**ATTENTION**  - One of the error factors that we can try to control if we are aware of them

**MOTIVATION**  - Everyone will at some point have a cold, take some kind of drugs or drink alcohol

**OBJECTIVE**  - To familiarize the student with different aeromedical issues that affects a pilot's ability and precautionary measures

**CONTENT**  - Introduction  
- Hypoxia, symptoms, effects and corrective action  
- Hyperventilation, symptoms, effects and corrective action  
- Middle ear and sinus problems, causes, effects and corrective action  
- Spatial disorientation, causes, effects and corrective action  
- Motion sickness, causes, effects and corrective action  
- Effects of alcohol and drugs and their relation to safety  
- CO poisoning, its symptoms, effects and corrective action  
- How evolved gas from scuba diving affects a pilot during flight  
- Fatigue, its effects and corrective action

**SCHEDULE**  - Ground Discussion  60

**EQUIPMENT**  - Whiteboard + pens for pre- and post-flight discussions

**INSTRUCTOR'S ACTIONS**  - Discuss lesson objective  
- Ask the student questions  
- Give homework

**STUDENT'S ACTIONS**  - Discuss lesson objective  
- Ask pertinent questions

**SUMMARY**  - Review lesson emphasis on weak areas and corrective actions
HYPOXIA

DEFINITION
- A condition that results from having an insufficient amount of oxygen in the body

OBJECTIVE
- To teach the student symptoms of hypoxia, the effects and the corrective actions should one be subjected to an oxygen deficiency

THEORY
- There are 4 different types of hypoxia

1. HYPOXIC HYPOXIA
2. HYPEMIC / ANEMIC
3. STAGNENT HYPOXIA
4. HISTOTOXIC HYPOXIA

1. HYPOXIC HYPOXIA
Due to the reduced barometric pressures encountered at altitude, which prevent the diffusion of O² from the lungs to the bloodstream. Aviation personnel are most likely to encounter this type at altitude.

- High altitude

2. HYPEMIC HYPOXIA (ANEMIC HYPOXIA)
A reduction in the oxygen-carrying capacity of the blood. Anemia (lowered hemoglobin) and blood loss are the most common causes. Carbon monoxide also causes this hypoxia by forming compounds with hemoglobin and reducing the hemoglobin that is available to combine with oxygen.

- Anemia
- Blood loss
- Blood donation
- Hemorrhage
- Low hemoglobin
- Carbon monoxide poisoning

3. STAGNANT HYPOXIA
Blood circulation is inadequate. Often occur when extreme gravitational forces are experienced, disrupting blood flow and causing the blood to stagnate.

- Heart failure
- Arterial spasm
- Occlusion of a blood vessel
- Venous pooling during positive G-maneuvers

4. HISTOTOXIC HYPOXIA
Interference with the use of O² by body tissues. Alcohol, narcotics, and certain poisons - such as cyanide - interfere with the cells ability to use an adequate supply of oxygen.

- Alcohol
- Narcotics
- Certain poisons
HYPOXIA

5. SUSCEPTIBILITY TO HYPOXIA

- Physiological Altitude
- Smoking
- Alcohol
- Individual Factors
- Ascent Rate
- Exposure Duration
- Ambient Temperature
- Physical Activity
- Physical Fitness

6. SYMPTOMS OF HYPOXIA

- The symptoms of hypoxia vary with the individual, but common symptoms include
  F - Fatigue
  I - Impaired Judgement
  S - Sense of well being
  H - Headache
  R - Reduced vision
  I - Improper decision making
  B - Blue lips (Cyanosis)

- The brain makes up only 2% of the body’s total weight but requires 20% of the body’s oxygen requirements
- Nervous tissue has a heavy requirement for O²
- If the lack of O² is prolonged or severe, then brain death results and ultimately you will die

7. PREVENTION OF HYPOXIC HYPOXIA

- Use lowest practical flight level
- Minimize duration of flight at high altitude
- Allow acclimatization to higher altitudes
- Refrain from alcohol and tobacco products
- Maintain good physical condition
- Use supplemental oxygen

8. SUPPLEMENTAL OXYGEN

- For optimum protection, pilots are encouraged to use supplemental oxygen above 10,000 feet during the day, and above 5,000 feet at night

- FAR 91.211 require that at the minimum:
  - Flight crew After 30 minutes 12,500 - 14,000 feet
  - Flight crew Immediately > 14,000 feet
  - Every occupant Immediately > 15,000 feet

9. TREATMENT OF HYPOXIC HYPOXIA

- Signs and symptoms of hypoxia must be treated immediately
- Treat by giving 100 percent oxygen
- If no oxygen, descent to an altitude below 10,000 feet
- When symptoms persist, the type and cause of the hypoxia must be determined and treated accordingly

REFERENCES

- FAR/AIM, AIM 8-1-2 - Effects of Altitude
- FAR/AIM, FAR 91.211 - Supplemental Oxygen
- FAA-H-8083-25 Handbook of Aeronautical Knowledge, 15-
- FAA Pilot Safety Brochure - Hypoxia
**DEFINITION**
- An abnormal increase in the volume of air breathed in and out of the lungs

**OBJECTIVE**
- To teach the student the recognition and actions required to treat the condition

**THEORY**

**1. OUTLINE**
- The carbon dioxide level in the blood is reduced by over-breathing, the oxygen replaces the carbon dioxide and upsets the acid balance in the blood
- This condition is not lethal

**2. CAUSES**
- Stress or anxiety, breathing faster than normal
- The onset of hypoxia may cause hyperventilation
- Pressure breathing may cause hyperventilation

**3. SYMPTOMS**
- Light headedness
- Drowsiness
- Suffocation
- Tingling in fingers and toes
- Coolness
- Incoordination
- Disorientation
- Muscle spasms
- Unconsciousness

**4. TREATMENT**
- Rate of breathing must be reduced
- Get the person to talk or sing
- Place a paper bag over nose and mouth (to restore Carbonic Acid balance)

**5. OTHER FACTORS**
- If hyperventilation is encountered at high altitude, this might be a sign of hypoxia
- Hypoxia being the more dangerous condition should be treated with 100% oxygen
- This may make hyperventilation worse but would not be fatal

**REFERENCES**
- FAR/AIM, AIM 8−1−3 - Hyperventilation in Flight
DEFINITION
- Climbs and descents can sometimes cause ear or sinus pain and a temporary reduction in the ability to hear

OBJECTIVE
- To teach the student the reasons, factors, effects the and possible actions to minimize the condition

EAR BLOCK
DEFINITION
- Difference in the air pressure outside the body and that inside the middle ear

THE MIDDLE EAR
- A small cavity located in the bone of the skull
- Closed off from the external ear canal by the eardrum
- Pressure differences are equalized by the eustachian tube
- This tube is usually closed
- Open during chewing, yawning, or swallowing to equalize pressure
- Even a slight difference between external pressure and middle ear pressure can cause discomfort

PRESSURE DIFFERENCE
- Draw the ear and ear drum both ascending and descending
- During ascent, the expanding air in the middle ear pushes the eustachian tube open, and automatically equalizes pressure
- During descent, the pilot must periodically equalize pressure
  · Swallowing
  · Yawning
  · Tensing muscles in the throat
  · Valsalva maneuver - Closing the mouth, pinching the nose closed, and attempting to blow
- An ear block occurs most frequently during descent

FACTORS
- Enough congestion around the eustachian tube to make equalization difficult
  - Upper respiratory infection, such as a cold or sore throat
  - Nasal allergic condition
- Consequently, the difference in pressure between the middle ear and aircraft cabin can build up to a level that will hold the eustachian tube closed, making equalization difficult if not impossible
EAR BLOCK CONTINUED...

**EFFECTS**
- Severe ear pain and loss of hearing that can last from several hours to several days
- Rupture of the ear drum can occur in flight or after landing
- Fluid can accumulate in the middle ear and become infected

**PREVENTION**
- Not flying with an upper respiratory infection or nasal allergic condition
- Adequate protection is usually NOT provided by decongestant sprays or drops to reduce congestion around the eustachian tubes
- Oral decongestants have side effects that can significantly impair pilot performance

**TREATMENT**
- If an ear block does not clear shortly after landing, a physician should be consulted

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**SINUS BLOCK**

**DEFINITION**
- Difference in the air pressure outside the body and that inside the sinuses

**THE SINUSES**
- Cavities in the skull behind the face which serves two purposes
  1. Resonance to the voice and lighten the skull
  2. Warm and moisten the air passing from the nose to the lungs

**PRESSURE**
- Air pressure in the sinuses equalizes through small openings that connect to the nasal passages

**DIFFERENCE**
- A sinus block occurs most frequently during descent

**FACTORS**
- Congestion around an opening to slow equalization, and eventually plug the opening
  1. Upper respiratory infection, such as a cold or sinusitis
  2. A nasal allergic condition
MIDDLE EAR AND SINUS PROBLEMS

SINUS BLOCK CONTINUED...

EFFECTS
- Occur in the frontal sinuses, located above each eyebrow, or in the maxillary sinuses, located in each upper cheek
- It will usually produce excruciating pain over the sinus area
- A maxillary sinus block can also make the upper teeth ache
- Bloody mucus may discharge from the nasal passages

PREVENTION
- Not flying with an upper respiratory infection or nasal allergic condition
- Adequate protection is usually not provided by decongestant sprays or drops to reduce congestion around the sinus openings
- Oral decongestants may have side effects that can impair pilot performance

TREATMENT
- If a sinus block does not clear shortly after landing, a physician should be consulted

GENERAL
- Always advise passengers with a cold or flu symptoms NOT TO FLY
- If pain occurs in flight, consider stopping the descent and climb back up
- Try and descend more slowly

REFERENCES
- FAR/AIM, AIM 8-1-2 - Effects of Altitude
**DEFINITION**  
- Lack of orientation with regard to the position, attitude, or movement of the helicopter

**OBJECTIVE**  
- To teach the student the reasons, factors, effects and possible actions to minimize the condition

**INTRODUCTION**  
- Motions, forces and certain visual scenes can create illusions of motion and position  
- Many different illusions can be experienced in flight  
- Some can lead to spatial disorientation  
- Others can lead to landing errors  
- Illusions rank among the most common factors cited as contributing to fatal aircraft accidents  
- Can be prevented only by visual reference to reliable, fixed points on the ground or to flight instruments

**THREE SENSES**  
- The body uses three integrated systems to ascertain orientation and movement in space  
  - Visual System - Our eyes  
  - Vestibular System - Organs found in the inner ear  
  - Somatosensory System - Nerves in the skin, muscles, and joints  
- Most of the time, giving a clear idea of where and how the body is moving  
- Sometimes these systems supply conflicting information to the brain, which can lead to disorientation  
- The eyes are the major orientation source and usually prevail over false sensations from other sensory systems  
- When these visual cues are taken away, false sensations can cause a pilot to quickly become disoriented

**ILLUSIONS LEADING TO SPATIAL DISORIENTATION**

**THE LEANS**  
- An **abrupt correction of a banked attitude**, which has been entered too slowly to stimulate the motion sensing system in the inner ear, can create the **illusion of banking in the opposite direction**  
- The disoriented pilot will **roll the aircraft back into its original dangerous attitude**, or if level flight is maintained, will **feel compelled to lean in the perceived vertical plane** until this illusion subsides

**CORIOLIS ILLUSION**  
- An **abrupt head movement in a prolonged constant-rate turn that has ceased stimulating the motion sensing system** can create the **illusion of rotation or movement in an entirely different axis**  
- The disoriented pilot will **maneuver the aircraft into a dangerous attitude** in an attempt to stop rotation  
- This **most overwhelming of all illusions in flight may be prevented by not making sudden, extreme head movements**, particularly while making prolonged constant-rate turns in poor visibility operations
**SPATIAL DISORIENTATION**

**SOMATOGRAVIC ILLUSION**
- A rapid acceleration can create the illusion of being in a nose up attitude
- The disoriented pilot will push the helicopter into a nose low, or dive attitude
- A rapid deceleration can create the illusion of being in a nose down attitude
- The disoriented pilot pulling the helicopter into a nose up attitude

**INVERSION ILLUSION**
- An abrupt change from climb to straight and level flight can create the illusion of tumbling backwards
- The disoriented pilot will push the helicopter abruptly into a nose low attitude, possibly intensifying this illusion

**ELEVATOR ILLUSION**
- An abrupt upward vertical acceleration, usually by an updraft, can create the illusion of being in a climb
- The disoriented pilot will push the helicopter into a nose low attitude
- An abrupt downward vertical acceleration, usually by a downdraft, can create the illusion of being in a descent
- The disoriented pilot pulling the helicopter into a nose up attitude

**FALSE HORIZON**
- Sloping cloud formations, an obscured horizon, a dark scene spread with ground lights and stars, and certain geometric patterns of ground light can create illusions of not being aligned correctly with the actual horizon
- The disoriented pilot will place the aircraft in a dangerous attitude

**AUTOKINESIS**
- In the dark, a static light will appear to move about when stared at for many seconds
- The disoriented pilot will lose control of the aircraft in attempting to align it with the light

**ILLUSIONS LEADING TO LANDING ERRORS**

**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, aerial visual inspection of unfamiliar airports before landing, using electronic glide slope or VASI systems when available, and maintaining optimum proficiency in landing procedures

**RUNWAY WIDTH ILLUSION**
- A narrower-than-usual runway can create the illusion that the helicopter is at a higher altitude than it actually is
- The pilot who does not recognize this illusion will fly a lower approach, with the risk of striking objects along the approach path or landing short
- A wider-than-usual runway can create the illusion that the helicopter is at a lower altitude than it actually is
- The pilot who does not recognize this illusion will fly a higher approach, with the risk of overshooting the runway
**SPATIAL DISORIENTATION**

| RUNWAY/TERRAIN SLOPES ILLUSION | - An upsloping runway, upsloping terrain, or both, can create the illusion that the helicopter is at a higher altitude than it actually is  
- The pilot who does not recognize this illusion will fly a lower approach, with the risk of striking objects along the approach path or landing short  
- A downsloping runway, downsloping approach terrain, or both, can create the illusion that the helicopter is at a lower altitude than it actually is  
- The pilot who does not recognize this illusion will fly a higher approach, with the risk of overshooting the runway |

| 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 altitude than it actually is  
- The pilot who does not recognize this illusion will fly a lower approach, with the risk of striking objects along the approach path or landing short |

| ATMOSPHERIC ILLUSIONS | - Rain on the windscreen can create the illusion of greater height, and atmospheric haze the illusion of being at a greater distance from the runway  
- The pilot who does not recognize this illusion will fly a lower approach, with the risk of striking objects along the approach path or landing short  
- Penetration of fog can create the illusion of pitching up  
- The pilot who does not recognize this illusion will steepen the approach, often quite abruptly |

| GROUND LIGHTING ILLUSIONS | - Lights along a straight path, such as a road, and even lights on moving trains can be mistaken for runway and approach lights  
- Bright runway and approach lighting systems, especially where few lights illuminate the surrounding terrain, may create the illusion of less distance to the runway  
- The pilot who does not recognize this illusion will fly a higher approach  
- Conversely, the pilot overflying terrain which has few lights to provide height cues may make a lower approach |

| PREVENTION | - Prevention is usually the best remedy for spatial disorientation  
- Flight in reduced visibility or at night when the horizon is not visible should be avoided  
- A pilot can reduce susceptibility to disorienting illusions through training and awareness  
- Rely totally on flight instruments |

| REFERENCES | - FAR/AIM, AIM 8-1-5 - Illusions in Flight  
- AC 60-4A Pilot’s Spatial Disorientation |
MOTION SICKNESS

DEFINITION
- Caused by the brain receiving conflicting messages about the state of the body

FACTORS
- Anxiety
- Stress

SYMPTOMS
- General discomfort
- Nausea
- Dizziness
- Paleness
- Sweating
- Vomiting

TREATMENT
- Opening fresh air vents
- Focusing on objects outside the helicopter
- Avoiding unnecessary head movements

- Although medications can prevent airsickness in passengers, they are not recommended for pilots since they can cause drowsiness and other problems

NOTES
- A pilot may experience motion sickness during initial flights
- Generally goes away within the first few lessons
- Experiencing airsickness is no reflection on one’s ability as a pilot
- If prone to motion sickness, let the flight instructor know since there are techniques that can be used to overcome this problem
  - Avoid lessons in turbulent conditions until becoming more comfortable in the airplane
  - Start with shorter flights and graduate to longer instruction periods

REFERENCES
ALCOHOL

INTRODUCTION
- Alcohol impairs the efficiency of the human mechanism
- The safe outcome of any flight depends on the ability to make the correct decisions and take the appropriate actions during routine occurrences, as well as abnormal situations
- The influence of alcohol drastically reduces the chances of completing a flight without incident

EFFECTS OF ALCOHOL
- Even in small amounts, alcohol can
  - Impair judgment
  - Decrease sense of responsibility
  - Affect coordination
  - Constrict visual field
  - Diminish memory
  - Reduce reasoning power
  - Lower attention span

- As little as one ounce (29.57 milliliters) of alcohol can
  - Decrease the speed and strength of muscular reflexes
  - Lessen the efficiency of eye movements while reading
  - Increase the frequency at which errors are committed

FACTS OF ALCOHOL
- Impairments vision and hearing at alcohol blood levels as low as .01 percent
- Alcohol is a central nervous system depressant
- It acts on the body much like a general anesthetic
- The “dose” is generally much lower and more slowly consumed in the case of alcohol, but the basic effects on the system are similar
- Alcohol is easily and quickly absorbed by the digestive tract
- The bloodstream absorbs about 80 to 90% of the alcohol within 30 minutes on an empty stomach
- The body requires about 3 hours to rid itself of all the alcohol contained in one mixed drink or one beer

HANGOVER
- With a hangover, a pilot is still under the influence of alcohol
- Impairment of motor and mental responses still remains
- Considerable amounts of alcohol can remain in the body for over 16 hours
- Pilots should be cautious about flying too soon after drinking
ALCOHOL CONTINUED...

**ALTITUDE**
- Altitude multiplies the effects of alcohol on the brain
- Alcohol interferes with the brain’s ability to utilize oxygen, histotoxic hypoxia
- Effects are rapid because alcohol passes so quickly into the bloodstream
- The brain is a highly vascular organ that is immediately sensitive to changes in the blood’s composition
- The lower oxygen availability at altitude, along with the lower capability of the brain to use what oxygen is there, adds up to a deadly combination

**INTOXICATION**
- Determined by the amount of alcohol in the bloodstream
- This is usually measured as a percentage by weight in the blood

**REGULATIONS**
- FAR 91.17 Alcohol and drugs
- The blood alcohol level must be less than .04 percent
- 8 hours bottle to throttle - 8 hours must pass after drinking alcohol
- It is a good idea to be more conservative than the regulations

**DRUGS**

**INTRODUCTION**
- Pilot performance can be seriously degraded by both prescribed and over-the-counter medications, as well as by the medical conditions for which they are taken

**EFFECTS OF DRUGS**
- Many medications, such as tranquilizers, sedatives, strong pain relievers, and cough-suppressants may impair
  - Judgment
  - Memory
  - Alertness
  - Coordination
  - Vision
  - Ability to make calculations
- Others, such as antihistamines, blood pressure drugs, muscle relaxants, and agents to control diarrhea and motion sickness have side effects that may impair the same critical functions
- Medication that depresses the nervous system, such as a sedative, tranquilizer, or antihistamine can make a pilot more susceptible to hypoxia
DRUGS CONTINUED...

STIMULANTS
- Stimulants are drugs that excite the central nervous system and produce an increase in alertness and activity
  - Amphetamines
  - Caffeine
  - Nicotine
- Common uses of these drugs include appetite suppression, fatigue reduction, and mood elevation
- Some of these drugs may cause a stimulant reaction, even though this reaction is not their primary function
- In some cases, stimulants can produce anxiety and mood swings, both of which are dangerous when flying

DEPRESSANTS
- Depressants are drugs that reduce the body’s functioning in many areas
- These drugs lower blood pressure, reduce mental processing, and slow motor and reaction responses
- There are several types of drugs that can cause a depressing effect on the body
  - Tranquilizers
  - Motion sickness medication
  - Stomach medication
  - Decongestants
  - Antihistamines
- The most common depressant is alcohol

OTHER DRUGS
- Some drugs, which can neither be classified as stimulants nor depressants, have adverse effects on flying
- Some antibiotics can produce side effects, such as balance disorders, hearing loss, nausea, and vomiting
- While many antibiotics are safe for use while flying, the infection requiring the antibiotic may prohibit flying

OTHER FACTORS
- Unless specifically prescribed by a physician, do not take more than one drug at a time
- Never mix drugs with alcohol, because the effects are often unpredictable
- The dangers of illegal drugs also are well documented
- Certain illegal drugs can have hallucinatory effects that occur days or weeks after the drug is taken
- Obviously, these drugs have no place in the aviation community

REGULATIONS
- FAR 91.17 Alcohol and drugs
- Crew members are prohibited from performing duties while using medication that affects safety
- Do not fly as a crew member while taking any medication, unless approved to do so by the FAA
- If there is any doubt regarding the effects of any medication, consult an aviation medical examiner before flying
REFERENCES

- FAR/AIM, AIM 8-1-1 - Fitness For Flight
- AC 91.11-1 Guide to Drug Hazards in Aviation Medicine [Not used for this briefing]
**CARBON MONOXIDE POISONING**

**CARBON MONOXIDE**
- Carbon monoxide (CO) is a **colorless, odorless, and tasteless gas** contained in **exhaust fumes**
- It **attaches itself to the hemoglobin in the blood** about 200 times more easily than oxygen
- When breathed even in **minute quantities over a period of time**, it can significantly reduce the ability of the blood to carry oxygen, resulting in **hypemic hypoxia**

**CAUSES**
- Most heaters in light aircraft work by **air flowing over the manifold**
- Aircraft heater vents and defrost vents may provide carbon monoxide a **passageway into the cabin**
- Particularly if the **engine exhaust system has a leak or is damaged**
- Use of these heaters while exhaust fumes are escaping through manifold cracks and seals is responsible every year for **several nonfatal and fatal aircraft accidents** from carbon monoxide poisoning

**EFFECTS**
- Some effects of carbon monoxide poisoning include:
  - Headache
  - Blurred vision
  - Dizziness
  - Drowsiness
  - Loss of muscle power
- If symptoms are severe or continue after landing, medical treatment should be sought
- If the poisoning is severe enough, it **can result in death**

**PREVENTION**
- If an odor of exhaust gases is detected, assume that carbon monoxide is present
- Carbon monoxide may be present in dangerous amounts **even if no exhaust odor is detected**
- Disposable, **inexpensive carbon monoxide detectors** are widely available
- These detectors change color to alert the pilot of the presence of carbon monoxide
- If any indication or symptoms are experienced, immediate corrective actions should be taken
  - Turning off the heater
  - Opening fresh air vents and windows
  - Using supplemental oxygen, if available

**TOBACCO**
- Tobacco smoke also **causes carbon monoxide poisoning**
- **Smoking at sea level** can raise the CO concentration in the blood
- Result in **physiological effects similar to flying at 8,000 feet**
- Besides **hypoxia**, tobacco causes diseases and physiological debilitation that are medically **disqualifying for pilots**
REFERENCES
- FAR/AIM, AIM 8-1-4 - Carbon Monoxide Poisoning in Flight
- AC 20-32B - Carbon Monoxide (CO) Contamination in Aircraft Detection and Prevention
- FAA Pilot Safety Brochure - CARBON MONOXIDE: A Deadly Menace
DECOMPRESSION SICKNESS

- Scuba diving subjects the body to increased pressure
- This allows more nitrogen to dissolve in body tissues and fluids
- The reduction of atmospheric pressure when flying can produce physical problems for scuba divers
- Reducing the pressure too quickly allows small bubbles of nitrogen to form inside the body
- These bubbles can cause a painful and potentially incapacitating condition called “the bends”
- An example is dissolved gas forming bubbles as pressure decreases by slowly opening a bottle of soda
- Scuba training emphasizes how to prevent the bends when rising to the surface
- But increased nitrogen concentrations can remain in tissue fluids for several hours after a diver leaves the water
- The bends can be experienced from as low as 8,000 feet MSL, with increasing severity as altitude increases

PREVENTION

- 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 gas can occur during exposure to low altitude and create a serious in-flight emergency
- The recommended waiting time before going to flight altitudes of up to 8,000 feet is:
  - At least 12 hours after diving which has not required controlled ascent (non-decompression stop diving)
  - At least 24 hours after diving which has required 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
- Recommended altitudes are actual flight altitudes above mean sea level (AMSL) and not pressurized cabin altitudes
- This takes into consideration the risk of decompression of the aircraft during flight

REFERENCES

- FAR/AIM, AIM 8-1-2 - Effects of Altitude
- FAA Pilot Safety Brochure - ALTITUDE-INDUCED DECOMPRESSION SICKNESS
ATTENTION  - Fatigue is frequently associated with pilot error

EFFECTS  - Some of the effects of fatigue include degradation of attention and concentration, impaired coordination, and decreased ability to communicate
- These factors can seriously influence the ability to make effective decisions

CAUSES  - Physical fatigue can result from sleep loss, exercise, or physical work
- Stress and prolonged performance of cognitive work can result in mental fatigue

TYPES  - Fatigue falls into two broad categories:
- Acute
- Chronic

ACUTE FATIGUE

INTRODUCTION  - Acute fatigue is short term and is a normal occurrence in everyday living
- It is the kind of tiredness people feel after a period of strenuous effort, excitement, or lack of sleep
- Rest after exertion and 8 hours of sound sleep ordinarily cures this condition

SKILL FATIGUE  - A special type of acute fatigue is skill fatigue

EFFECTS  - Skill fatigue has two main effects on performance:
- Timing disruption
  - Appearing to perform a task as usual, but the timing of each component is slightly off
  - This makes the pattern of the operation less smooth, because the pilot performs each component as though it were separate, instead of part of an integrated activity
- Disruption of the perceptual field
  - Concentrating attention upon movements or objects in the center of vision and neglecting those in the periphery
  - This may be accompanied by loss of accuracy and smoothness in control movements
ACUTE FATIGUE CONTINUED...

PREVENTION
- Acute fatigue can be prevented by a proper diet and adequate rest and sleep
- A well-balanced diet prevents the body from having to consume its own tissues as an energy source

TREATMENT
- Adequate rest maintains the body’s store of vital energy

CHRONIC FATIGUE

INTRODUCTION
- Chronic fatigue, extending over a long period of time, usually has psychological roots, although an underlying disease is sometimes responsible

CAUSES
- Continuous high stress levels, for example, can produce chronic fatigue

EFFECTS
- An individual may experience this condition in the form of:
  - Weakness
  - Tiredness
  - Palpitations of the heart
  - Breathlessness
  - Headaches
  - Irritability
- Sometimes chronic fatigue even creates:
  - Stomach or intestinal problems
  - Generalized aches and pains throughout the body
- When the condition becomes serious enough, it can lead to emotional illness

ACTION
- If suffering from acute fatigue, stay on the ground
- If fatigue occurs in the cockpit, no amount of training or experience can overcome the detrimental effects

PREVENTION
- Getting adequate rest is the only way to prevent fatigue from occurring
- Avoid flying:
  - Without a full night’s rest
  - After working excessive hours
  - After an especially exhausting or stressful day
CHRONIC FATIGUE CONTINUED...

**TREATMENT**
- Chronic fatigue is not relieved by proper diet and adequate rest and sleep, and usually requires treatment by a physician
- Pilots who suspect they are suffering from chronic fatigue should consult a physician

**REFERENCES**
- FAR/AIM, AIM 8-1-1 - Fitness For Flight
ATTENTION - Most accidents happen at day in good visibility

MOTIVATION - By developing a good scanning technique and learning about how our vision works we become safer and better pilots

OBJECTIVE - Familiarize the student with visual scanning techniques and collision avoidance, dangerous situations and precautionary measures

CONTENT - Introduction
- Visual sense and how mental and physical condition effects it
- Illumination
- Scanning technique
- Collision avoidance
- Right-of-way rules
- Situations with greatest collision risk
- Optical illusions

SCHEDULE - Ground Discussion 30

EQUIPMENT - Whiteboard + pens for pre- and post-flight discussions
- Helicopter models

INSTRUCTOR’S ACTIONS - Discuss lesson objective
- Give homework
- Ask the student questions

STUDENT’S ACTIONS - Discuss lesson objective
- Ask pertinent questions

SUMMARY - Review lesson emphasis on weak areas and danger areas
VISUAL SCANNING AND COLLISION AVOIDANCE

OBJECTIVE
- Be aware of proper scanning technics, possible illusions in order to avoid collisions

VISION IN FLIGHT
- Of the body senses, vision is the most important for safe flight
- Most things perceived while flying are visual or heavily supplemented by vision
- Vision is subject to some limitations, such as illusions and blind spots
- The more a pilot understands about the eyes and how they function, the easier it is to use vision effectively and compensate for potential problems

THE EYE
- The eye functions much like a camera
- Light passes through the cornea (the transparent window on the front of the eye) and then through the lens to focus on the retina
- The pupil is the opening at the center of the iris
- The size is adjusted to control the amount of light entering the eye
- The rods and the cones of the retina are the receptors which record the image and transmit it through the optic nerve to the brain for interpretation
- The brain interprets the electrical signals to form images

CONES AND RODS
- There are two kinds of light sensitive cells in the eyes: rods and cones
- The cones are responsible for all color vision, from appreciating a glorious sunset to discerning the subtle shades in a fine painting
- Cones are present throughout the retina, but are concentrated toward the center of the field of vision at the back of the retina
- At the fovea almost all the light sensing cells are cones
- This is where detail, color sensitivity, and resolution are highest
- The rods are better able to detect movement and provide vision in dim light
- The rods are unable to discern color but are very sensitive in low light levels
- Large amount of light overwhelms the rods, and they take a long time to adapt to the dark again
- There are so many cones in the fovea that the very center of the visual field hardly has any rods at all
- So in low light, the middle of the visual field isn’t very sensitive, but farther from the fovea, the rods are more numerous and provide the major portion of night vision
- The area where the optic nerve enters the eyeball has no rods or cones, leaving a blind spot in the field of vision
VISION UNDER DIM AND BRIGHT ILLUMINATION

**EMPTY-FIELD MYOPIA**
- Empty-field myopia, or induced nearsightedness, occur when flying at night, in IMC and/or reduced visibility.
- With nothing to focus on, the eyes automatically focus on a point just slightly ahead.
- Focusing on distant light sources, no matter how dim, helps prevent the onset of empty-field myopia.

**DIM LIGHT**
- Small print and colors on aeronautical charts and aircraft instruments can become unreadable.
- Another aircraft must be much closer to be seen unless its navigation lights are on.

**DARKNESS**
- In darkness, vision becomes more sensitive to light, a process called dark adaptation.
- Exposure to total darkness for at least 30 minutes is required for complete dark adaptation.
- A pilot can achieve a moderate degree of dark adaptation within 20 minutes under dim red cockpit lighting.
- Red light severely distorts colors, especially on aeronautical charts, and can cause serious difficulty in focusing on objects inside the aircraft.
- White cockpit lighting or flashlight must be available for map and instrument reading.
- Dark adaptation is impaired by:
  - Exposure to cabin pressure altitudes above 5,000 feet.
  - Carbon monoxide inhaled in smoking and from exhaust fumes.
  - Deficiency of Vitamin A in the diet.
  - Prolonged exposure to bright sunlight.
- Since any degree of dark adaptation is lost within a few seconds of viewing a bright light, a pilot should close one eye when using a light to preserve some degree of night vision.

**BRIGHT LIGHT**
- Excessive illumination, especially from light reflected off the canopy, surfaces inside the aircraft, clouds, water, snow, and desert terrain, can produce glare, with uncomfortable squinting, watering of the eyes, and even temporary blindness.
- Sunglasses for protection from glare should absorb at least 85 percent of visible light (15 percent transmittance) and all colors equally (neutral transmittance), with negligible image distortion from refractive and prismatic errors.
VISUAL SCANNING AND COLLISION AVOIDANCE

SCANNING FOR OTHER AIRCRAFT

SCANNING
- Scanning the sky for other aircraft is a key factor in collision avoidance
- It should be used continuously by the pilot and co-pilot to cover all areas of the sky visible from the cockpit
- The ability to read an eye chart does not ensure ability to efficiently spot other aircraft
- Develop an effective scanning technique
- The probability of spotting a potential collision, increases with the time spent looking outside
- Must use timesharing techniques to efficiently scan airspace while monitoring instruments as well

SCANNING TECHNIQUE
- The eyes can observe an approximate 200 degree arc of the horizon at one glance
- Only the fovea has the ability to send clear, sharply focused messages to the brain
- Other visual information, not processed directly through the fovea, will be of less detail
- Effective scanning is accomplished with a series of short, regularly spaced eye movements that bring successive areas of the sky into the central visual field
- Each movement should not exceed 10 degrees
- Each area should be observed for at least 1 second to enable detection
- Develop a scanning pattern that is most comfortable and then adhere to it to assure optimum scanning
- The time spend on visual tasks inside the cabin should represent no more than 25% of the scan time outside
- Since the brain is already trained to process sight information that is presented from left to right, one may find it easier to start scanning over the left shoulder and proceed across the windshield to the right

EYE FATIGUE
- The eyes may require several seconds to refocus when switching views between the cockpit and outside
- The eyes will tire more quickly when forced to adjust to distances immediately after close-up focus

NOTES
- Effective scanning also helps avoid empty-field myopia
INTRODUCTION
- Pilots should also be familiar with the following information to reduce the possibility of mid-air collisions.

TECHNIQUES
- Determining Relative Altitude
  - Use the horizon as a reference point
  - If the other aircraft is above the horizon, it is probably on a higher flight path
  - If the aircraft appears to be below the horizon, it is probably flying at a lower altitude

- Taking Appropriate Action
  - Pilots should be familiar with rules on right-of-way, so if an aircraft is on an obvious collision course,
  - one can take immediate evasive action, preferably in compliance with applicable FAR’s
  - Even if entitled to the right-of-way, a pilot should give way if it is felt another aircraft is too close

- Consider Multiple Threats
  - The decision to climb, descend, or turn is a matter of personal judgment, but one should anticipate
    that the other pilot may also be making a quick maneuver
  - Watch the other aircraft during the maneuver and begin your scanning again immediately since
    - there may be other aircraft in the area

- Collision Course Targets
  - Any aircraft that appears to have no relative motion and stays in one scan quadrant
    - is likely to be on a collision course
  - Also, if a target shows no lateral or vertical motion, but increases in size, take evasive action

- Recognize High Hazard Areas
  - Airways, especially near VOR’s, and Class B, Class C, Class D, and Class E surface areas
    - are places where aircraft tend to cluster
  - Remember, most collisions occur during days when the weather is good
  - Being in a ”radar environment” still requires vigilance to avoid collisions

- Cockpit Management
  - Studying maps, checklists, and manuals before flight, with other proper preflight planning;
    - e.g., noting necessary radio frequencies and organizing cockpit materials, can reduce the
    - amount of time required to look at these items during flight, permitting more scan time
JUDGMENT ASPECTS OF COLLISION AVOIDANCE CONTINUED...

- Windshield Conditions
  - Dirty or bug-smear windshields can greatly reduce the ability of pilots to see other aircraft
  - Keep a clean windshield

- Visibility Conditions
  - Smoke, haze, dust, rain, and flying towards the sun can also greatly reduce the ability to detect targets

- Visual Obstructions in the Cockpit
  - Pilots need to move their heads to see around blind spots caused by fixed aircraft structures
  - It will be necessary at times to maneuver the aircraft
  - Pilots must cockpit objects, are secured, removed or stowed during flight

- Lights On
  - Day or night, use of exterior lights can greatly increase the conspicuity of any aircraft
  - Keep interior lights low at night

- ATC Support
  - ATC facilities often provide radar traffic advisories on a workload-permitting basis
  - Flight through Class C and Class D airspace requires communication with ATC
  - Use this support whenever possible or when required

RIGHT-OF-WAY RULES

FAR 91.113
- Look it up the the FAR/AIM
CLEARING PROCEDURES

- The following procedures and considerations should assist a pilot in collision avoidance under various situations

- **Before Takeoff**
  Prior to taxiing onto a runway or landing area in preparation for takeoff, pilots should scan the approach area for possible landing traffic, executing appropriate maneuvers to provide a clear view of the approach areas

- **Climbs and Descents**
  During climbs and descents in flight conditions which permit visual detection of other traffic, pilots should execute gentle banks left and right at a frequency which permits continuous visual scanning of the airspace

- **Straight and Level**
  During sustained periods of straight-and-level flight, a pilot should execute appropriate clearing procedures at periodic intervals

- **Traffic Patterns**
  Entries into traffic patterns while descending should be avoided

- **Traffic at VOR Sites**
  Due to converging traffic, sustained vigilance should be maintained in the vicinity of VOR’s and intersections

- **Training Operations**
  Vigilance should be maintained and clearing turns should be made prior to a practice maneuver
  During instruction, the pilot should be asked to verbalize the clearing procedures
VISUAL SCANNING AND COLLISION AVOIDANCE

RUNWAY INCURSION AVOIDANCE

DEFINITION
- Any occurrence in the airport runway environment involving an aircraft, vehicle, person, or object on the ground that creates a collision hazard or results in a loss of required separation with an aircraft taking off, intending to take off, landing, or intending to land

GENERAL
- It is important to give the same attention to operating on the surface as in other phases of flights
- Proper planning can prevent runway incursions and the possibility of a ground collision
- Be aware of the helicopters’s position on the surface at all times and be aware of other aircraft and vehicle operations on the airport

PRACTICES
- The following are some practices to help prevent a runway incursion
  - Read back all runway crossing and/or hold instructions
  - Review airport diagrams when preflight planning, before descending to land, and while taxiing as needed
  - Know airport markings and signs
  - Review NOTAM’s for information on runway/taxiway closures and construction areas
  - Request progressive taxi instructions from ATC when unsure of the taxi route
  - Check for traffic before crossing any Runway Hold Line and before entering a taxiway
  - Turn on aircraft lights and the rotating beacon or strobe lights while taxing
  - When landing, clear the active runway as soon as possible, then wait for taxi instructions
  - Study and use proper phraseology in order to understand and respond to ground control instructions
  - Write down complex taxi instructions at unfamiliar airports

MORE INFO
- AC 91-73, Part 91 Pilot and Flightcrew Procedures During Taxi Operations and Part 135 Single-Pilot Operations
- Air Safety Foundation’s Runway Safety Learning Tool

REFERENCES
- FAR/AIM, AIM 8-1-6 - Vision in Flight
- AC 90-48C - Pilots’ Role in Collision Avoidance
USE OF DISTRACTIONS DURING FLIGHT TRAINING

BACKGROUND
- National Transportation Safety Board (NTSB) statistics reveal that most stall/spin accidents occurred when the pilot's attention was diverted from the primary task of flying the aircraft.
- 60% of stall/spin accidents occurred during takeoff and landing.
- 20% were preceded by engine failure.
- Preoccupation inside or outside the cockpit while changing aircraft configuration or trim, maneuvering to avoid other traffic or clearing hazardous obstacles during takeoff and climb could create a potential stall/spin situation.
- The intentional practice of stalls and spins seldom resulted in an accident.
- The real danger was inadvertent stalls induced by distractions during routine flight situations.
- Pilots at all skill levels should be aware of the increased risk of entering into an inadvertent stall or spin while performing tasks that are secondary to controlling the aircraft.
- The FAA has also established a policy for use of certain distractions on practical tests for pilot certification.
- The purpose is to determine that applicants possess the skills required to cope with distractions while maintaining the degree of aircraft control required for safe flight.
- The most effective training is the simulation of scenarios that can lead to inadvertent stalls by creating distractions while the student is practicing certain maneuvers.
- The instructor should tell the student to divide his/her attention between the distracting task and maintaining control of the aircraft.

EXAMPLES
- Ask the student to determine a heading to an airport using a chart.
- Ask the student to reset the clock.
- Ask the student to get something from the glove box.
- Ask the student to read the outside air temperature.
- Ask the student to call the Flight Service Station (FSS) for weather information.
- Ask the student to compute time and fuel consumption to a given point.
- Ask the student to identify terrain or objects on the ground.
- Ask the student to identify a field suitable for a forced landing.
ATTENTION - If we do not know why helicopter reacts a certain way we cannot do anything to help the situation. Many accidents can be avoided

MOTIVATION - We need to know the aerodynamics of the helicopter to understand how and why it is acting a certain way. If we know what to expect we become better pilots and will have a smoother flight

OBJECTIVE - To familiarize the student with different aerodynamic phenomena associated with helicopter flight, dangerous situations and recovery measures

CONTENT - Characteristics off different rotor systems
- Effect of lift, weight, thrust and drag during different flight maneuvers
- Retreating blade stall
- Torque effect
- Dissymmetry of lift
- Blade flapping and coning
- Coriolis effect
- Translating tendency
- Translational lift
- Transverse flow effect
- Pendular action

SCHEDULE - Ground Discussion 120

EQUIPMENT - Whiteboard + pens for discussions
- Helicopter model
- Cone for disc

INSTRUCTOR’S ACTIONS - Discuss lesson objective
- Give homework
- Ask the student questions

STUDENT’S ACTIONS - Discuss lesson objective
- Ask pertinent questions

SUMMARY - Review lesson emphasis on weak areas and recovery
CHARACTERISTICS OF DIFFERENT ROTOR SYSTEMS

DEFINITION
- Main rotor systems are classified according to how the blades move relative to the main rotor hub
- There are three different main types

THEORY

FULLY ARTICULATED - Schweizer 300CB
- A series of hinges allow the blades to move independently
- Normally three or more blades
  - Flap - A horizontal hinge (flapping hinge) allows the blades to move up and down to compensate for dissymmetry of lift
  - Lead-Lag - The vertical hinge (lead-lag or drag hinge) allows the blades to move forth and back to compensate for Coriolis Effect
  - Feather - The blades can be rotated about their spanwise axis to change the pitch angle of the blade

SEMI RIGID - R22 / Bell 206
- The blades are rigidly mounted to the main rotor hub
- Normally two blades
  - Flap - A teetering hinge allows the hub to tilt with respect to the main rotor shaft, making the blades flap as a unit
  - Lead-Lag - Lead-lag forces are absorbed through blade bending
  - Feather - The blades can be rotated about their spanwise axis to change the pitch angle of the blade

RIGID - BO-105
- The blades, mast and hub are rigid with respect to each other
- No vertical or horizontal hinges
  - Flap - Flapping forces are absorbed through blade bending
  - Lead-Lag - Lead-lag forces are absorbed through blade bending
  - Feather - The blades can be rotated about their spanwise axis to change the pitch angle of the blade
EFFECT OF LIFT, WEIGHT, THRUST, AND DRAG DURING VARIOUS FLIGHT MANEUVERS

DEFINITION
- In order to maneuver the helicopter we need to change the relationship between the four forces.

MOTIVATION
- We want to have an understanding of the effect of the four forces during various flight maneuvers in order to operate the aircraft in a safe manner.

THEORY

The Four Forces
- **LIFT**: The upward force created by the airflow passing around the rotor blades.
- **WEIGHT**: The downward force is caused by gravity.
- **THRUST**: The force that propels the helicopter through the air.
- **DRAG**: The retarding force caused by lift development and movement through the air.

Newton’s Three Laws of Motion
- **Newton’s First Law**: Law of Inertia
  Every object will remain at rest or in uniform motion in a straight line unless compelled to change its state by the action of an external force.
- **Newton’s Second Law**: Fundamental law of dynamics
  The relationship between an object’s Mass, its Acceleration, and the applied Force $F$ is $F = ma$.
- **Newton’s Third Law**: Law of reciprocal actions
  For every action (force) there is an equal and opposite reaction (Used to explain lift).

Hover
- Assuming still air conditions
- Maintain a constant position over a selected point on the ground
- All forces must act in a vertical manner
- All forces must be in balance
**Vertical Flight**

- Assuming still air conditions
- We want to ascend or descend
- We use collective to increase or decrease the blade pitch and thereby the angle of attack to produce more or less lift
- The helicopter we accelerate upwards and settle in a steady climb

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**Forward Flight**

- The disc is tilted forward, tilting the total lift-thrust force forward from the vertical
- The resultant can be resolved into lift acting vertically and thrust acting horizontally
- In addition we have weight acting downward and drag acting rearward

**STRAIGHT AND LEVEL UNACCELERATED FLIGHT**

- Lift equals weight and thrust equals drag

**CLIMB**

- Lift greater than weight

**DESCEND**

- Lift less than weight

**SPEED UP**

- Thrust greater than drag

**SLOW DOWN**

- Thrust less than drag
Sideward Flight
- Similar to forward flight
- The plane of rotation is tilted in the desired direction
- This tilts the total lift-thrust vector sideward
- Lift still straight up and weight straight down
- But in this case the thrust is acting in a sideward manner and drag to the opposite side

Rearward Flight
- Opposite to forward flight
- The plane of rotation is tilted rearward
- This tilts the total lift-thrust vector rearward
- Drag now acts forward being opposed by thrust
- Lift still acts straight up opposing the weight
**Turning Flight**

- When turning the rotor disc is tilted both forward and sideward
- As a result the lift is being divided into two components
- Lift acting upward and opposing weight
- Lift acting horizontally and opposing inertia

- More lift is used horizontally
- To keep altitude we must increase the total lift force
- We have to increase the angle of attack
- The rate of turn is faster
DEFINITION
- As high speed the low blade speed on the retreating blade and its high angle of attack, causes a loss of lift (stall).

THEORY
- In forward flight, the relative airflow is different on the advancing and retreating side
- To generate the same lift across the disc, the advancing blade flaps up while the retreating blade flaps down
- AoA decreases on the advancing blade, which reduces lift, and increases on the retreating blade, which increases lift
- The low blade speed on the retreating blade, together with its high angle of attack, causes a loss of lift (stall)

- The retreating blade stall begins at the tip as it exceeds the critical angle
- Retreating blade stall is a major factor in limiting a helicopter’s top forward speed (VNE)

INDICATIONS
- Low frequency vibration
- Pitching up of the nose
- Roll to the retreating side

CONSIDERATIONS
- High weight
- High density altitude
- Steep and abrupt turns
- Low rotor RPM
- Turbulence
- Exceeding VNE

VNE
- As altitude is increased, higher blade angles are required to maintain lift at a given airspeed
- Thus, retreating blade stall is encountered at a lower forward airspeed at altitude
- Most manufacturers publish charts and graphs showing a VNE decrease with altitude

RECOVERY
- Moving the cyclic aft only worsens the stall as aft cyclic produces a flare effect, thus increasing angles of attack
- Pushing forward on the cyclic also deepens the stall as the angle of attack on the retreating blade is increased
- Correct requires the collective to be lowered first, which reduces pitch angles and thus angle of attack
- Aft cyclic can then be used to slow the helicopter
**DEFINITION**

- The aircraft’s tendency to rotate in the opposite direction to the main rotor due to Newton’s third law
- "Every action has an equal and opposite reaction"

**THEORY**

**POWER VS TORQUE**

- The more power we use
- The more torque we need to overcome
- The less power we use
- The less torque we need to overcome

**CORRECTION**

- Torque is the reason we need a tail rotor or some other form of anti-torque control
- As the engine supplies more power, the tail rotor must produce more thrust
- This is done through the use of the pedals

- In forward flight the airflow over the horizontal stabilizer is assisting the tail rotor
DEFINITION
- Due to different relative wind speeds, the advancing side of the rotor disc produces more lift than the retreating side.

THEORY

RESULT
- If not corrected for a roll to the retreating side will occur.
**CORRECTION**
- The blades flap to correct for dissymmetry of lift, without pilot input needed

**THEORY**

- Blade velocity decreases
- Flapping down begins
- Angle of attack increases
- Rate of flapping up decreases

- Blade velocity increases
- Flapping up begins
- Angle of attack reduces
- Rate of flapping down decreases

- Blade velocity is maximum
- Rate of up flapping is maximum
- Angle of attack is minimum
- More lift produced

- Blade velocity is minimum
- Rate of down flapping is maximum
- Angle of attack is maximum
- Less lift produced

**RESULT**
- Due to the blade flapping Blow Back occur
**DEFINITION**
- As forward airspeed is increased the flapping that occurs to compensate for dissymmetry of lift causes a displacement of the disc

**CORRECTION**
- The cyclic has to be moved forward by the pilot in order to overcome blow back
**DEFINITION**
- Flapping is the movement of the blade above and below the main rotor hub
- Coning is the flapping or bending of the blades due to collective inputs and RPM changes

**FLAPPING**
- In a fully articulated and a semi rigid rotor system the blades are able to flap up and down around a hinge
  - in order to change the lift produced around the disc
  - Cyclic blade pitch change
  - Change in speed
  - Change in relative wind

**CONING**
- Collective adjustments affect the pitch angle on the blades and the lift produced
- Throttle adjustments affect the rotor RPM and thus the centrifugal force
- The two factors together determine the coning angle
- In a fully articulated system the blades will move about the flapping hinge
- In a semi-rigid or rigid system coning results in blade bending
**CORIOLIS EFFECT**

**DEFINITION**
- The tendency of a rotor blade to change its velocity in the plane of rotation due to mass movement
- Also known as “Law of conservation of angular momentum”

**THEORY**
- Same principle as the little skating queen moving her arms up and down
- When a blade flaps upward, the center of mass moves closer to the axis of rotation, and the blade accelerates
- When the blade flaps down, its center of mass moves further from the axis of rotation, and the blade decelerates
- Flap up = Accelerate
- Flap down = Decelerate
- Two bladed “underslung” rotor systems are subject to Coriolis Effect to a much lesser degree

**CORRECTION**
- The acceleration and deceleration of the rotor blades are absorbed by either drag dampers or the blade structure itself

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**Diagram Notes: **

1. Blade Flapping
2. Blade Flapping
3. Law of conservation of angular momentum

**Equation:**

\[ \text{Angular momentum} = \text{Mass} \times \text{Velocity} \times \text{Radius} \]

**Conservation of angular momentum**

\[ M_1 \times V_1 \times R_1 = M_2 \times V_2 \times R_2 \]
DEFINITION
- The tendency for a helicopter to drift in the direction of tail rotor thrust

THEORY
- Torque gives the helicopter a tendency to rotate in the opposite direction to the main rotor
- This is due to Newton's third law “Every action has an equal and opposite reaction”
- The torque effect is compensated for with the tail rotor

CORRECTION
- To overcome the drift we must produce a small sideward thrust by:
  1. The pilot manually tilts the disc in the direction opposite tail thrust
  2. The rotor mast is rigged to have a built-in tilt opposite tail thrust
  3. Flight control rigging to have a tilt opposite tail thrust when the cyclic is centered

NOTES
- In the Schweizer 300CB we correct with left cyclic pilot input to compensate for translating tendency, which gives us the left skid low attitude
**DEFINITION**
- Increased lift without a change in collective position due to a horizontal airflow

**THEORY**
- With horizontal airflow due to forward movement or strong winds two factors must be considered
  
  1. **Horizontal airflow**
    
    **Hover**
    - Induced flow is large
    - Increased by recirculation
    - Angle of attack is small
    - Lift is little

    **Moving forward**
    - Airflow becomes more horizontal
    - Induced flow decreases
    - Angle of attack increases
    - Lift increases

  2. **Vortices and recirculation**
    
    - As the helicopter moves forward the disc moves into cleaner air leaving the vortices behind

**NOTES**
- Translational lift is present with any horizontal airflow, but most noticeable at 16-24 knots
- The additional lift available is known as "Effective Translational Lift" or ETL

**RECOGNITION**
- The onset of ETL is recognized by vibrations

**TAIL ROTOR**
- The tail rotor also gets ETL so less left pedal is required as the helicopter accelerates
DEFINITION
- When the helicopter accelerates the uneven induced flow over the disc causes a roll to the right

THEORY
- Induced flow is reduced on the front of the disc and increased on the rear
- This increases the angle of attack on the front of the disc causing the blade to flap up and
- reduces the angle of attack on the rear causing the blade to flap down
- Due to gyroscopic precession the flapping is felt 90° later in the plane of rotation causing
- the disc to tilt to the right, making the helicopter roll to the right
- The roll happens at approximately 20 knots airspeed or with 20 knots headwind

CORRECTION
- To overcome the right roll we must manually tilt the disc in the opposite direction with the cyclic

RECOGNITION
- Transverse flow effect is recognized by the increased vibrations at airspeeds just below ETL on takeoff and after passing through ETL on landing
- Not as pronounced on landing as the approach is happening slower
- Vibrations due to more flapping, more lift produced, less drag and higher blade speed in clear air
DEFINITION
- Since the helicopter is suspended from a single point and has considerable mass, it is free to oscillate either horizontally or laterally in the same way as a pendulum.

THEORY
- This pendular action can be exaggerated by over controlling.
- Therefore control movements should always be smooth and not exaggerated.
INTRODUCTION
- There are four basic controls used during flight
  - Collective pitch control
  - Throttle
  - Cyclic pitch control
  - Antitorque pedals

COLLECTIVE
- Located on the left side of the pilot’s seat
- Changes the pitch angle of all main rotor blades simultaneously
- When raised, there is a simultaneous and equal increase in pitch angle of all main rotor blades
- When lowered, there is a simultaneous and equal decrease in pitch angle of all main rotor blades
- This is done through a series of mechanical linkages
- The amount of movement in the collective lever determines the amount of blade pitch change
- An adjustable friction control helps prevent inadvertent collective pitch movement
- Changing the pitch angle on the blades changes the angle of attack on each blade
- With a change in angle of attack comes a change in drag, which affects the RPM of the main rotor
- As the pitch angle increases, angle of attack increases, drag increases, and rotor RPM decreases
- Decreasing pitch angle decreases both angle of attack and drag, while rotor RPM increases
- In order to maintain a constant rotor RPM, a change in power is required to compensate for the change in drag
- This is done with the throttle control or a correlator and/or governor, which automatically adjusts engine power

THROTTLE
- The function of the throttle is to regulate engine RPM
- The throttle has to be moved manually with the twist grip in order to maintain RPM
  - If the correlator or governor system does not maintain the desired RPM
  - If those systems are not installed
- Twisting the throttle outboard increases RPM
- Twisting it inboard decreases RPM
COLLECTIVE
THROTTLE
COORDINATION
- When the collective pitch is raised, the load on the engine is increased in order to maintain desired RPM
- The load is measured by a manifold pressure gauge in piston or by a torque gauge in turbine helicopters
- In piston helicopters, the collective pitch is the primary control for manifold pressure, and the throttle is the primary control for RPM
- However, the collective pitch control also influences RPM, and the throttle also influences manifold pressure; therefore, each is considered to be a secondary control of the other’s function
- Both the tachometer and the manifold pressure gauge must be analyzed to determine which control to use

CORRELATOR
- What we have in the Schweizer 300CB
- A correlator is a mechanical connection between the collective lever and the engine throttle
- When the collective lever is raised, power is automatically increased and when lowered, power is decreased
- This system maintains RPM close to the desired value, but still requires adjustment of the throttle for fine tuning

GOVERNOR
- What we have in the R22
- A governor is a sensing device that senses rotor and engine RPM and makes the necessary adjustments in order to keep rotor RPM constant
- In normal operations, once the rotor RPM is set, the governor keeps the RPM constant, and there is no need to make any throttle adjustments
- Governors are common on all turbine helicopters and used on some piston powered helicopters

MANUAL RPM
- Some helicopters do not have correlators or governors
- These require coordination of all collective and throttle movements
- When the collective is raised, the throttle must be increased
- When the collective is lowered, the throttle must be decreased
- As with any aircraft control, large adjustments of either collective pitch or throttle should be avoided
- All corrections should be made through the use of smooth pressure
CYCLIC

- The cyclic pitch control tilts the main rotor disc by changing the pitch angle of the rotor blades in their cycle of rotation
- When the main rotor disc is tilted, the horizontal component of lift moves the helicopter in the direction of tilt
- The rotor disc tilts in the direction that pressure is applied to the cyclic pitch control
- If the cyclic is moved forward, the rotor disc tilts forward
- If the cyclic is moved aft, the disc tilts aft, and so on
- Because the rotor disc acts like a gyro, the mechanical linkages for the cyclic control rods are rigged in such a way that they decrease the pitch angle of the rotor blade approximately 90° before it reaches the direction of cyclic displacement, and increase the pitch angle of the rotor blade approximately 90° after it passes the direction of displacement
- An increase in pitch angle increases angle of attack
- A decrease in pitch angle decreases angle of attack
- For example, if the cyclic is moved forward, the angle of attack decreases as the rotor blade passes the right side of the helicopter and increases on the left side
- This results in maximum downward deflection of the rotor blade in front of the helicopter and maximum upward deflection behind it, causing the rotor disc to tilt forward
PEDALS

- Anti-torque pedals or tail rotor pedals
- Located on the cabin floor by the pilot’s feet
- Control the pitch, and therefore the thrust, of the tail rotor blades
- The main purpose of the tail rotor is to counteract the torque effect of the main rotor
- Since torque varies with changes in power, the tail rotor thrust must also be varied
- The pedals are connected to the pitch change mechanism on the tail rotor gearbox and allow the pitch angle on the tail rotor blades to be increased or decreased
- Besides counteracting torque of the main rotor, the tail rotor is also used to control the heading of the helicopter while hovering or when making hovering turns
- Hovering turns are commonly referred to as "pedal turns"
- In forward flight, the anti-torque pedals are used to compensate for torque to put the helicopter in longitudinal trim so that coordinated flight can be maintained
- The thrust of the tail rotor depends on the pitch angle of the tail rotor blades
- This pitch angle can be positive, negative, or zero
- A positive pitch angle tends to move the tail to the right
- A negative pitch angle moves the tail to the left
- No thrust is produced with a zero pitch angle
HELICOPTER WEIGHT AND BALANCE

OBJECTIVE
- Determine aircraft Centre of Gravity for all flight phases and ensuring the aircraft is within limitations

GENERAL
- Weight affects structural integrity and performance
- Balance and center of gravity deviations change a helicopter's handling characteristics
- It is vital and required by FAR 91.9(a) to comply with weight and balance limits established for the helicopter

WEIGHT
- You must consider the weight of the basic helicopter, crew, passengers, cargo, and fuel
- Effective weight (load factor) varies during maneuvering flight, we primarily consider the weight of the loaded helicopter while at rest

WEIGHT TERMS
- Basic Empty Weight
  - The standard helicopter, optional equipment, unusable fuel, and full operating fluids including full engine oil

  - Licensed Empty Weight
  - Nearly the same as basic empty weight, except that it does not include full engine oil, just undrainable oil
  - If you fly a helicopter that lists a licensed empty weight, be sure to add the weight of the oil to your computations

  - Useful Load
  - The difference between the gross weight and the basic empty weight is referred to as useful load
  - It includes the flight crew, usable fuel, drainable oil, if applicable, and payload

  - Payload
  - The weight of the passengers, cargo, and baggage

  - Gross Weight
  - The sum of the basic empty weight and useful load

  - Maximum Gross Weight
  - The maximum weight of the helicopter
  - Internal maximum gross weight, which refers to the weight within the helicopter structure
  - External maximum gross weight, which refers to the weight of the helicopter with an external load

  - Minimum Gross Weight
  - Is the opposite of the maximum gross weight but not all helicopters have one
  - The R22 has a minimum gross weight of 920 lbs
## Helicopter Weight and Balance

### Weight Limitations
- To guarantee the **structural integrity** of the helicopter
- To predict **helicopter performance** accurately
- Manufacturers have built in **safety factors**
- Never exceed the load limits
- Structural deformation or failure if you encounter excessive load factors, strong wind gusts, or turbulence
- Operating **below a minimum weight** could adversely affect the **handling characteristics** of the helicopter

### Performance
- It is **not safe** to take off with maximum gross weight under all conditions
- **Anything that adversely affects** takeoff, climb, hovering, and landing **performance** may require off-loading of fuel, passengers, or baggage to some **weight less** than the published maximum
- Factors include **high altitude**, **high temperature**, and **high humidity**, which result in a high density altitude

### Determining Empty Weight
- Weight and balance records **contain essential data**, including a complete list of all installed optional equipment
- Use these records to **determine the weight and balance** condition of the empty helicopter
- Any **changes** to the aircraft must be reflected in the weight and balance **records**
- Located in the FAA approved **Rotorcraft Flight Manual**

### Balance
- Helicopter **performance** is not only **affected by** gross weight, but also by the **position of that weight**
- **Must load** the aircraft within the allowable **center-of-gravity range**

### Center of Gravity (CG)
- The **theoretical point** where all of the aircraft’s weight is considered to be concentrated
- If a helicopter was **suspended by a cable** attached to the center-of-gravity point, it **would balance** like a teeter-totter
- **CG is usually close** to the main rotor mast
- **Improper balance** of a helicopter’s load can result in **serious control problems**
- The exact CG location and range are **specified in the rotorcraft flight manual** for each helicopter
- An **out-of-balance loading** condition results in
  - Difficult to control
  - Decreases maneuverability since cyclic control is less effective in the direction opposite to the CG location
- Changing the center of gravity changes the angle at which the aircraft **hangs** from the rotor
  - When the center of gravity is **directly under** the rotor mast, the helicopter **hangs horizontal**
  - If the **CG is too far forward** of the mast, the helicopter hangs with its **nose tilted down**
  - If the **CG is too far aft** of the mast, the **nose tilts up**
HELICOPTER WEIGHT AND BALANCE

CG FORWARD OF FORWARD LIMIT

- Heavy pilot and passenger
- Becomes worse if the fuel tanks are located aft of the rotor mast
- Nose-low attitude
- Excessive rearward displacement of the cyclic control
- May be impossible to decelerate sufficiently to bring the helicopter to a stop
- In autorotation, you may not have enough cyclic control to flare properly

CG AFT OF AFT LIMIT

- A lightweight pilot takes off solo with a full fuel
- A lightweight pilot with maximum baggage located aft of the rotor mast
- Tail-low attitude
- Excessive forward displacement of cyclic control
- Impossible to fly in the upper allowable airspeed
- Gusty or rough air could accelerate the helicopter, causing
  - Dissymmetry of lift and blade flapping cause the rotor disc to tilt aft
  - Full forward cyclic is already applied
  - Might not be able to lower the rotor disc
  - Possible loss of control, or tail boom strike

LATERAL BALANCE

- For most helicopters, it is usually not necessary to determine the lateral
- CG for normal flight instruction and passenger flights
- Cabins are relatively narrow and optional equipment is located near the center line
- Some helicopter manuals specify the seat from which you must conduct solo flight
- Heavy pilot and a full fuel on one side of the helicopter, could affect the lateral CG
- External loads in a position that requires large lateral cyclic control displacement
  - to maintain level flight, fore and aft cyclic effectiveness could be very limited
HELICOPTER WEIGHT AND BALANCE

CG DEFINITIONS

Centre Of Gravity (Balance Pivot Point)
Datum (Imaginary Reference Line)
Arm / Station (Distance from the Datum)

CALCULATING THE MOMENTS

Moment = Weight x Arm

CALCULATION CG

CG = Total moments / Total weight

SHIFTING, ADDING AND REMOVING WEIGHT

\[
\frac{W}{w} = \frac{D}{d}
\]

W = Total weight
w = Weight to be shifted, added or removed
D = Distance object moved / Distance from CG to object
d = Distance CG moves

BASIC FLUID WEIGHTS

AV-gas 6 lbs/gal
Engine Oil 7.5 lbs/gal
**LONGITUDENAL**

<table>
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<tr>
<th></th>
<th>Weight</th>
<th>Arm</th>
<th>Moment</th>
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<td>100.3</td>
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<td>Passenger and bags</td>
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<td>Fuel tank</td>
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<td>Glove box (max20 lbs)</td>
<td>0</td>
<td>50.3</td>
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<tr>
<td>Total weight with fuel</td>
<td>1656.5</td>
<td>97.06</td>
<td>160778.5</td>
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</tbody>
</table>

**LATERAL**

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<thead>
<tr>
<th></th>
<th>Weight</th>
<th>Arm</th>
<th>Moment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic empty weight</td>
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<tr>
<td>Right seat</td>
<td>155</td>
<td>12.8</td>
<td>1984</td>
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<tr>
<td>Left seat</td>
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<tr>
<td>Total zero fuel</td>
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<tr>
<td>Fuel</td>
<td>150</td>
<td>-16.6</td>
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<tr>
<td>Glove box</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total with fuel</td>
<td>1656.5</td>
<td>-1.95</td>
<td>-3226.5</td>
</tr>
</tbody>
</table>

**AIRCRAFT VARIABLES**

- Registration #: N2044D
- Basic empty weight: 1121.5
- Longitudinal Arm: 100.3
- Longitudinal Moment: 112471.5
- Lateral Arm: 0.4
- Lateral Moment: 453.5

**WEIGHT VARIABLES**

- Right seat: 155
- Left seat: 230
- Glove box (max20 lbs): 0
- Fuel - Gallons: 25
- Fuel Tank (-16.6 / -17.0): -16.6

**LIMITATIONS**

- Maximum Gross Weight: 1750
- Maximum Inside Cabin: 600
- Maximum in Compartment: 20

NB: Lateral fuel arm depends on the tank 35.2 / 33 gallons.
ATTENTION - Student getting lost for hours in the dark on a solo cross-country flight

MOTIVATION - The better the navigation preparation is the more we can enjoy the flight, and be safer and better pilots

OBJECTIVE - Familiarize the student with cross country navigation and flight planning. Student should be able to do own planning and file flight plan after this lesson.

CONTENT - Introduction and navigation terms
- Features of aeronautical charts
- Importance of proper and current charts
- Identification of airspaces
- Course plotting, fuel stops, alternates
- Pilotage and dead reckoning
- Radio navigation
- Diversion to alternate
- Lost procedures
- Computing fuel requirement
- Preparing and using flight log
- WX-check and good judgment – “go/no go” decision
- How to and why we file a flight plan

SCHEDULE - Ground Discussion 60

EQUIPMENT - Whiteboard + pens for pre- and post-flight discussions
- Charts, sectional and terminal
- AFD
- Flight log / Flight plan
- CRP5, ruler, calculator
- Permanent markers

INSTRUCTOR’S ACTIONS - Discuss lesson objective
- Ask the student questions
- Give homework

STUDENT’S ACTIONS - Discuss lesson objective
- Ask pertinent questions

SUMMARY - Review lesson emphasis on weak areas
OBJECTIVE
- Accurately directing the movements of the helicopter throughout flight referencing position and course

3 METHODS
- Pilotage
  Navigation solely be reference to visual landmarks

- Dead Reckoning
  Calculation of heading to fly and times to destination and/or checkpoints
  Position is confirmed be outside references

- Radio Navigation
  Aircraft position determined and confirmed by using radio navigation aids
  Eg. VOR, DME, NDB and GPS - Refer to FAR/AIM - AIM Chapter 1, Navigation Aids

PILOTAGE
- Uses obvious features eg. roads/rivers etc. to fly to
- Route may not necessarily follow straight lines
- Requires basic distance/speed/fuel calculation
- Not a direct route
- Slower than dead reckoning
- Useful to avoid Prohibited, Restricted, Warning Areas and Airspace (Dog legs)

DEAD RECKONING
- Use of magnetic heading and time to check point/fix
- Unexpected drift can be corrected for halfway or at a specific point of flight
- Amount of drift is doubled to regain track
- Route may cross poor terrain
- May be blown into airspace unwillingly
- Most direct commercial route
**COMMON TERMS**

- **Line of position**: A line the aircraft is on e.g. a visual feature (Roads, Powerlines) or a navaid eg. VOR
- **Fix**: Confirmation of position with at least 2 features. Eg. 2 VOR radials, Direction Finding (VDF), 2 roads intersecting
- **Checkpoint**: A fix is used as a reference point. Natural, manmade or navaid
- **Leg**: A segment of cross country flight eg. between check points
- **True North**: The geographic North or Axis of the Earth’s rotation and theoretically located in the North Pole. Most charts have coordinates given to true north
- **Magnetic North**: The position of the Magnetic North Pole. The compass datum is the magnetic north. This datum varies in position with time
- **Variation**: The difference between true and magnetic north measured in degrees. This difference will vary from different locations
- **Isogonic Lines**: Also called Isogonals. Lines connecting locations with the same magnetic variation
- **Agonic Line**: The line of zero magnetic variation
- **True Course**: Course referenced to true north
- **Magnetic Course**: True course corrected for local magnetic variation
- **Magnetic Heading**: Magnetic course corrected for wind effects
- **Magnetic Deviation**: The compass error caused by electromagnetic sources within the aircraft. Deviation changes with different headings - use the deviation card
- **Compass Heading**: Magnetic heading corrected for deviation
AERONAUTICAL CHARTS

- Use the Orlando Terminal and Jacksonville Sectional with the student. Refer to the legend for info.

- Types of charts
  - Sectional Charts 1:500,000 (1 inch = 6.86 nautical miles)
  - VFR Terminal Area Charts 1:250,000 (1 inch = 3.43 nautical miles)
  - World Aeronautical Charts 1:1,000,000 (1 inch = 13.7 nautical miles)

- Airports
  Explain colors and identification of runways, Use the legend

- Airspace
  Differences, Cloud clearance and visibility, Equipment required, Shapes and heights

- Obstructions
  Tower etc.

- Landmarks
  Line features

- Radio Aids
  How to read the information in radio aid and communication boxes, Use the legend

- MEF’s
  Maximum Elevation Figures

- SUP
  Special Use Airspace, See the bottom of the chart

- Isogonals
  Maximum Elevation Figures

- Grid lines
  Maximum Elevation Figures

- Elevations
  MSL (AGL)

- Chart currency
  Each pilot in command shall, before beginning a flight, become familiar with all available information concerning that flight (FAR 91.103)
  - Terminal Area Chart 6 months
  - Sectional Chart 6 months
  - World Aeronautical Chart 1 year
  - Airport/Facility Directory 56 days
  Where to find the expiration dates and updates in AF/D

- Night Lighting
  Colors
<table>
<thead>
<tr>
<th>Step</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Define start and finish point on a current aeronautical chart</td>
</tr>
<tr>
<td>2</td>
<td>Find a rough halfway point near grid lines and measure true course with protractor</td>
</tr>
<tr>
<td>3</td>
<td>Measure distance - either with correct side of navigation ruler or transpose distance with compass and the scale in bottom of chart</td>
</tr>
<tr>
<td>4</td>
<td>Calculate pressure altitude, use POH to find Corrected Airspeed (CAS) and then use E6-B/CRP-5 to find true airspeed (TAS)</td>
</tr>
<tr>
<td>5</td>
<td>Use E6-B/CRP-5 to calculate true bearing and ground speed from wind direction and speed. Instructions found on E6-B</td>
</tr>
<tr>
<td>6</td>
<td>Enter the data on the Navigation Log</td>
</tr>
<tr>
<td>7</td>
<td>Work through speed / distance / time / fuel calculations</td>
</tr>
<tr>
<td>8</td>
<td>Highlight obstacles and define minimum safe altitude</td>
</tr>
<tr>
<td>9</td>
<td>Determine refueling points if necessary</td>
</tr>
<tr>
<td>10</td>
<td>Mark frequencies on chart and navigation log</td>
</tr>
<tr>
<td>11</td>
<td>Define alternates, highlight on chart / nav log</td>
</tr>
<tr>
<td>12</td>
<td>Copy required airport diagrams for kneeboard</td>
</tr>
<tr>
<td>13</td>
<td>Consult AF/D for current airport information</td>
</tr>
<tr>
<td>14</td>
<td>Check NOTAM’s</td>
</tr>
<tr>
<td>15</td>
<td>Call FSS for Standard Weather Briefing for a VFR flight</td>
</tr>
<tr>
<td>16</td>
<td>Complete flight plan</td>
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</table>
LOST PROCEDURES
- Unable to determine position or recognize surrounding features
- Ensure the student knows when he/she is lost and the procedure to follow

UNSURE OF POSITION
- Locate distinct features
- Towers, Roads, Train tracks, Power lines, Towns and Coast lines
- Use these to estimate your position
- Radio a nearby airport

FIVE C’S
1 - CLIMB - Better for visibility, radio and navigation aid range
2 - CIRCLE - Pick a point and circle around it
3 - COMMUNICATE - With any nearby facilities using frequencies shown on your chart
4 - CONFESS - Tell ATC that you are uncertain of your position
- Contact emergency frequency 121.5 and squawk 7700 if your situation gets threatening, e.g. low fuel
5 - COMPLY - With ATC instructions

ACTIONS
- Ensure adequate flight planning
- Use nav facilities (VOR)
- Don’t panic if you become lost
DIVERSIONS - A change in heading to an alternate destination point due to bad weather, closed runway, etc.

PROCEDURE
- SET TIMER In order to check the time from turning point to alternate
- HEADING Turn onto an approximate heading towards alternate
- ALTITUDE Choose an altitude to remain clear of any obstacles
- DISTANCE Measure the distance from turning point to alternate, using pen or thumb
- TIME Calculate the time using mental calculation
- FUEL Calculate amount required using mental calculation
- NAVAIDS Use nav aids at alternate, equipment permitting
- Following this procedure will help you to determine if you have the required fuel for the journey
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<tr>
<th>VOR</th>
<th>Ident</th>
<th>Course (Route)</th>
<th>Altitude</th>
<th>Wind (Dir.  Temp)</th>
<th>CAS</th>
<th>TC</th>
<th>TH</th>
<th>MH</th>
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<th>Dist.</th>
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Total: 92  30  8

Flight Plan and Weather Log on Reverse Side
**WEATHER LOG**

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<tr>
<th>Reported</th>
<th>Forecast</th>
<th>Winds Aloft</th>
<th>Icing and Freezing Level</th>
<th>Turbulence and Cloud Tops</th>
<th>Position of Fronts, Lows and Highs</th>
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<td></td>
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<td></td>
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</tbody>
</table>

**FLIGHT PLAN**

1. **Type**: X VFR
2. **Aircraft Identification**: N20447
3. **Aircraft Type/ Special Equipment**: H269/U
4. **True Airspeed**: 70
5. **Departure Point**: KTIX
6. **Departure Time**:
   - Proposed [Z]: KTIX
   - Actual [Z]: KTIX
   - Altitude: 1500
7. **Cruising Altitude**:

**Route of Flight**

**KTIX - KMLB**

8. **Remarks**

**Destination**

9. **Destination (Name of airport and city)**: KMLB
10. **Est. Time Enroute**:
    - Hours: 1
    - Minutes: 0
12. **Fuel on board**:
    - Hours: 1
    - Minutes: 30
13. **Alternate Airport(s)**: THOMAS JORGENSEN HELICOPTER ADVENTURES INC, SPACE COAST REGIONAL
14. **Pilot’s Name, Address, Tel # & Aircraft Home Base**
15. **# Aboard**: 2
16. **Color of Aircraft**: WHITE
17. **Destination Contact / Telephone [Optional]**: 1-800-686-4080

**CLOSE VFR FLIGHT PLAN WITH FSS ON ARRIVAL**

**Position Report**

<table>
<thead>
<tr>
<th>Arrival</th>
<th>Departure</th>
<th>Time</th>
<th>Flying Status</th>
<th>Est.</th>
<th>Dest.</th>
<th>FSS</th>
<th>Details</th>
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<tbody>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**(Special Equipment Suffix)**

- X: No Transponder
- I: Transponder with no altitude encoding capability
- D: Transponder with altitude encoding capability
- B: DME, transponder with no altitude encoding capability
- A: DME, transponder with altitude encoding capability
- R: RNAV, transponder with altitude encoding capability
- C: RNAV, transponder with no altitude encoding capability
- W: RNAV, no transponder
ATTENTION - Visibility greatly reduced, more pre-flight planning and thinking necessary

MOTIVATION - The better the knowledge about how the body works in different situations and the preparation is the more we can enjoy the flight and be safer and better pilots

OBJECTIVE - Familiarize the student with the eye, illusions and situations specific for night flying including flight planning. Student should know a little better what to expect night flying and what to bring on a night flight after this lesson

CONTENT - Introduction
- Factors related to night vision, disorientation and optical illusions
- Weather considerations at night
- Pre-flight inspection, windshield and window cleanliness
- Interior light adjustment and flashlights
- Use of position and anti-collision lights from when to when
- Hover taxiing and airport orientation
- Takeoff and climb-out
- In-flight orientation
- Attitude cross checking visual references and instruments
- Recovery from critical flight attitudes by visual references and instruments
- Emergencies as electrical failure, engine malfunction and emergency landing
- Traffic patterns
- Approaches and landings with and without landing light

SCHEDULE - Ground Discussion 60

EQUIPMENT - Whiteboard + pens for pre- and post-flight discussions

INSTRUCTOR’S ACTIONS - Discuss lesson objective
- Ask the student questions
- Give homework

STUDENT’S ACTIONS - Discuss lesson objective
- Ask pertinent questions

SUMMARY - Review lesson with emphasis on the weak areas and dangerous situations
DEFINITION
- Night means the time between the end of evening civil twilight and the beginning of morning civil twilight, as published in the American Air Almanac, converted to local time - FAR Part 1

POSITION LIGHTS
- 91.209
- From sunset to sunrise, no person may operate an aircraft unless it has lighted position lights

LOGABLE NIGHT
- 1.1
- Night means the time between the end of evening civil twilight and the beginning of morning civil twilight, as published in the American Air Almanac, converted to local time

NIGHT CURRENCY
- 61.57
- During the period beginning 1 hour after sunset and ending 1 hour before sunrise, no person may act as PIC of an aircraft carrying passengers unless
  - 3 takeoffs and landings to a full stop in the preceding 90 days
  - In an aircraft of same category and class
EXAMPLE

PROBLEM

- Sunset is 8:23PM  - Civil Twilight is 8:50PM  - Takeoff time is 7:37PM  - Landing time is 9:37PM

- How much time can be logged as night
- How much time do you have to do your recurrency takeoffs and landings?

NIGHT VISION

FACTORS

- Diet and general physical health
- Deficiencies in vitamins A and C
- Carbon monoxide poisoning
- Smoking
- Alcohol and certain drugs
- A lack of oxygen

ADAPTATION

- The rods take 30 minutes to fully adapt to the dark
- Avoid bright lights
- Close one eye to keep night vision
- Use sunglasses

- EXERCISE
  Keep one eye closed for 15 minutes before you go to bed tonight, turn of the lights and open the both eyes

NIGHT SCANNING

- Once fully adapted to darkness, the rods are 10,000 times more sensitive to light than the cones
- Rods are the primary receptors for night vision
- The concentration of cones in the fovea can make it a night blind spot
- Along with the loss of sharpness and color at night, depth perception and judgment of size may be lost

- Scanning in 10° sectors (Same as day scanning)
- Move the eyes slowly in small sectors
- Don’t look directly on the object you that you want to see, look 5-10° off center, peripheral vision
- Avoid starring in one place for too long
**NIGHT OPERATIONS**

**NIGHT VISUAL ILLUSIONS**
- There are many different types of visual illusions that commonly occur at night
- Anticipating and staying aware of them is usually the best way to avoid them

**NIGHT MYOPIA**
- Another problem associated with flying at night empty-field myopia, or induced nearsightedness
- With nothing to focus on, the eyes automatically focus on a point just slightly ahead of the eyes
- Searching out and focusing on distant light sources, no matter how dim, helps prevent the onset of empty-field myopia

**AUTOKINESIS**
- Caused by staring at a single point of light against a dark background for more than a few seconds
- After a few moments, the light appears to move on its own
- To prevent this illusion, focus the eyes on objects at varying distances and avoid fixating on one target
- Be sure to maintain a normal scan pattern

**FALSE HORIZON**
- A false horizon can occur when the natural horizon is obscured or not readily apparent
- Confusing bright stars and city lights
- While flying toward the shore of an ocean or a large lake
- Because of the relative darkness of the water, the lights along the shoreline can be mistaken for stars in the sky

**NIGHT LANDING ILLUSIONS**
- Lower-than-normal approach
  - Illusion of being too high
  - Rain, haze, or a dark runway environment
  - Above featureless terrain
  - Narrow runway
- Higher-than-normal approach
  - Illusion of being too low
  - Bright lights
  - Steep surrounding terrain
  - Wide runway

- Not landing on runways
  - Regularly spaced lights along a road or highway can appear to be runway lights
  - Pilots have even mistaken the lights on moving trains as runway or approach lights

**HEIGHT-DEPTH ILLUSIONS**
- Not able to evaluate the height of the aircraft
- Due to the lack of visual reference

**FLICKER VERTIGO**
- Caused by the flickering light
- Anticollision lights in fog or cloud
- Can cause epilepsy for certain persons
- Try a slight change in rotor RPM
- Turn off anticollision lights - 91.209
Normal-appearing approach

Over flat terrain with upsloping runway
Visual illusion of a high-altitude

Over a downsloping terrain with a flat runway
Visual illusion of a high-altitude

Over a flat terrain with a downsloping runway
Visual illusion of a low-altitude

Over an upsloping terrain with a flat runway
Visual illusion of a low-altitude
Normal-appearing approach

An unusually narrow or an unusually long runway
Visual illusion of a high-altitude

An unusually wide runway
Visual illusion of a low-altitude
DISORIENTATION - Occurs when the brain receives conflicting message from your sensory organs
- You get it mainly by loss of outside visual references
- Rely on your instruments - Artificial horizon is the best
- You are more subject to disorientation if you use the body’s signals to interpret the flight attitude
- Refer to Aeromedical Factors briefing on Spatial Disorientation for different illusions

WEATHER

CONSIDERATION - Basic VFR weather minimums (91.155) are the same as for Day VFR
- ONLY different in class G > 1,200 AGL and < 10,000 MSL where visibility must be greater than 3 SM
- During night you are not able to see clouds if overcast

PREFLIGHT - Perform preflight during day if possible or with a good flashlight after dark
- Check all the interior, instrument and panel lights
- Check the panel light dimmer
- Required for night VFR - 91.205 + POH 2-3
  - Same as for Day VFR plus
    P - Position lights
    A - Anti-collision lights
    L - Landing light
    I - Instrument lights (POH)
    S - Source of energy
    S - Spare fuses
- Flashlight with new batteries available and accessible
- All necessary equipment are accessible, charts, airport diagrams, etc.
- Extra attention on the cleanliness of the canopy

COCKPIT LIGHTS - Red cockpit lighting helps preserve night vision
- Distorts some colors and completely washes out the color red
- This makes reading an aeronautical chart difficult
- A carefully directed flashlight can enhance night reading ability
- Keep the instrument panel and interior lights turned up no higher than necessary
- This helps to see outside references more easily

ENGINE START

AND ROTOR ENGAGEMENT - Use extra caution
- Turn on position lights and anti-collision lights before starting engine
- Turn landing light momentarily on before rotor engagement
NIGHT OPERATIONS

HOVER TAXI AND AIRPORT OPS
- Hover taxi on the taxiways
- When operationing at an unfamiliar airport request “Progressive taxi”
- Hovering 5 feet over the ground
- Airport beacons, see Airport and Heliport Operations briefings
- Airport lighting, signs and markings, see Airport and Heliport Operations briefings
- Pilot operated runway lights, High (7), Medium (5), Low (3)

TAKEOFF AND CLIMB
- Make sure that the takeoff path is clear
- Takeoff from runway or taxiway
- To compensate for the lack of outside reference
  - Check altimeter and airspeed indicator to verify proper climb attitude
- In a small airport, heliport or out of airport a takeoff at night is usually an “Altitude over Airspeed”
  - This improves the obstacle clearance

INFLIGHT PROCEDURES
- Select cruising altitude higher than normal
  - More clearance between obstacles
  - More time for setup and landing if you have an engine failure
  - Radio reception is improved
- Select your course/route
  - In order to be able to reach a safe forced landing area
  - As close as possible to lighted areas, eg. town, highway, etc.

TRAFFIC PATTERNS
- Keep an extra good lookout for other traffic
- ATC might ask you to report certain legs
- In an uncontrolled airport self announce legs and intentions

APPROACH AND LANDING
- Make the approach to a lighted runway, then use the taxiway
- At night there is a tendency to make lower approaches than during day
  - It’s good practice to make steeper approaches at night
- Pay special attention to the airspeed indicator because the outside visual reference for airspeed and rate of closure may not be available
  - Be aware not to get Settling With Power conditions
CODE OF FEDERAL REGULATIONS - C.F.R.

- Title 14
- Aviation Chapter
- Subchapter D - Airmen
- Part 61
- Subpart H - Flight Instructors
- FAR 61.195
- Paragraphs [a]
- Subparagraphs (1)
- Sub-Subparagraphs (i)
- Sub-Sub-Subparagraphs (A)

NOTE: An example of all these is found in 61.195

FAR/AIM CONTENTS

Part 1 Definitions and Abbreviations
Part 43 Maintenance
Part 61 Certification
Part 67 Medial Standards and Certification
Part 71 Airspace
Part 73 Special Use Airspace
Part 91 General Operating and Flight Rules
Part 97 Standard Instrument Approach Rules
Part 119 Air Carriers and Commercial Operations
Part 133 Rotorcraft External Load Operations
Part 135 Commuter and On Demand Operations
Part 141 Pilot Schools
Part 142 Training Centers
HMR 175 Hazardous Material Regulations
NTSB 830 Reporting of Accidents and Incidents

SUGGESTED STUDY LIST

A suggested study list for the different certificates is found in the start of the FAR/AIM
PART 1

Contains definitions and abbreviations that are used throughout the FAR

PART 61

Applicability and definitions

a. This part prescribes

1. The requirements for issuing pilot, flight instructor, and ground instructor certificates and ratings; the conditions under which those certificates and ratings are necessary; and the privileges and limitations of those certificates and ratings.

2. The requirements for issuing pilot, flight instructor, and ground instructor authorizations; the conditions under which those authorizations are necessary; and the privileges and limitations of those authorizations.

3. The requirements for issuing pilot, flight instructor, and ground instructor certificates and ratings for persons who have taken courses approved by the Administrator under other parts of this chapter.

PART 91

Applicability

a. This part prescribes rules governing the operation of aircraft within the United States, including the waters within 3 nautical miles of the U.S. coast.

b. Each person operating an aircraft in the airspace overlying the waters between 3 and 12 nautical miles from the coast of the United States must comply with only specified paragraphs.

c. This part applies to each person on board an aircraft being operated under this part, unless otherwise specified.

NATIONAL TRANSPORTATION AND SAFETY BOARD REGULATIONS - NTSB PART 830

Notification and reporting of aircraft accidents or incidents and overdue aircraft, and preservation of aircraft wreckage, mail, cargo, and records.
FAR REFERENCES TO ROTORCRAFT/HELICOPTER

43.15 (b) Rotorcraft inspections

61.1 (b)[3][iii] Definitions
61.5 (b)[3], (c) Certificates and ratings issued
61.63 (b) Additional category rating
61.87 (f) Student pilot pre-solo training
61.93 (g) Solo cross-country requirements
61.98 (b)[2] Recreational pilot certificate
61.107 (3) Private pilot flight proficiency
61.109 (c) Private pilot aeronautical experience
61.127 (b)[3] Commercial pilot flight proficiency
61.129 (c) Commercial pilot aeronautical experience
61.157 (e)[4] ATP flight proficiency
61.161 ATP aeronautical experience
61.165 (a) ATP additional category and class rating
61.187 (b)[3] CFI flight proficiency
61.195 (f) CFI limitations and qualifications

91.9 Aircraft flight manual, markings, placards
91.13 Careless and reckless operation
91.103 Preflight action
91.113 Right-of-way rules
91.119 (d) Minimum safe altitudes
91.126 (b)[2] Operations in Class G airspace
91.129 (f)[2] Operations in Class D airspace
91.151 (b) VFR fuel requirements
91.155 (b)[1] VFR basic weather minimums
91.157 (b) Special VFR weather minimums
91.167 (a)[3], (b)[2][ii] IFR fuel requirements
91.169 (b)[2][ii], (c)[1][ii] IFR flight plan
91.175 (f)[3] IFR takeoff and landing minimums
91.205 (b)[17], (d)[3][ii] VFR/IFR instrument equipment requirements
91.213 (d) Inoperative instruments and equipment MEL
91.409 (c)[4], (e), (f), (g) Inspections

97.3 (d)[1], (h)[1], (o)[1] IFR approach minimums/symbols/terms

133 Rotorcraft external load operations
AIM REFERENCES TO ROTORCRAFT/HELICOPTER

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<th>Section</th>
<th>Description</th>
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<td>2-3-2 (b)</td>
<td>Airport/heliport pavement markings</td>
</tr>
<tr>
<td>2-3-6 (f)</td>
<td>Helicopter landing areas</td>
</tr>
<tr>
<td>4-1-11 (b)[2]</td>
<td>Helicopter frequencies</td>
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<tr>
<td>4-1-21 (b)</td>
<td>High density traffic airports</td>
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<td>4-2-13 (a)[2]</td>
<td>Loss of radio with control tower</td>
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<tr>
<td>4-3-2 (b)</td>
<td>Airport operation with control tower</td>
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<tr>
<td>4-3-14 (d)</td>
<td>Communication (frequency change)</td>
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<td>4-3-17</td>
<td>VFR helicopter operations at controlled airports</td>
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<td>4-4-5 (a)[3]</td>
<td>Special VFR clearances</td>
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<td>5-4-8 (a)[2]</td>
<td>Procedure turn</td>
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<td>Radar approaches</td>
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<td>5-6-4</td>
<td>Interception signals</td>
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<td>7-3-7</td>
<td>Vortex avoidance of helicopters</td>
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<td>10-1-1</td>
<td>Helicopter IFR operations</td>
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<tr>
<td>10-1-2</td>
<td>Helicopter instrument approaches</td>
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<tr>
<td>10-1-3</td>
<td>Helicopter point-in-space approach procedures</td>
</tr>
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</table>
PRACTICAL TEST STANDARDS

Are published by the FAA to establish the standards for pilot certification practical tests. Examiners shall conduct practical tests in compliance with these standards. Helpful during training and when preparing for the practical test.

- Introduction
- Additional rating matrix
- Checklist
- Task descriptions
- Completion standards

HELICOPTER FLIGHT MANUAL

Part 91 requires that pilots comply with the operating limitations specified in approved rotorcraft flight manuals, markings, and placards.

Standardized format for all rotorcraft flight manuals
Pilot’s Operating Handbook (POH) vs. Rotorcraft Flight Manual (RFM)
If POH is used as the main title it must state that the document is the FAA-Approved

An FAA-Approved Rotorcraft Flight Manual may contain as many as ten sections:
- General Information
- Operating Limitations
- Emergency Procedures
- Normal Procedures
- Performance
- Weight and Balance
- Aircraft and Systems Description
- Handling, Servicing, and Maintenance
- Supplements
- Safety and Operational Tips

GENERAL INFORMATION

- Basic descriptive information on the rotorcraft and the power plant
- There is a three-view drawing of the rotorcraft with the various dimensions
- This is a good place to quickly familiarize yourself with the aircraft
- Definitions, abbreviations, explanations of symbology, and terminology
OPERATING LIMITATIONS

- Contains only those limitations required by regulation or that are necessary for the safe operation of the rotorcraft, power plant, systems, and equipment
- Includes operating limitations, instrument markings, color coding, and basic placards
- Some areas included are: airspeed, altitude, rotor, and power plant limitations, including fuel and oil requirements; weight and loading distribution; and flight limitations

EMERGENCY PROCEDURES

- Recommended procedures for coping with various types of emergencies or critical situations
  - Emergencies covered include
  - Engine failure in a hover and at altitude
  - Tail rotor failures
  - Fires
  - Systems failures.
  - Restarting an engine
  - Ditching in the water

- To be prepared for an abnormal or emergency situation, memorize each checklist

NORMAL PROCEDURES

- Includes several checklists, which take you through the preflight inspection, before starting procedure, how to start the engine, rotor engagement, ground checks, takeoff, approach, landing, and shutdown
- To avoid skipping an important step, you should always use a checklist when one is available

PERFORMANCE

- Contains all the information required by the regulations, and any additional performance information the manufacturer feels may enhance your ability to safely operate the rotorcraft
- These charts, graphs, and tables vary in style but all contain the same basic information
  - Calibrated versus indicated airspeed conversion graph
  - Hovering ceiling versus gross weight charts
  - Height-velocity diagram
WEIGHT AND BALANCE
- Information required by the FAA that is necessary to calculate weight and balance

AIRCRAFT AND SYSTEMS DESCRIPTION
- Excellent place to study and familiarize yourself with all the systems found on your aircraft
- Should describe the systems in a manner that is understandable to most pilots

HANDLING, SERVICING, AND MAINTENANCE
- Describes the maintenance and inspections recommended by the manufacturer, as well as those required by the regulations, and Airworthiness Directive (AD) compliance procedures
- Describes preventive maintenance and ground handling procedures
ADVISORY CIRCULARS

The FAR/AIM obviously is a great source of information. Not only the regulations in the FAR but also the AIM hold a lot of very important information for pilots.

ADVISORY CIRCULARS

WHAT IS AN ADVISORY CIRCULAR
- Guidance
- Information
- Acceptable methods to comply with FAR’s

ADVISORY CIRCULAR NUMBERS
- 61 is the Part it deals with
- 65 is the sequence number
- D is the revision, i.e. revision 4

- 00-6A is a list of all AC’s produced
- 00 is used for general information not connected to a regulation
- 99 is used for flying guidance and safety

HOW TO GET ADVISORY CIRCULARS
- FAA website
- FSDO
- Subscribe to mailing list
- Private publication companies
- Government printing office - GPO

NTSB REPORTS

The NTSB has a large database with accident Investigation reports that can be a very interesting and learning experience to read.

http://www.ntsb.gov/aviation/aviation.htm

PILOT SAFETY BROCHURES

Pilot Safety Brochures are prepared for both general aviation and commercial pilots. The brochures acquaint pilots with the physiological challenges of the aviation environment so pilots are better prepared to cope with the challenges.

http://www.faa.gov/pilots/safety/pilotsafetybrochures/
THE DIFFERENCE BETWEEN A MMEL AND A MEL

A list of instruments and equipment that is allowed to be NOT working

PMMEL - Proposed Master Minimum Equipment List

- The PMMEL is the working document used as the basis for development of the MMEL
- Normally, the manufacturer proposes it during the certification process
- However, an operator of a unique type aircraft, for which an MMEL does not exist, may submit a PMMEL for FAA approval

MMEL - Master Minimum Equipment List

- Contains a list of items of equipment that may be inoperative on a specific type of aircraft
- It is also the basis of the development of an individual operator’s MEL
- Approved by the FAA

MEL - Minimum Equipment List

- The MEL is the specific inoperative equipment document for a particular make and model aircraft by serial and registration number
- A MEL consists of
  1. The MMEL for a particular type aircraft
  2. The MMEL’s preamble
  3. The procedures document
  4. Letter of Authorization
- The FAA considers the MEL as an STC
- The MEL permits operation of the aircraft under specified conditions with certain equipment inoperative
- Approved by the FSDO
OPERATIONS THAT REQUIRE A MEL 91.213

No person may take-off an aircraft with inoperative instruments or equipment installed unless it has a MEL.

Flights with inoperative instruments or equipment conducted without a MEL must:

1. Be conducted in
   - Rotorcraft without a MMEL
   - Small Rotorcraft < 12,500 lbs with a MMEL

2. Instruments or equipment are not
   - Requires by type certificate
   - Required by Aircraft Equipment List, or Operation Equipment List
   - Requires by 91.205 - SOFATACOS AND PALISS
   - Required by AD

3. The inoperative instruments or equipment is
   - Removed, placarded and recorded in maintenance log
   - Deactivated, placarded and possibly recorded in maintenance log

4. Does not constitute a hazard to the aircraft

LIMITATIONS ON OPERATIONS WITH INOPERATIVE INSTRUMENTS AND EQUIPMENT

1. With a MEL
   - Actions must be taken according to the procedures document of the MEL

2. Without a MEL
   - Removed, placarded and recorded in maintenance log
   - Deactivated, placarded and possibly recorded in maintenance log
   - Will not constitute a hazard to the aircraft

LETTER OF AUTHORIZATION

- The FSDO issues a LOA to the operator when the FSDO authorizes the operator to operate under the provisions of a MEL
- Together, the LOA, the procedures document, and the MMEL constitute a STC
- The operator must carry the STC in the aircraft during its operation
SUPPLEMENTAL TYPE CERTIFICATE

A Supplemental Type Certificate (STC) is a document issued by the FAA approving a product (aircraft, engine, or propeller) alteration. An STC is a major change in type design not great enough to require a new application for a type certificate under FAR §21.19. An example would be installation of a different engine from what was included in the original type certificate. It is the manufactures permanent approval of a part to be installed on all aircraft of the same type.

SPECIAL FLIGHT PERMIT

Special flight permit may be issued for an aircraft that may not currently meet applicable airworthiness requirements, but is capable of safe flight, for the following purposes:

1. Flying aircraft to a point for repairs, alterations, maintenance, or storage.
2. Delivering new aircraft to the base of a purchaser or to a storage point.
3. Conducting production flight tests.
4. Evacuating an aircraft from impending danger.
5. Conducting customer demonstration flights in new production aircraft that have passed or completed production flight tests.
7. The special flight permit does not authorize flight over a country other than the United States without permission of that country.

91.213 (e): “Notwithstanding any other provisions oh this section, an aircraft with inoperable instruments or equipment may be operated under a special flight permit issued under in accordance with §21.197 and §21.199 of this chapter.”

The process for obtaining a special flight permit is highly dependent on your circumstances. You should contact your local FAA Flight Standards District Office (FSDO) or Manufacturing Inspection District Office (MIDO) to determine the requirements for your particular circumstances.

DEFERRING MAINTENANCE

1. Postponement of the repair or replacement of an item of equipment or an instrument
2. When the aircraft is due for inspection in accordance with FAR, the operator should have all inoperative items repaired or replaced
3. If an operator does not want specific inoperative equipment repaired, then:
   - Maintenance must check that it conforms to the requirements of 91.213(d)
   - Effects of permanent removal should be assessed
   - Maintenance must furnish operator with a list of discrepancies not repaired
   - Maintenance must ensure items are placarded appropriately
THINKING PROCESS WHEN WORKING WITH INOPERABLE INSTRUMENTS AND EQUIPMENT

- FAR 91.213 - Inoperative instruments and equipment.
- AC 91-67 - Minimum Equipment Requirements for General Aviation Operations
BASIC VFR WEATHER MINIMUMS

<table>
<thead>
<tr>
<th>Class</th>
<th>Altitudes</th>
<th>Flight Visibility</th>
<th>Cloud Clearance</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>&gt; 18,000 MSL</td>
<td>IFR</td>
<td>IFR</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td>3</td>
<td>Clear of clouds</td>
</tr>
<tr>
<td>C</td>
<td>&lt; 10,000 MSL</td>
<td>3</td>
<td>5 - 10 - 20</td>
</tr>
<tr>
<td>D</td>
<td>≥ 10,000 MSL</td>
<td>5</td>
<td>1 - 1 - 1</td>
</tr>
<tr>
<td>E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>&lt; 1,200 AGL (Helicopters)</td>
<td>See and avoid</td>
<td>Clear of clouds</td>
</tr>
<tr>
<td></td>
<td>≥ 1,200 AGL &lt; 10,000 MSL (Day)</td>
<td>1</td>
<td>5 - 10 - 20</td>
</tr>
<tr>
<td></td>
<td>≥ 1,200 AGL &lt; 10,000 MSL (Night)</td>
<td>3</td>
<td>5 - 10 - 20</td>
</tr>
<tr>
<td></td>
<td>≥ 1,200 AGL ≥ 10,000 MSL</td>
<td>5</td>
<td>1 - 1 - 1</td>
</tr>
</tbody>
</table>

AIRSPACE CLASSES

Class A - From 18,000 MSL to FL 600  
- IFR only  
- Flight plan required

Class B - From surface to 10,000 MSL  
- Individually designed for each class B  
- Minimum PPL (w/ exceptions) to enter  
- Mode C transponder within 30 nautical miles radius  
- Need clearance to enter

Class C - 5 nm radius core surface area, from surface to 4,000 AGL  
- 10 nm radius shelf area, from 1,200 to 4,000 AGL  
- 20 nm radius outer area, pilot participation optional and radar service available  
- Mode C transponder  
- Two-way radio communication required

Class D - From surface to 2,500 AGL  
- Lateral limits vary  
- Two-way radio communication required

Class E - From surface, 700 AGL, 1,200 AGL, or 14,500 MSL  
- Radio communications not required but encouraged

Class G - Uncontrolled airspace  
- From surface to 700 AGL, 1,200 AGL, or 14,500 MSL  
- Radio communications not required but encouraged
SPECIAL USE AIRSPACE

Regulatory

Prohibited area
- Flight is not permitted without authorization of the using agency
- Established for security or other reasons associated with national welfare
- Pentagon, The White House, etc.

Restricted area
- Flight is not permitted without the advance permission of the controlling agency (FAA facility) or the using agency [military command]
- Contains invisible hazards such as artillery firing, aerial gunnery, guided missiles

Non-regulatory

Warning area
- Airspace of defined dimensions extending 3 nm from the coast
- Contains activities that may be hazardous to aircraft
- Warning areas exist to warn pilots to potential danger
- Flight is permitted

Military Operations Area
- Airspace of defined lateral and vertical limits
- Established to separate military training activities from IFR flight
- Aircraft in this area will be performing abrupt or acrobatic maneuvers
- If IFR separation can be provided be ATC traffic will be routed through a MOA
- If not it will be routed around the area
- VFR traffic should exercise extreme caution
- Pilots should contact FAA within 100 nm radius to ascertain the status

Alert Area
- Contains a high volume of training activities or unusual activities
- Pilots should be alert when flying in these areas

Controlled Firing Area
- Activities that may be hazardous to aircraft if not conducted in a controlled environment
- Activities are suspended when spotter aircraft, radar or observers indicate an aircraft might be approaching the area
- They are not depicted on charts
OTHER AIRSPACE AREAS

Military Training Routes
- Military aircraft conduction low-level, high-speed training
- Flight is not prohibited within an MTR
- Extreme vigilance should be exercised when operating through or near an MTR
- < 1,500 AGL; VR1206 or IR 1207
- > 1,500 AGL; VR206 or IR 207
- Pilots should contact FAA within 100 nm radius to ascertain the usage

Temporary Flight Restrictions
- Issued due to a specific hazard in order to protect persons or property on the surface or in the air
- To provide a safer environment for the operation of disaster relief aircraft
- To prevent congestion of sightseeing aircraft over an incident that may generate high degree of public interest
- May be used for the presidential party
- A NOTAM will be issued to advise pilots of a TFR in effect
- Certain exceptions apply to IFR traffic and VFR traffic operating to or from an airport within the TFR where weather or terrain mean rerouting is impracticable and the flight does not endanger rescue operations or is not for the purpose of sightseeing
- ENG aircraft with permission may also operate in a TFR area when a flight plan is filed with the appropriate FSS or ATC

National Security Area
- Areas where increased security and safety of ground facilities is required
- Pilots are requested to voluntarily avoid flying through these areas
SPECIAL VFR

A special VFR clearance enables you to fly with a lower than VMC minima. You can only get special VFR in controlled airspace that extends from the surface. With special VFR a helicopter can fly with “see and avoid and clear of clouds”.

ATC can’t offer this service - the pilot has to request it!

---

FLIGHT FOLLOWING

- Orlando Approach, Helicopter 2044D
- Helicopter 2044D, Orlando Approach, Go-ahead
- Helicopter 2044D, 8 miles to the west of Space Coast Regional, Routing to Orlando Executive, Request VFR Flight Following

- No Flight Plan is needed for this service
NO EXPERIENCE

REQUIRED DOCUMENTS

1. Medical 61.23 (a)
   Appropriate type for rating, HAI must be 2nd class

2. Student pilot certificate 61.19 (b)
   Valid for 24 calendar months

NOTE: The yellow paper has the medical on the front and the SPC on the back

HOW TO GET A NEW SPC

1. New medical

2. Flight Standards District Office - FSDO
   Fill out 8710

3. Designated Pilot Examiner - DPE
   Fill out 8710

NOTE: A part time student that takes more than 24 calendar months will need a new SPC

FIRST SOLO

REF: 61.87 Solo requirements for student pilots, AC 61.65 Instructor endorsements

1. Pre-solo knowledge test endorsement 61.87 (b)
   Endorsement is not required but recommended - AC 61.65
   Maneuvers must be logged before sending students solo - 61.87 (f)

2. Log maneuvers and procedures 61.87 (f)

3. Student pilot certificate endorsement 61.87 (n) (1)
   Specific make and model, One time endorsement

4. Logbook endorsement 61.87 (n) (2)
   Specific make and model, Expires every 90 days. Is only good in the local area
   MUST include weather limitations; Ceiling, Wind, Visibility

5. Takeoffs and landings at other airport within 25 NM 61.93 (b) (1)
   Only if required
SOLO CROSS-COUNTRY

REF: 61.93 Solo cross-country flight requirements, AC 61.65 Instructor endorsements

1. Log maneuvers and procedures 61.93 (g)
2. Student pilot certificate endorsement 61.93 (c) (1)
   Specific make and model, One time endorsement
3. Logbook endorsement 61.93 (c) (2) (i)
   Specific make and model, One time endorsement
4. Planning and preparation endorsement 61.93 (c) (2) (ii)
   For each cross-country flight, Can be given by any instructor
   Instructor must check planning, weather, endorsements - 61.93 (d)
5. Repeated solo cross-country endorsement 61.93 (b) (2)
   Less than 50 NM, Must have flown with student both directions incl. entry/exit to pattern

CLASS B AIRSPACE

REF: 61.95 Operations in Class B airspace and at airport located within Class B airspace

1. Student pilot must receive training on specific airspace 61.95 (a) (1)
2. Training endorsement 61.95 (a) (2)
   Valid for 90 days only, Only valid for flying through the airspace

CLASS B AIRPORT

REF: 61.95 Operations in Class B airspace and at airport located within Class B airspace

1. Student pilot must receive training at that specific airport 61.95 (a) (1)
2. Training endorsement 61.95 (a) (2)
   Valid for 90 days only, Only valid to/from the specified airport

NOTE: Solo students are not permitted in certain locations, the Dirty Dozen
91.131 (b) (2) or AIM 3-2-3
PRIVATE PILOT CHECK RIDE

REF:  61.39 Prerequisites for practical test, 61.103 Eligibility requirements

1. Knowledge test endorsement   61.103 (d)
2. Knowledge test deficiency endorsement   61.39 (a) (6) (iii)
3. Log areas of operation   61.107 (b) (3)
4. 60 days training endorsement   61.39 (a) (6) (i)
   3 hours of flight training with preceding 60 days - 61.109 (c) (3)
5. Practical test endorsement   61.103 (f)
6. 8710

INSTRUMENT RATING CHECK RIDE

REF:  61.39 Prerequisites for practical test, 61.65 Instrument rating requirements

1. Knowledge test endorsement   61.65 (a) (4)
2. Knowledge test deficiency endorsement   61.39 (a) (6) (iii)
3. Log areas of operation   61.65 (a) (5)
4. 60 days training endorsement   61.39 (a) (6) (i)
   3 hours of flight training with preceding 60 days - 61.65 (d) (2) (ii)
5. Practical test endorsement   61.65 (a) (6)
6. 8710
COMMERCIAL PILOT CHECK RIDE

REF: 61.39 Prerequisites for practical test, 61.123 Eligibility requirements

1. Knowledge test endorsement 61.123 (c)
2. Knowledge test deficiency endorsement 61.39 (a) (6) (iii)
3. Log areas of operation 61.127 (b) (3)
4. 60 days training endorsement 61.39 (a) (6) (i)
   3 hours of flight training with preceding 60 days - 61.129 (c) (3) (iv)
5. Practical test endorsement 61.123 (e)
6. 8710

CERTIFIED FLIGHT INSTRUCTOR CHECK RIDE

REF: 61.39 Prerequisites for practical test, 61.183 Eligibility requirements

1. Aeronautical knowledge endorsement 61.183 (d)
   Fundamentals of Instruction, Needed for check-ride but not to take the written test
2. Knowledge test deficiency endorsements 61.39 (a) (6) (iii)
   For BOTH Fundamentals of Instruction and Aeronautical Knowledge
3. Log areas of operation 61.187 (b) (3)
4. 60 days training endorsement 61.39 (a) (6) (i)
5. Practical test endorsement 61.187 (a)
6. 8710
ADD-ONS FOR RATED PILOTS

REF: 61.39 Prerequisites for practical test, 61.63 Additional aircraft ratings

- Rated pilots are not student pilots so 61 Subpart C does not apply
- No pre-solo knowledge test is required but recommended
- Need not to take an additional knowledge test 61.63 (b) [5]

1. PIC Endorsement 61.31 (d) [3]
   No pre-solo or solo cross-country endorsement required, You can give weather limitations

2. Ground and flight proficiency endorsement 61.63 (b) [2] [3]

3. 60 days training endorsement 61.39 [a] [6] [i]

4. Practical test endorsement 61.39 [a] [6] [ii]

5. 8710

A rated in single-engine airplanes, who wants to earn add a rotorcraft-helicopter rating to his commercial certificate. He has a commercial certificate, so he’s already a certificated pilot in the eyes of the FAA. What that means to you, the instructor, is that your student is an ‘airman seeking a rating in another category and class of aircraft,’ which is an important distinction. This also changes which endorsements you’ll use as compared to an initial private pilot applicant.

Legally, this endorsement is all-encompassing. As a certificated pilot without a rotorcraft-helicopter rating, your student could use this endorsement to fly solo PIC anywhere he/she wants, anytime. There is only one restriction: he cannot carry passengers. It is therefore up to you to add restrictions to your endorsements, expirations, and so on. For example:

Restrictions: Ceiling/visibility must be at least 3000 feet AGL and 8SM; winds <10kts; no solo flight after civil sunset; no solo without express prior approval from instructor [your name here]; no solo to any airport other than [airport name, airport name]; must remain within 25nm of departure airport unless specifically authorized. This endorsement expires [date].

Instructors and DPE’s have indicated that the FAA’s interpretation of which endorsements are required for instances such as those indicated above will vary from inspector to inspector, and FSDO to FSDO. Furthermore, the FAA grants itself the right to interpret the FAR’s as it sees fit, so there are no strict answers to many regulation-oriented questions. As such, it may be advisable to provide all endorsements to each applicant regardless of which are legally required - for example, solo cross country endorsements to certificated pilots who are not yet rated in helicopters. One can envision a scenario in which a student is ramp-checked at a remote airport and is found not to have the appropriate endorsements [in the eyes of the FAA safety inspector.] This is a decision that is subject to the discretion of the individual instructor.
RETESTING AFTER FAILURES

REF: 61.49 Retesting after failures

1. Give additional training 61.49 (a) (1)
2. Additional training endorsement 61.49 (a) (2)
3. 8710
   If flight only

ROBINSON R22/R44 - SFAR 73

REF: SFAR No. 73 to Part 61 Robinson R-22 / R-44 Special Training and Experience Requirements

MANIPULATE THE CONTROLS IN R-22

1. Awareness training
2. Endorsement
   No solo allowed, One time endorsement

ACT AS PILOT IN COMMAND IN R-22

1. 200 hours total, 50 in R-22

Or

1. 10 hours dual training
   You can log PIC during training - 61.51, but you need SFAR endorsement
2. Endorsement
   Valid for 12 calendar months after which a flight review must be completed

INSTRUCTION IN R-22

1. Awareness training
2. 200 hours total, 50 in R-22
3. SFAR check-out with DPE or FAA
4. SFAR check-out endorsement
FOREIGN LICENCES

REF: 61.75 Private pilot certificate issued on basis of a foreign pilot license

APPLICATION PROCESS

- Application for a FAA private based on a foreign license to FSDO
- FAA will send paperwork to contracting state
  4-6 weeks before you will receive FAA license with restrictions

THINGS TO BE AWARE OF

- ICAO license must be valid
- You need both US medical and contracting state medical
- Must do a flight review before going solo
- Type rating in US is not required
- Your FAA license will be restricted
  Any contracting state restrictions apply to the FAA license
  No night if a JAA private

LETTER OF AUTHORIZATION

- The letter of authorization is valid for 6 months only
- Must bring valid letter of authorization for check-ride
- ICAO license must be valid

NO NIGHT ON JAA PPL

- You need to train and give PIC endorsement for night flying 61.31

HOW TO GET RID OF RESTRICTIONS

- Take private check-ride
- Take commercial check-ride
- Previous flight time will count
- Bring charts to proof previous cross-country flights
PILOT LOGBOOKS 61.51

Each person must document and record the following time in a manner acceptable to the Administrator:

1. Requirements for a certificate, rating or flight review
2. Requirements to meet recent flight experience

FLIGHT REVIEW 61.56

REF: 61.56 Flight review, AC 61-98A

Must consist of 1 hour of flight training and 1 hour of ground training and be done within the preceding 24 calendar months

1. Review of current general operating and flight rules
2. Review of maneuvers and procedures to demonstrate safe exercise of the certificate
3. Endorsement when satisfied with performance

NOTE: Use PTS to know which standards or refer to Appendix 2 of AC 61-98A
If the flight is bad, just log it as a dual flight

RECENT FLIGHT EXPERIENCE: PILOT IN COMMAND 61.57

Three takeoffs and three landings within the preceding 90 days

Night take-off and landing experience

Three take-offs and three landings within the preceding 90 days
Must be completed 1 hour after sunset to one hour before sunrise
Landings must be to a full stop

A flight for night flight experience will count as day flight experience, but not visa versa
This is not actually written in the regulations

DAY/NIGHT

<table>
<thead>
<tr>
<th>SUNSET</th>
<th>POSITION LIGHTS</th>
<th>SUNRISE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIVIL EVENING TWILIGHT</td>
<td>LOG NIGHT</td>
<td>CIVIL MORNING TWILIGHT</td>
</tr>
<tr>
<td>SUNSET + 1 HR</td>
<td>CURRENCY</td>
<td>SUNRISE - 1 HR</td>
</tr>
</tbody>
</table>

If you are not night current you can fly up to 59 min after sunset and still log part of it as night, but it will not count towards night currency. In the logbook remember to specify how many take-offs and landings that are made in the currency period.