# HUMAN FACTORS

https://www.youtube.com/watch?v=xK44nFczulo

# Physical factors

**General Health-** Must be in good health: colds, indigestion, nausea, worry, lack of sleep is not conductive to safe flying.

**Hypoxia- Lack of sufficient oxygen.**
**There are four types of hypoxia:**

1. **Hypoxic hypoxia-**high altitude, less oxygen, avoided by use of on board oxygen
2. **Anaemic hypoxia-** caused by an over abundance of carbon monoxide in the hemoglobin.
3. **Stagnant hypoxia-** brain is deprived of blood supply, for example, high G-load.
4. **Histotoxic hypoxia-** is caused by chemical poisoning, for example, high blood alcohol.

# Effects at different heights

- 5,000 feet first hypoxia effects: poor night vision. Typical commercial jet cabin altitude is 6000+ feet…
- 10,000 feet , definite  hypoxia. Highest level continuously allowed for pilots, judgement, ability degraded.
- 14,000 feet, lassitude and indifference are appreciable. Dimming of vision, hand tremor, clouding of thought, poor memory and judgement. Cyanosis, blue discoloring of fingernails, starts.
- 16,000 feet, may be disoriented, belligerent, euphoric, poor judgement.
- 18,000 feet, primary shock may set in, may lose consciousness.  Non-smokers in good health can last longer than old, sick smokers.  Half the atmosphere below, half the oxygen.
- 18k+ death may result after a prolonged period.  But people climb Mount Everest 29,029 feet, without oxygen, so varies with individuals.
- CARs: maximum 30 minutes between 10,000 and 13,000 feet, 13,000+ feet oxygen readily available for each crew member.

**Symptoms of ozone sickness are:**

1. Hacking cough
2. Poor night vision
3. Shortness of breath
4. Headache
5. Burning eyes, mouth and nose
6. Mild chest pains
7. Leg cramps
8. Fatigue
9. Drowsiness
10. Nose bleed
11. Nausea and vomiting

Ozone is a bluish gas that exists in relatively high concentrations in the upper levels of the atmosphere. Any flight operating above 35,000 feet is likely to come into contact with ozone at some time.

# Carbon Monoxide

Colourless, odorless and tasteless. Even the smallest amounts of carbon monoxide can seriously interfere with the distribution of oxygen and produce anemic hypoxia. It can take several days to rid the body of carbon monoxide.

# Cigarettes

Cigarette smoke contains a minute amount of carbon monoxide. A heavy smoker will lower his ceiling by more than 4,000 feet.

# hyperventilation

Is an increase in respiration that upsets the natural balance of oxygen and carbon dioxide in the system.

**The most common symptoms are:**

1. Dizziness
2. Tingling of the toes and fingers
3. Hot and cold sensations
4. Nausea
5. Sleepiness

The early symptoms of hyperventilation an hypoxia are similar may be confused. Both conditions can occur at the same time. A pilot flying at high altitude, may think that they can counteract the effects of hypoxia by taking more rapid breaths. Hyperventilation does not help you get more oxygen.

# Decompressive sickness

**Trapped gases-** because of the change in barometric pressure during ascent and descent, gases trapped in certain body cavities expand or contract. The inability to pass this gas may cause the following:

1. Abdominal pain
2. Toothache
3. Pain in ears
4. Pain in sinus cavities

Certain conditions predispose to the development of decompressive sickness. It is more common in the ederly and in females and in people who are inactive. Obese, overweight persons are more susceptible to it as fatty tissue contains more nitrogen.

# Suba Diving & Flying

- A person that flies in an aircraft immediately after engaging in the sport of scuba diving risks severe decompressive sickness at much lower altitudes than would normally be expected from this problem.
- A good rule, if you have dived to a depth below 30 feet, is not to fly for 24 hours to permit the nitrogen content of the body to return to normal.

# Circadian Rhythm

- Normal sleep wake cycles.
- Takes 1 day per time zone to recover.
- Don’t sleep during the day.

# Vision

- At night the pilot's vison is greatly impaired. The cones that are concentrated in the center of the eye need a lot of light to function properly. As a result, there is a blind spot in the center of the eye at night. This blind spot is sufficiently large to block out the view of another aircraft some distance away if the pilot is looking directly at it. At night it is necessary to develop the technique of using peripheral vision. You must look off center at about 15 to 20 degrees. Night vision is also sensitive to hypoxia. Supplementary oxygen should be used above 5,000 feet to avoid depriving the eye of oxygen. Dirt and reflection on the windshield cause confusion at night. A very clean windshield is important. Don't use a yellow or pink highlighter on flight charts as it does not show up in the red cockpit lighting. Use Blue highlighter.
- **Depth perception-** clues for accurate depth perception re often absent in the air. Clouds are of varying size and there is no way to estimate their distance. Landings on glassy water or on wet runways are a problem as in the condition known as white out that occurs in blowing snow and other winter situations.
- **Thunderstorms-** The blinding flashes destroy night adaption. Turn the cockpit lights full bright if you are in the vicinity of lightning activity in order to prevent lightning blindness.
- **Anti collision lights-** when flying in clouds, strobe lights and rotating beacons should be turned off as the reflection off the cloud of the blinking

# Noise

- Sound is measured in decibels (dB). The zero level is defined as the weakest sound that can be heard by a person with good hearing in a quiet location. The loudest sound that most people can hear is 140 dB. High levels cause pain or nausea. Noise levels approaching these levels should not be experienced without ear protection. In fact ear protection should be used for continuous noise levels above 80 dB.

# Vibration

- Vibration is responsible for fatigue and irritability an can even cause chest and abdominal pains, backache, headaches, eyestrain and muscular tension.  If the vibration happens to occur in the frequency of about 40 cycles per second, blurring of the eyes may occur. It is even possible to become hypnotized as a result of rhythmic and monotonous vibrations.
- Vibration can rarely be completely controlled but it can be dampened by placing a barrier between the pilot and the source to reduce the effect. Dampening can also be accomplished by reducing the source of the vibration or by modifying the transmission pathway.

# Temperature

- At temperatures over 30˚, discomfort, irritability and loss of efficiency are pronounced. High temperatures also reduce the pilot's tolerance to mental and physical stresses, such as acceleration and hypoxia.
- **Hypothermia-** can attack a pilot in the aircraft cockpit if there is no cabin heating system and if they are not adequately dressed to protect against very cold ambient temperatures.
- **Hyperthermia-** Occurs when the body is unable to dissipate heat either through radiation or by sweating. If the body core temperature rises above 41˚ c, thermostatic control is mostly lost.

# Sensory illusions

- **Kinaesthetic sensors-** centrifugal force directed outward and the pull of gravity combined give illusion of level flight.

  Acceleration- illusion of climbing / Deceleration- illusion of diving

- **Autokinetic phenomenon-** Depth perception.
- **Spatial disorientation** means loss of bearings or confusion concerning one's sense of position or movement in relation to the surface of the earth.
- **Coriolis effect** is probably the most dangerous type of disorientation. The three semicircular canals of the inner ear are interconnected. If movement is occasioned in two of them, the sympathetic but more violent movement is induced in the third. This is known as tumbling and causes extreme confusion, nausea, and even rolling of the eyeballs that prevents the pilot from correctly reading instruments. This situation can occur if the aircraft is in a turn. The pilot suddenly turns his head in another direction.

# Sensory Illusions

**There are three situations in which Somatogravic- false climb illusion may occur:**

1. Take-off at night or in IFR conditions.
2. An overshoot in reduced visibility or in IFR conditions.
3. A climb from VFR into IFR conditions.

**Black hole illusion-** darkness, absence of visual cues and few ground lights combine to induce false perception of altitude and/or attitude. Even the most experienced pilots may visually overestimate altitude and fly too low with the risk of landing short of the runway.

# Alcohol and drugs

- It takes bout 3 hours for the effects of 1 ounce of alcohol to wear off.
- Alcohol is absorbed into the fluid of the inner ear and stays there after it has gone from the blood and brain. The presence of alcohol in the middle ear can be responsible for incorrect balance information and possibly spatial disorientation.
- The effects of one drink are magnified 2 to 3 times in flight over the effects the same drink would have at sea level.
- The Canadian aviation regulations require that a pilot allow at least 8 hours between the consumption of alcohol and piloting an aircraft.
- **Antihistamines**- do not pilot an aircraft within 24 hours of taking an antihistamine.
- **Sulpha drugs-** Remain off flying for 48 hours.
- Any use of illicit drugs is incompatible with air safety.
- Pilots are subject to random drug testing and the presence of a illicit drug, even if taken unknowingly, may result in immediate grounding and loss of job.
- It is recommended to wait at least 48 hours after donating blood.

# Fatigue

- One of the most common physiological problems for air crew members and will adversely affect individuals who are otherwise in good health.
- The biggest danger of fatigue is that the individual may not recognise its effects.

**Some symptoms of fatigue are:**

1. Deterioration in timing of movements
2. Irritability
3. Lack of patience
4. A tendency to lock the attention of individual instruments rather than to see the instrument panel as a whole
5. Tendency to become forgetful and ignorant of relevant cues
6. A tendency to overcontrol the aircraft
7. An awareness of physical discomforts

# Pregnancy

- Providing the pregnancy is normal and without complications, pilots may continue to fly up to 30 weeks into the pregnancy.
- In the first trimester, nausea is common and may be worsened by motion, engine fumes and G forces.
- In the Second trimester, anemia is common and may effect the pilot's susceptibility to hypoxia.
- After 30 weeks , the fetus may be subject to seat belt injury, and cosmic radiation.

# Eating

- You should be eating three nutritious meals a day, starting with a good breakfast. Note that a doughnut and cup of coffee is not a substitute for a breakfast or lunch.
- At altitudes above 5,000 feet ASL, the body experiences a higher loss of water through the surface area of the lungs than it does at sea level.

# Stresses

There are many factors that contribute to stress in the cockpit. They are generally classified into three categories:

1. **Physical-** includes extreme temperature and humidity, noise, vibration, lack of oxygen.
2. **Physiological-** includes fatigue, poor physical condition, hunger, disease.
3. **Psychological-** Relates to emotional factors such as a death or illness in the family, business worries, poor interpersonal relationships with family of boss, financial worries, etc.

As a pilot it is essential to recognize when stress levels are getting too high.

**Panic-** the best way to prevent panic is through training and frequent rehearsal of emergency techniques. A pilot who knows their emergency routines so well that they are automatic and will be less likely to panic when faced with real emergency situation.

# Physical fitness

Maintaining physical fitness is of prime importance for Pilot's. Persons who are physically active, participating in a regular routine of exercise or sports, will most likely have a healthy heart, lungs, and not be overweight. Diet is important, not only to keep weight at an acceptable level but also in the control of heart disease.

- Aeronautical knowledge, skill and judgement have been considered the three essential faculties that pilots must possess to be professional in the execution of their duties.
- Pilot judgement is the process of recognizing and analyzing all available information about oneself, the aircraft and the flying environment, followed by the rational evaluation of alternatives to implement a timely decision which maximizes safety. Pilot judgement thus involves one's attitudes toward risk-taking and one's ability to evaluate risks and make decisions based upon one's knowledge, skills and experience. A judgement decision always involves a problem or choice, an unknown element, a time constraint, and stress.
- The causal factor in about 80% to 85% of civil aviation accidents is the human element, in other words, pilot error, a poor decision or a series of poor decisions made by the pilot-in-command.

# Pilot Decision Making

# Pilot Decision Making

**DECIDE** acronym was developed to assist a pilot in the decision making process.

**D-** detect change

**E-** estimate the significance of the change

**C-** Choose the outcome objective

**I-** identify plausible action options

**D-** do the best action

**E-** evaluate the progress

# The Process

- Pilot decision making is a process. There must, be situational awareness, which means you need to determine everything you can about a flying situation and assess whether the information is important. Establish various courses of action. Give yourself as many options as possible and consider the likely outcome of each. Now choose what action to take and do it before time runs out. Then you must act and carry out your decision with all your skill.  Monitor the results of your action to be sure you are getting the desired outcome. The evaluation of the results is in effect re-evaluating the whole situation and beginning the process again.

# Attitude

- Your ability to make good decisions depends to great extent on your attitude. They can be developed through training into a mental framework that encourages good pilot decision making. The training program is based on recognition of five hazardous attitudes.

1. **Anti-authority**- this attitude is common to those who do not like anyone telling them what to do
2. **Resignation-** some people do not see themselves as making a great deal of difference in what happens to them and will go along with anything that happens.
3. **Impulsivity-** some people need to do something, anything, immediately without stopping to think about what is the best action to take.
4. **Invulnerability-** many people feel that accidents happen to other people but never to themselves. Pilots who think like this are more likely to take unwise risks.
5. **Macho-** people who need to always prove they are better than anyone else and take risks to prove themselves and impress others.

# Human Factors

- The human factor is the most flexible, adaptable and valuable part of the aviation system, but it is also the most vulnerable to influences which can adversely affect its performance.
- Optimizing the role of people in the aviation environment involves all aspects of human performance and behaviour; decision making, the design of displays and controls and the cabin layout, and even the design aircraft operating manuals, checklists and computer software.

# THE END