Causes:** Fatigue, stress, anxiety, the use of alcohol, drugs, and medications.

**Effects:** Airsickness is usually a combination of spatial disorientation, nausea and vomiting.

**Corrective Actions:** Sit facing forward, focus on a point outside, look out the window and gaze toward the horizon. Fresh, cool air and avoid foul odors.
Carbon Monoxide Poisoning

Carbon Monoxide is a colorless, odorless, and tasteless gas contained in exhaust fumes. When breathed it reduces the ability of the blood to carry oxygen.

**Symptoms:** Headaches, drowsiness, or dizziness, increasing blurred vision.

**Causes:** Exhaust fumes escaping through shroud heaters or through manifold cracks and seals.

**Effects:** Carbon Monoxide is **cumulative.** Unconsciousness and eventual death may occur if you don’t remove yourself from the source.

**Corrective Actions:** Turn off cabin heat, increase fresh air intake, open windows, use oxygen, land as soon as possible.
Stress

The Body’s Stress Response

When you perceive a threat, your nervous system responds by releasing a flood of stress hormones, including adrenaline and cortisol. These hormones rouse the body for emergency action.

Your heart pounds faster, muscles tighten, blood pressure rises, breath quickens, and your senses become sharper. These physical changes increase your strength and stamina, speed your reaction time, and enhance your focus—preparing you to either fight or flee from the danger at hand.

Causes: Flying into deteriorating weather conditions, or trying to fly outside your comfort zone.

Corrective Actions: Consider delaying or re-scheduling the flight.
Fatigue

Fatigue is one of the most treacherous hazards to flight safety. Fatigue is best described as **acute (short-term) or chronic (long-term)**.

**Symptoms:** Acute – Is tiredness felt after periods of physical and mental strain.

**Symptoms:** Chronic – Not enough time to recover between episodes of acute fatigue.

**Causes:** Emotional pressure, mental strain, and lack of sleep.

**Effects:** Acute – Coordination and alertness are reduced.

**Effects:** Chronic – Performance continues to drop off, and judgment becomes impaired so that unwarranted risks may be taken.

**Corrective Actions:** Acute – Prevented by adequate rest and sleep, as well as exercise and proper nutrition.

**Corrective Actions:** Chronic – Requires a prolonged period of rest or can be treated by a doctor.

![Graph showing percentages of crashes due to fatigue as a function of hours of driving.](image)
Scuba Diving

A pilot or passenger who intends to fly after scuba diving should allow the body sufficient time to rid itself of excess nitrogen absorbed during diving. If not, decompression sickness due to evolved gasses from our bodies own tissues, as a result of the increased pressure, can occur during exposure to low altitude flying.

<table>
<thead>
<tr>
<th>Type</th>
<th>Bubble Location</th>
<th>Signs &amp; Symptoms (Clinical Manifestations)</th>
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| Bends | Mostly large joints of the body (elbows, shoulders, hip, wrists, knees, ankles) | - Localized deep pain, ranging from mild (a "tingle") to excruciating. Sometimes a dull ache, but rarely a sharp pain.  
- Active and passive motion of the joint aggravates the pain.  
- The pain may be reduced by bending the joint to find a more comfortable position.  
- If caused by altitude, pain can occur immediately or up to many hours later. |

**Causes:** Leaving a high pressure environment, Ascent from depth, and Ascent to altitude.

**Effects:** Nitrogen bubbles expand and settle in the joints.

- **The rate and duration of gas absorption under pressure.** The deeper or longer the dive the more gas is absorbed into body tissue in higher concentrations than normal (Henry's Law).
- **The rate and duration of outgassing on depressurization.** The faster the ascent and the shorter the interval between dives the less time there is for absorbed gas to be offloaded safely through the lungs, causing these gases to precipitate (come out of solution) and form "micro bubbles" in the blood.
Scuba Diving

Corrective Actions:

- For flights up to 8,000 feet: Wait at least 12 hours after diving (Non-decompression dive) or (Uncontrolled Ascent).
- For flight up to 8,000 feet: Wait at least 24 hours after diving (Decompression dive) or (Controlled Ascent).
- The waiting time before going to flight altitudes above 8,000 feet should be at least 24 hours. (AMSL – Aircraft mean sea level)

A recompression chamber is a pressure vessel used to treat divers suffering from certain diving disorders such as decompression sickness.

Often the terms recompression chamber, decompression chamber, hyperbaric chamber, and hyperbaric oxygen therapy chamber are used interchangeably.
The Eye

The retina is a layer at the back of the eye. Cells called rods and cones, convert light energy to signals that are carried to the brain by the optic nerve. In the middle of the retina is a small dimple called the fovea. It is the center of the eye’s sharpest vision.

The fovea contains exclusively cones. The retina contains rods and cones. There are approximately 120 million rods and 6 million cones.
The Eye

- **Cones**: Very high resolution, used for color and distance. Day only.
- **Rods**: Very light sensitive, used for black and white vision. Day and Night.

**Rodopsium**: Liquid produced at night to stimulate night vision. This is why it takes 30-45 minutes to adjust to a low light situation.

**Iodopsium**: Liquid produced during the day. If you turn off the lights, rodopsium begins to be produced (The white sparkles you see in your eyes).
Dehydration

A few hot weather causes of dehydration are hot cockpits and flight lines, wind, humidity, and diuretic drinks - coffee, tea, alcohol, and soft drinks-changes in climatic conditions, sunburns, and improper attire for conditions.

Some common signs of dehydration are headache, fatigue, cramps, sleepiness, and dizziness.

Here, in checklist form, are the three stages of heat exhaustion. Transition from the one to the other can be very evident, hardly noticeable, or not evident at all.

1. Heat stress (body temperature, 99.5-100°F) reduces
   - Performance, dexterity, and coordination
   - Ability to make quick decisions
   - Alertness
   - Visual capabilities
   - Caution and caring
2. Heat exhaustion (101-105°F) symptoms:
   - Fatigue
   - Nausea/vomiting
   - Giddiness
   - Cramps
   - Rapid breathing
   - Fainting
3. Heat stroke (>105°F) symptoms
   - Body's heat control mechanism stops working
   - Mental confusion
   - Disorientation
   - Bizarre behavior
   - Coma

Preventing dehydration

To help prevent dehydration, you should drink two to four quarts of water every 24 hours. Since each person is physiologically different, this is only a guide. Most people are aware of the eight-glasses-a-day guide: If each glass of water is eight ounces, then you end up with 64 ounces, which is two quarts.
Alcohol and Flying

Alcohol

When alcohol is consumed, it is very rapidly absorbed into the blood and tissues of the body but the process of detoxification is quite slow. The impairing effects of alcohol are apparent quite soon after ingestion but it takes about 3 hours for the effects of 1 ounce of alcohol to wear off. Nothing, inclusive of sleep, coffee or exercise, will speed up this process or minimize the effects of the alcohol.

It has been recently determined that alcohol is absorbed into the fluid of the inner ear and will stay there after it has been eliminated from the blood, brain and body tissues. Since the inner ear affects balance, the presence of alcohol within the vestibular apparatus can lead to spatial disorientation and the potential of vertigo.

The presence of alcohol in the blood interferes with the normal absorption of oxygen by the tissues and can result in histotoxic hypoxia. As the reduced cabin pressure at high altitudes has already reduced the ability of the hemoglobin to absorb oxygen (Hypoxic Hypoxia), the effect of alcohol in the blood, during flight at high cabin altitudes, becomes much more pronounced than it would be at sea level. The negative effects of one drink can be magnified as much as 2 to 3 times due to the cumulative effects of alcohol and altitude.

Remember: Eight (8) hours bottle to throttle and .04% blood alcohol.
Drugs and Flying

Drugs, and the condition or illness for which they are being taken, can negatively impact on pilot performance and efficiency and, as a consequence, can pose a significant risk to safety of flight. Both prescription and non-prescription (over-the-counter) drugs can impair judgement and degrade coordination. Common side effects of many non-prescription drugs, such as cold tablets, cough mixtures, antihistamines, appetite suppressors and laxatives, include drowsiness, confusion, blurred vision and dizziness. The effects of some of these drugs can be even more pronounced at altitude than they are on the ground. Drugs can also have a cumulative effect and, if more than one drug is taken at the same time, the combined negative effect may be well in excess of that of the individual drugs. Likewise, prescription drugs such as antibiotics or antidepressants can have a pronounced effect on judgement, mental acuity and coordination. The advice of a qualified aviation medical practitioner should be sought to ensure that it is safe to fly during the course of a prescribed drug regimen. Obviously, the use of any illicit drug is completely incompatible with flight safety.

- **Antihistamines**: Antihistamines are often taken to reduce the affects of an allergy or for a specific allergic reaction. They cause a level of sedation with varying degrees (dependant upon both the drug and the individual) of drowsiness, degraded reaction time and disturbances of equilibrium and balance.

- **Sulfa Drugs**: Sulfa drugs are antimicrobial drugs which inhibit the growth of bacterial. They also cause an allergic reaction in a significant percentage of the population. Side effects of these drugs also can include visual disturbances, dizziness, impaired reaction time, and depression.

- **Tranquillizers**: Tranquillizers affect reaction time, cause drowsiness, reduced concentration and division of attention.

- **Motion Sickness Medications**: Motion sickness remedies, in both oral and topical format, can cause drowsiness and depress brain function. They can also result in temporary deterioration in judgement and in decision making skills.
• **Weight Loss Drugs**: Appetite suppressing drugs inclusive of amphetamines can cause feelings of well-being that can affect judgment.

• **Barbiturates**: Barbiturate, including phenobarbital can noticeably reduce alertness.

**A Guide for Aviation Medical Examiners: Go to FAA.GOV**

**Pharmaceuticals (Therapeutic Medications) Do Not Issue - Do Not Fly**

The information in this section is provided to advise Aviation Medical Examiners (AMEs) about two medication issues:

• Medications for which they should not issue applicants without clearance from the Federal Aviation Administration (FAA), AND

• Medications for which they should advise airmen to not fly and provide additional safety information to the applicant.

**Night Flying and Illusions**

**Introduction**

In today's complex world of GPS, glass cockpits, and flight management systems, sometimes a simple rule of thumb or memory aid is still the best way for a pilot to avoid an accident. After a lot of work, I think N.I.G.H.T. is one such flight planning aid pilots should use before every night flight.

Night flight has certain inherent risks. After a friend was killed in a nighttime accident, I started reviewing all the information I could find relating to night flying accidents, including various safety recommendations. In summarizing my research, I think the five most important questions a pilot can ask or review before a night flight are contained in the acronym **N.I.G.H.T.** Each letter asks a question or relates to a topic that I think a pilot should consider before every night flight.
The five simple letters stand for five critical issues that address important operational issues, potential hazards, or physical limitations - topics unique to night flight.

(N) Notams

When it comes to NOTAMs, you don't know what you don't know! Every prudent pilot obtains a full briefing from a Flight Service Station or by using a DUAT session to ensure they have all the information necessary to conduct a safe flight. An important part of that briefing will be NOTAMs.

But do you really know what you're getting ... or not getting? Often, the answer is "No!"

NOTAMs are classified into three categories:

- NOTAM (D) or distant
- NOTAM (L) or local; and
- Flight Data Center (FDC) NOTAMs.

If your flight is to a distant airport, the NOTAMs you receive typically will include information on navigational facilities, frequency changes, and regulatory amendments. But it will not include information contained in local NOTAMs. For instance, local NOTAMs include such information as runway or taxiway closures and airport lighting outages. A total or partial outage of a Visual Approach Slope Indicator (VASI) or Runway End Identifier Lights (REIL) system also will be reported as a local NOTAM.

The only way to obtain a local NOTAM for your destination airport is to call the FSS responsible (see Airport/Facility Directory) or to call the airport manager.

(I) Illusions

Many different illusions can be experienced in flight; some can lead to spatial disorientation while others can lead to landing errors. Illusions
rank among the most common factors cited as contributing to fatal accidents.

**Illusions Leading to Spatial Disorientation**

Various complex motions and forces and certain visual scenes encountered in flight can create illusions of motion and position. Spatial disorientation from these illusions can be prevented only by visual reference to reliable, fixed points on the ground or to flight instruments. For more information on the illusions such as:

- Coriolis illusion
- Graveyard spiral
- Somatogravic illusion
- False horizon
- Autokinesis
- Elevator illusion
- Inversion illusion

Refer to Chapter 8 of the *Aeronautical Information Manual (AIM)*.

**Illusions Leading to Landing Errors**

Various surface features and atmospheric conditions encountered in landing can create illusions of incorrect height above and distance from the runway threshold. Landing errors from these illusions can be prevented by anticipating them during approaches and by using an electronic glide slope or VASI system when available. The most common illusions leading to landing errors are:

- **Runway width illusion.** A narrower than usual runway can create the illusion that the aircraft is at a higher altitude than it actually is. The pilot who does not recognize this illusion will likely fly a lower approach, with the risk of striking objects along the approach path or landing short. A wider than usual runway can
have the opposite effect, with the risk of overshooting the runway.

- **Runway and terrain slopes illusion.** An up-sloping runway, up-sloping terrain, or both, can create the illusion that the aircraft is at a higher altitude than it is actually is. The pilot who does not recognize this illusion will actually fly a lower than normal approach. A down-sloping runway, down-sloping approach terrain, or both, can have the opposite effect.

- **Featureless terrain illusion.** An absence of ground features, as when landing over water, darkened areas, and terrain made featureless by snow, can create the illusion that the aircraft is at a higher attitude than it actually is. The pilot who does not recognize this illusion will fly a lower approach.

- **Atmospheric illusions.** Rain on the windscreen can create the illusion of greater height, and atmospheric haze can create the illusion of being at a greater distance from the runway.

- **Ground lighting illusions.** Bright runway and approach light systems, especially when few lights illuminate the surrounding terrain, may cause the illusion of less distance from the runway. A pilot who does not recognize this will fly a higher approach. Conversely, the pilot over-flying terrain which has few lights to provide height cues may make a lower than normal approach.

**G** **Glideslope**

Check to see if a visual or electronic glide slope is available before departing to your destination. Although visual glide slope indicators are installed at most airports, it is important to note that they may be installed at only one runway end. Also, there are many variations. Some of the not-so-common indicators include the Tricolor System, Pulsating System, Alignment of Element System, and the Three-bar VASI.
• **Tri-color System.** Tri-color visual approach slope indicators normally consist of a single light unit projecting a three-color visual approach path into the final approach area of the runway upon which the indicator is installed. The below glide path indication is red, the above glide path indication is amber, and the on glide path indicator is green. These types of indicators have a useful range of approximately one-half to one mile during the day and up to five miles at night. *Note: Since the tri-color VASI consists of a single light source which could possibly be confused with other light sources, pilots should exercise care to properly locate and identify the light signal.*

• **Pulsating Systems.** Pulsating visual approach slope indicators normally consist of a single light unit projecting a two color visual approach into the final approach area of the runway upon which the indicator is installed. The on-glide path indication is a steady white light. The slightly below-glide path indication is a steady red light. If the aircraft descends further below the glide path, the red light starts to pulsate. The above glide path is a pulsating white light. The pulsating rate increases, as the aircraft gets further above or below the desired glide slope. The useful range of this system is about four miles during the day and up to ten miles at night.

• **Alignment of Element Systems.** Alignment of elements systems are installed on some small general aviation airports and are a low-cost system consisting of painted panels, normally black, white or fluorescent orange. Some of these are lighted for night use. The useful range of these systems is about three-quarters of a mile.

• **Three-bar VASI.** Three bar VASI installations provide two visual glide paths. The lower glide path is normally set at three degrees while the upper glide path, provided by the middle and far bars, is normally 1/4 degree higher. The higher glide path is intended for
use only by high cockpit aircraft (Boeing 747, DC10) to provide a sufficient threshold crossing height.

*Note: Although normal glide path angles are three degrees, angles at some locations may be as high as 4.5 degrees to give proper obstacle clearance. Pilots of high performance aircraft are cautioned that use of VASI angles in excess of 3.5 degrees may cause an increase in runway length required for landing and rollout.*

**(H) How do I control the lighting system**

Operation of airport lighting systems (rotating beacons, approach lights, VASI, REIL, taxiway lights and runway lights) may be controlled by the control tower, a Flight Service Station (FSS) or by the pilot with radio control. On runways with both approach lighting and runway lighting (runway edge lights, taxiway lights, etc.) systems, the approach lighting system takes precedence for air to ground radio control over the runway lighting system.

*Note: Although the CTAF is used to activate lights at many airports, other frequencies may also be used. The appropriate frequency for activating the lights on the airport can only be found in the Airport/Facility Directory or on a standard instrument approach procedures publication. It is not identified on the sectional charts.*

**(T) Terrain**

Avoiding terrain at night is easier if altitudes shown on VFR and IFR charts are used as part of your preflight planning.

- **VFR Charts show Maximum Elevation Figures (MEFs).** The Maximum Elevation Figures shown in quadrangles bounded by ticked lines of latitude and longitude are represented in THOUSANDS and HUNDREDS of feet above mean sea level. MEFs are determined by rounding the highest known elevation within the quadrangle, including terrain and obstruction (trees, towers, antennas, etc) to the next 100 foot level. These altitudes are then
adjusted upward between 100 to 300 feet. Recognize that this practice could give as little as 101 feet of obstacle clearance.

- **IFR enroute low altitude charts contain Off Route Obstruction Clearance Altitudes (OROCA).** On the IFR enroute low altitude chart, the Off Route Obstruction Clearance Altitude (OROCA) guarantees 1,000 foot obstacle clearance in non-mountainous terrain and can be used at night to ensure obstacle clearance. In mountainous terrain, this altitude offers 2,000 feet of obstacle clearance.

**See - Spatial Disorientation**
**Visual Illusions by the Federal Aviation Administration**

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**Hypothermia**

**Hypothermia** - Hypothermia is dangerously low body temperature, below 95°F (35°C). Hypothermia occurs when more heat is lost than the body can generate. It is usually caused by extended exposure to the cold. Symptoms usually begin slowly. There is likely to be a gradual loss of mental acuity and physical ability. The person experiencing hypothermia may be unaware that he or she requires emergency medical treatment. Hypothermia can occur in warm as well as cold weather if body temperature falls due to extended immersion in water. Body heat is lost up to 25 times faster in water. Hypothermia can also be caused by wind exposure.

**Death** - Hypothermia, if not medically treated immediately, can lead to coma and death.

When the body is unable to warm itself, serious cold-related illnesses and injuries may occur, and permanent tissue damage and death may result.
Hypothermia can occur when land temperatures are above freezing or water temperatures are below 98.6°F/37°C.

Cold-related illnesses can slowly overcome a person who has been chilled by low temperature, brisk winds, or wet clothing.

**LOW TEMPERATURE + WIND SPEED + WETNESS = INJURIES & ILLNESS**

Cold Effects

- **Trenchfoot** - Trenchfoot is a very serious, nonfreezing cold injury which develops when the skin of the feet is exposed to moisture and cold for prolonged periods (12 hours or longer). Untreated, trenchfoot can eventually require amputation. Often, the first sign of trenchfoot is itching, numbness, or tingling pain. The risk of this potentially crippling injury is high during cold, wet weather. However, rubberized or tight-fitting boots can cause trenchfoot regardless of weather, sweat accumulating inside these boots keeps feet wet.

- **Frostbite** - Frostbitten skin is hard, pale, cold, and has no feeling. It is caused by exposure to cold for a length of time. The extent of injury depends on severity and how promptly treatment is administered:
  - **Early** - As skin thaws, it is red and painful. Upon warming, it is common to experience intense pain and tingling or burning in the affected area.
  - **Moderate** - With more severe frostbite, the skin may appear white and numb because tissue has started to freeze. The area is likely to lack sensitivity to touch, although there may be an aching pain. As the area thaws, the flesh becomes red and very painful. Any part of the body may be affected by frostbite; but hands, feet, nose and ears are the most vulnerable. If only the skin and underlying tissues are damaged, recovery may be complete.
  - **Very Severe** - If blood vessels are affected, damage is permanent. Blistering, gangrene, and damage to deep structures such as tendons, muscle, nerves, and bone can occur. If severe, amputation, can be required.
AERONAUTICAL DECISION MAKING (ADM):

ADM is a systematic approach to risk assessment and stress management.

CRM – CREW RESOURCE MANAGEMENT

SRM – SINGLE-PILOT RESOURCE MANAGEMENT

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<thead>
<tr>
<th>Hazardous Attitude</th>
<th>Antidote</th>
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<tbody>
<tr>
<td>Anti-authority: Don’t tell me.</td>
<td>Follow the rules. They are usually right.</td>
</tr>
<tr>
<td>Impulsivity: Do something quicky.</td>
<td>Not so fast. Think first.</td>
</tr>
<tr>
<td>Invulnerability: It won’t happen to me.</td>
<td>It could happen to me.</td>
</tr>
<tr>
<td>Macho: I can do it.</td>
<td>Taking chances is foolish.</td>
</tr>
<tr>
<td>Resignation: What’s the use?</td>
<td>I’m not helpless. I can make a difference.</td>
</tr>
</tbody>
</table>

5 HAZARDOUS ATTITUDES
MITIGATING RISK:

<table>
<thead>
<tr>
<th>PAVE Personal Minimums Checklist</th>
<th>I’M SAFE Checklist</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pilot:</strong></td>
<td>Illness - Symptoms</td>
</tr>
<tr>
<td>Experience/Recency</td>
<td>Medication - Prescription or OTC</td>
</tr>
<tr>
<td>Physical Condition</td>
<td>Stress - Job, Financial, Health, Family</td>
</tr>
<tr>
<td><strong>Aircraft</strong></td>
<td>Alcohol - 8 Hrs? 24 Hrs?</td>
</tr>
<tr>
<td>Fuel Reserves</td>
<td>Fatigue - Adequately rested</td>
</tr>
<tr>
<td>Experience in Type</td>
<td>Eating - Adequately Nourished</td>
</tr>
<tr>
<td>Aircraft Performance</td>
<td></td>
</tr>
<tr>
<td>Aircraft Equipment</td>
<td></td>
</tr>
<tr>
<td><strong>EnVironment</strong></td>
<td></td>
</tr>
<tr>
<td>Airport Conditions</td>
<td></td>
</tr>
<tr>
<td>Weather</td>
<td></td>
</tr>
<tr>
<td>Weather for VFR/IFR</td>
<td></td>
</tr>
<tr>
<td><strong>External Pressures</strong></td>
<td></td>
</tr>
<tr>
<td>Trip Planning</td>
<td></td>
</tr>
<tr>
<td>Diversion or Cancellation</td>
<td></td>
</tr>
<tr>
<td>Alternate Plans</td>
<td></td>
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<tr>
<td>Personal Equipment</td>
<td></td>
</tr>
</tbody>
</table>
A. Risk Management Process

1. Risk management is a process, or a cycle, and must be viewed as such. It is not a one-time consideration but rather an ongoing, repetitive procedure that is accomplished (with practice) out of habit.
   a. While many risk management processes exist, the most popular and easiest to implement is the 3P Model. The 3Ps are Perceive, Process, and Perform.

2. First, perceive risks by using the PAVE checklist. Remember, “Perceive with PAVE.”
   a. Use the following table to break down the PAVE checklist:

   | Pilot          | Experience, recency, currency, and physical and emotional condition |
   | Aircraft       | Fuel reserves, experience in type, aircraft performance, and aircraft equipment (e.g., avionics, retractable gear, etc.) |
   | enVironment    | Airport conditions, weather (VFR & IFR) requirements, runways, lighting, and terrain |
   | External pressures | Allowance for delays and diversions, alternative plans, and personal equipment |

3. After you have used the PAVE checklist to perceive and identify all hazards associated with the flight, you should process the hazards identified through the CARE checklist and determine the level and severity of the risk.
   a. By using CARE, you will better understand the situation at hand from a top-down, big-picture perspective.
   b. The mnemonic to remember here is to “Process with CARE.”
   c. Use the following table to break down the CARE checklist:

   | Consequences | Continuously evaluate the consequences (risks) of hazards that arise while en route. |
   | Alternatives | Continuously evaluate all available options and alternatives. |
   | Reality      | Acknowledge and address the reality of your situation (weather, aircraft, etc.), and avoid wishful thinking. |
   | External pressures | Be mindful of external pressures, especially tendencies toward “get-home-itis.” |

4. Finally, the third step is to perform risk management using the risk controls found in the TEAM checklist. The TEAM checklist will provide different options and/or alternatives for effective risk management. Remember, “Perform as a TEAM.”
   a. Use the following table to break down the TEAM checklist:

   | Transfer Risk | Should this risk decision be transferred to someone else (e.g., do you need to consult someone else for advice/guidance or take along a more experienced pilot or CFI)? |
   | Eliminate Risk | Is there a way to eliminate the risk altogether (e.g., cancel/reschedule the flight)? |
   | Accept Risk | Do the benefits of accepting the risk outweigh the costs? |
   | Mitigate Risk | What options do you have that can lessen the impact of the risk? |

5. These risk management concepts should be incorporated into every flight lesson from the beginning of the training. Implementing this mentality forces the student to analyze risk and make a proper decision to ensure flight safety.
   a. By utilizing the 3P cycle and the PAVE, CARE, and TEAM checklists, you can teach your students a standard procedure for identifying, categorizing, and controlling risks, which should help bring about fewer accidents and fatalities.
   b. Obviously, the student will not have the opportunity to list these acronyms and go through these checklists in the heat of the moment. However, if you instill these concepts in your students early in training, the process will be conducted naturally, immediately, and correctly when the time comes to react.
THE SRM FIVE “P” CHECK:

THE PLAN

THE PLANE

THE PILOT

THE PASSENGERS

THE PROGRAMMING
THE 3P MODEL: Perceive, Process and Perform

The first step in the 3-P model, **PERCEIVE**, is about developing a clear and comprehensive awareness of your particular situation. Consider: PAVE

**TEAM** – TRANSFER, ELIMATE, ACCEPT, MITIGATE (APPLY)
Evaluate with CARE
Next, you mentally **PROCESS** information about the circumstances that you have identified. The goal is to evaluate their impact on the safety of your flight, and consider “why must I CARE about these circumstances?” For each hazard that you perceived in step one, consider: CARE

**TEAM** – TRANSFER, ELIMINATE, ACCEPT, MITIGATE (APPLY)
Mitigate, Eliminate, Evaluate
Once you have *perceived* a hazard (step one) and *processed* its impact on flight safety (step two), it is time to *perform* by taking the best course of action, and then evaluating its impact. Your goal is to: ME

M itigate or eliminate risk
E valuate outcome of action(s)

TEAM – TRANSFER, ELIMATE, ACCEPT, MITIGATE (APPLY)

DECIDE MODEL

D etect the fact that a change has occurred.
E stimate the need to counter or react to the change.
C hoose a desirable outcome for the success of the flight.
I dentify actions which could successfully control the change.
D o the necessary action to adapt to the change.
E valuate the effect of the action.