



MODEULE 3:

HUMAN FACTORS

OBJECTIVE:

The participant will be able to describe the factors that can affect pilot decision-making.

TRAINING TIME:

60 Minutes

KEY TEACHING POINTS:

Physical Factors
Physiological factors
Psychological factors
Organizational Factors
Cultural Factors
Communications
Factors affecting judgment
Countermeasures
Case Study

[Slide #1 at opening]

LINK

As we have just seen, the pilot decision-making process is fraught with challenges. But there are many other factors that can wreak havoc with the pilot's ability to make optimal decisions.

AIM

The purpose of this module is to become acquainted with the factors that affect the pilot decision-making process and develop appropriate countermeasures.

MOTIVATION

The factors we are about to explore may cause physical, emotional or psychological effects. The ensuing stress will affect the pilot's ability to make decisions. Knowledge of these factors will help us develop appropriate countermeasures to offset their effects.

[Slide # 2]

OUTLINE

1. Physical factors
2. Physiological factors
3. Psychological factors
4. Organizational factors
5. Cultural Factors
6. Communications factors
7. Factors affecting judgment
8. Countermeasures



[Slide #3]

1. Physical Factors

Human Factors for Aviation—Basic Handbook, page 43

Physical means what the body is subjected to i.e. external influences.

In this respect, physical factors include:

[Slide # 4]

- Environment
- Climate
- Temperature
- Time
- Air quality
- Noise, vibration, turbulence
- Ergonomics

Environment is the entire set of conditions under which the pilot will operate an aircraft and be able to accomplish the work, both on the ground and in the air. It includes natural, social and cultural variables, such as operating in a remote community or outpost.

Climate. Climatic conditions have similar effects as the environment.

Temperature. Canada experiences great temperature variations. The human body works best within a certain range. Extreme heat or cold can cause stress, which, in turn, can hinder the decision-making process.

Time. Pilots often find themselves working under time constraints and limits.

Human Factors for Aviation—Advanced Handbook, page 62

Air quality has numerous dimensions:

- Haze or mist reduces visibility.
- Fumes, vapour, gas, or smoke can be irritating, harmful or strong and may cause impairment of decision-making skills.
- Odours can be offensive, causing discomfort that may interfere with the decision-making process
- Carbon monoxide is a colourless, odourless gas generated by the combustion of common fuels with an insufficient supply of air or where combustion is incomplete
- Called the *silent killer*, carbon monoxide poisoning may occur suddenly and without warning.

Noise, vibration and turbulence. Sustained noise or vibration causes fatigue and stress and, therefore, affects decision making while turbulence may generate anxiety or fear.



Ergonomics. Two ergonomic issues may play a role in the pilot’s ability to make good decisions: system design and automation.

While some badly designed cockpits and controls may be a nuisance, some may be hazardous especially those that cause pilots to make errors.

The advent of automated systems has also contributed to pilot error. While there is no denying the usefulness of such systems, they have introduced a new set of error-producing conditions. These include:

- Changed workload
- Changed risks
- Mental Workload
- Head in the cockpit
- Over reliance

[Slide # 5]

2. Physiological Factors

Physiological means the study of organisms.

[Slide # 6]

In this respect, physiological factors that affect pilot decision-making include:

- Hypoxia
- Carbon monoxide (CO)
- Fatigue
- Diet
- Use of stimulants
- Exercise (lifestyle)

Human Factors for Aviation—Basic Handbook, Chapter 5
Human Factors for Aviation—Advanced Handbook, Chapter

Hypoxia. All body tissues need oxygen. The respiratory system supplies the body with oxygen. The air is composed of 21% oxygen.

[Slide # 7]

Human Factors for Aviation—Advanced Handbook page 62

Hypoxia is what occurs when there is not enough oxygen in the lungs or the lungs cannot transfer sufficient oxygen to the bloodstream. There 4 types of hypoxia:

- Hypoxic Hypoxia—effects of altitude
- Anemic Hypoxia—overabundance of carbon monoxide in the hemoglobin
- Stagnant Hypoxia—the brain is deprived of an adequate blood supply
- Histotoxic Hypoxia—chemical poisoning and high blood alcohol

Human Factors for Aviation—Advanced Handbook, page 62

Time of useful consciousness

[Slide # 8]

The most common measure of the effects of hypoxia is “time of useful consciousness” (TUC) – the time you have to function competently without supplemental oxygen. As altitude increases, your ability to perform declines rapidly. Hypoxia is widely viewed as the cause of golfer Payne Stewart’s death in a Learjet on Oct. 25, 1999, in South Dakota.

The effects of hypoxia vary depending on a person’s physical activity – the more active at altitude, the shorter the TUC – and whether he or she is a smoker. Smokers always have shorter TUC.



To counteract hypoxia, use of supplemental oxygen is required.

[Slide # 9]

Carbon monoxide (CO) is a colourless and odourless gas generated by the combustion of fuels with an insufficient supply of air or where combustion is incomplete. It is often released by accident, by improper maintenance or adjustment of burners or flues in confined spaces, or by internal combustion engines. Called the *silent killer*, CO poisoning may occur suddenly and without warning.

[Slide # 10]

Human Factors for Aviation—Advanced Handbook page 53

Fatigue is one of the conditions most frequently cited as a contributing factor in aviation accidents.

There are two types of fatigue:

- Acute – (short-term) fatigue caused by intense mental or physical activity; and
- Chronic – (long-term) fatigue which results from many episodes of acute fatigue combined with other factors such as stress, jet lag, or insufficient sleep over many days (sleep deficit).

Fatigue impairs the pilot from functioning at optimum levels. The most important countermeasure to fatigue is to not fly and acquire sufficient sleep.

Human Factors for Aviation—Basic Handbook, page 51

Diet. Carbohydrates (sugars and starches) are the body's main dietary sources of glucose. During digestion, the glucose is absorbed into the bloodstream (hence the term *blood sugar*), which carries it to every cell in the body.

Hypoglycemia and hyperglycemia

Glucose, a form of sugar, is the body's main fuel.

Hypoglycemia, or low blood sugar, occurs when the blood levels of glucose drop too low to fuel the body's activity.

[Slide # 11]

Some warning signs of low blood sugar are:

- Shakiness;
- Sweatiness;
- Irritability/anxiety;
- Difficulty in speaking;
- Headache;
- Weakness;
- Numbness/tingling around lips;
- Inability to think straight;
- Palpitations; and
- Hunger.

[Slide # 12]

Uncorrected low blood sugar could result in:

- Incapacitation;
- Fainting;
- Seizure; and
- Coma.

Low blood sugar can occur when you skip a meal, change your usual meal times, do not eat enough food, exercise more or are more active than usual (without eating extra food).



Hypoglycemia prevention:

- Don't skip meals;
- Eat at your usual meal times;
- Eat enough; and
- If you exercise or are more active than usual, eat extra food.

Tips: Know the warning signs of low blood sugar. Always carry emergency sugar source/foods with you. Low blood sugar can happen quickly, and you need to act quickly to correct it.

Hyperglycemia, the opposite of hypoglycemia, is an excess of glucose in the blood stream. Warning signs of high blood sugar include:

[Slide # 13]

- Tiredness or fatigue;
- Increased appetite;
- Increased thirst;
- Frequent urination;
- Dry itchy skin;
- Poor healing of wounds;
- Flu-like aches;
- Headaches;
- Blurred vision; and
- Nausea.

Hyperglycemia prevention:

[Slide # 14]

- Follow your meal plan;
- Drink plenty of fluids;
- Stick with a regular exercise plan; and
- Try to decrease the stress in your life.

Tips: Know the warning signs of high blood sugar. Always have sugar-free fluids available to you. High blood sugar causes dehydration and treatment involves the replacement of needed fluids

Stimulants are a temporary remedy that masks symptoms, giving a false sense of having dealt with the problem. The degree of use determines the degree of the problem.

Common stimulants include:

[Slide # 15]

- Sugar—rapid, effective energy boost often in combination with caffeine; risk of hyperglycemia.
- Caffeine—it takes 15 to 45 min for caffeine to take effect, effective for three to five hours, risk of jitters and dehydration.
- Alcohol—impairment, sleep quality, hangover.
- Nicotine—depressant disguised as stimulant; hypoxia from smoke.
- Drugs—sleeping pills, etc.
- Mental and physical exercises—temporary; alertness crashes when activity stopped.

Rebound is the rapid improvement in symptoms when stimulants are taken; however, when it wears off, one plunges deeper than before because the body is attempting to compensate. For example, sugar and caffeine in a coffee takes you on a roller coaster



ride: hypoglycemic to hyperglycemic and back to hypoglycemic—the original problem. Usage triggers the body’s need to adapt; the result is a need for escalating doses to maintain normal feeling of balance. Be aware that the disadvantages may outweigh the benefits.

Prohibition regarding exercising the privileges while under the influence of drugs or alcohol.

Subsection 404.06(1) of the *Canadian Aviation Regulations* (CARs) stipulates the following:

“No holder of a permit, licence or rating shall exercise the privileges of the permit, licence or rating if

(a) One of the following circumstances exists and could impair the holder's ability to exercise those privileges safely:

- (i) the holder suffers from an illness, injury or disability,
- (ii) The holder is taking a drug, or
- (iii) The holder is receiving medical treatment.

Human Factors for Aviation—Basic Handbook, Chapter 5

The rules that apply to alcohol also apply to any substance that has a detrimental effect the ability to fly. Drugs prescribed or otherwise, affect one’s ability to fly (amphetamines and drugs for allergies, colds and other ailments).

Care should be exercise in deciding to fly while taking some of these drugs. When in doubt, contact your physician or pharmacists and/or do not fly.

Human Factors for Aviation—Basic Handbook page 62

Exercise. Physical conditioning strengthens the heart (reducing the risk of heart attack) and enhances blood flow throughout the body (reducing the effects of hypoxia). Exercise also changes your metabolism, burning off calories and affording the double benefit of enabling you to eat more without the weight gain associated with sedentary behaviour.

[Slide # 16]

3. Psychological Factors

By psychological, we mean influencing or tending to influence the mind or emotions.

Psychological effects can be triggered by what we acquire through our senses - the two most important ones being sight and hearing. But there are times when our brain incorrectly interprets information derived from our senses, and generates illusions that can affect our ability to making decisions.

Human Factors for Aviation—Basic Handbook, page 65

Visual processing. It is through the eyes that pilots gather the greatest amount of information needed for safe flying.

[Slide # 17]

The most common factors affecting vision in flight include:

- Empty-field myopia;
- Dirty windshields;
- Low light conditions;
- Night vision;



- Hypoxia;
- Air quality; and
- Blind spots.

Human Factors for Aviation—Basic Handbook, chapters 6 and 7

The psychological issues of vision and expectancy.

The brain uses its experience to interpret what it senses and, thus, has expectations. For example, we have all experienced the strange sensation of stepping onto the top of a stationary escalator. A conflict immediately rises between the visual message, which says the steps are not moving, and past experience, which says they should be moving and that acceleration should be sensed.

[Slide # 18]

Auditory processing. The ears are another of the brain’s most important means of obtaining information. The ears perform two very important functions:

- They gather sound waves, change them into electrical impulses, and transmit these to the brain for processing; and
- They provide a sense of balance; that is, in conjunction with the eyes, they help people determine their physical orientation with respect to the earth.

The psychological issues of aural expectancy, orientation and auditory illusions.

Aural Expectancy

Similar to vision, aural expectancy occurs when your brain is expecting something – a clearance to land after turning final – and misinterprets the instruction to conform to the expectation.

Active listening techniques can be used to counteract this phenomena. The practice of reading back is an example. But it, too, is not without problems.

A controller may say: - "Cleared two four zero" to which the crew may respond with "cleared four zero" interpreting the "two" for a "to".

Orientation and auditory illusions.

The ears affect our equilibrium and the motions of the aircraft can create illusions that may impact our ability to make good decisions. These include:

- Opposite turning illusions; and
- The pitch-up, pitch-down illusions.

[Slide # 19]

Human Factors for Aviation—Basic Handbook, Chapter 8

Stress may be defined as “an adaptive response in which your body prepares for, or adjusts to, a threatening situation”.

There are 2 types of stress:

- *Acute* - accumulated over a short period of time, i.e., from unusual daily event.
- *Chronic* - long-term accumulation of stress, i.e., from lifestyle event plus daily events.

Fight and flight responses are bodily changes that prepare you for an emergency or threat or a need for sudden increased physical exertion.

At the first hint of threat, your brain notifies a host of body mechanisms to prepare for action. Adrenal glands start pumping adrenaline and other hormones into your system. Your circulation speeds up, your lungs pump more air, your blood pressure soars.



Increased amounts of energy-rich sugar appear in your blood. Your blood clotting mechanisms are accelerated and your muscle function improves. New blood cells are released from storage. Your eyesight and hearing become keener. All the while, your digestive system goes into temporary dormancy.

Without these stress reactions, you'd never have a chance. Your built-in fight and flight responses give you a chance to overcome or escape the threat.

Stress is an adaptive response to a threat. Fight and flight responses are important significant to our survival, as a species and as individuals.

The insidious aspect of stressors is that they are not always obvious. Such stress-producing events as physical attacks, confrontations with the boss, or entering a hospital for surgery are obvious. Anything that makes you fearful or anxious is stressful, but a majority of stressors in our lives are subtler.

Flying an airplane or helicopter can be stressful, as can a Transport Canada exam, monotonous work, a mild rebuff, or waiting in line. These kinds of stressors may trigger such relatively low-profile physical reactions they go almost unnoticed. On a day you have been flying, you may only realize later that your hands were moist or that your heart was beating a little fast. The mind triggers all manner of bodily changes, and bodily changes influence the mind.

[Slide # 20]

4. Organizational Factors

An organization is a structure within which people work together in an organized and coordinated way to achieve certain goals.

[Slide # 21]

There are a variety of organizational factors that can play a role in pilot decision-making. These include:

- Poor or conflicting goals –safety versus the bottom line;
- Conflicting and/or inadequate policies and/or procedures;
- Inadequate resources – equipment, personnel, training, etc.);
- Poor supervision;
- Poor or inadequate planning; or
- Imposition of commercial pressures.

These and organizational culture can have a significant bearing on the pilot and the countermeasures that can be used to mitigate their effects.

5. Communication factors

Communication is the exchange of thoughts, messages, or information, as by speech, signals, writing, or behaviour.

Communications is the field of study concerned with the transmission of information by various means.

Crew Resource Management Facilitator Notes, pages 11-2

Effective communication is being able to communicate your thoughts and feelings in such a way that the other person shares the same meaning you do, which has the power to produce the desired effect.



[Slide # 22]

Human Factors for Aviation—Advanced Handbook, Chapter 5, – page 69

The ability to communicate well will help in many situations. But there are barriers to effective communication. We will take some time to review the communication process, the barriers to effective communication, and learn some techniques to overcome them.

Good communication entails the complete and accurate transfer of information from one person to another. Not only do you have to say what you mean, which implies using ordinary language and aviation phrases properly and accurately, but also the listener has to understand what you mean, which implies listening carefully and having the same interpretation of the words.

[Slide # 23]

Crew Resource Management Facilitator Notes, pg 11-3

The communication process. There are four elements in the communication process:

- The sender;
- The message;
- The receiver; and
- The feedback (evaluative response).

People acting as the sender or receiver are influenced by many factors: their perceptions, attitudes, values, knowledge, expectations, language skills, experience and relationship to the other person. These influences act like filters and can have an impact on the process of sending and receiving messages. Note that:

- 7% of all communication is accomplished verbally.
- 38% of communication is the result of unconscious signals and readings, such as tone or sound of voice.
- 55% of all communication is achieved through the non-verbal and symbolic means (body language).

[Slide # 24]

Human Factors for Aviation—Advanced Handbook, Chapter 5, pages 70–75

Barriers to communication are factors that have the potential to affect the decision-making process in the following ways:

1. Reluctance to question—when seeking information.
2. Failure to state your case clearly—confusion as to interpretation.
3. The influence of authority—lacking in authority.
4. Being ignored.
5. Difficulty listening—Indicators of bad listening: interrupting, diverting, debating, tuning out, dismissing.

[Slide # 25 & 26]

Human Factors for Aviation—Advanced Handbook, Chapter 5, pages 133–135

Countermeasures to the barriers of communication.

1. Reluctance to question—It is helpful to preface your requests with a brief statement about your context, i.e., admit up front that you're looking for help.
2. Failure to state your case clearly—Choose your words carefully, state, restate, and state continually until effective.
3. The influence of authority—Clearly and forcefully state the reasons for your reluctance.
4. Being ignored—Ascertain whether you are heard, ask why. Is the problem understood or is there the belief that the concerns are valid?
5. Difficulty listening—Improve your skills by practicing, being patient, asking questions, observing, paraphrasing, and being supportive to the person you are communicating with.

[Slide # 27]

There are five skills for effective communication:

- Seeking information,



Human Factors for Aviation—*Basic Handbook*, Chapter 9, pages 131–138

- Stating one's position,
- Listening,
- Resolving differences, and
- Providing feedback

Seeking information.

Good decisions are based on good information, so seeking and gathering information are vital to good decision making and safe flying. Typically, we obtain information from other crewmembers when we have them, from air traffic control, from universal communications (UNICOMs), and from other sources, such as instruments, checklists, and other documents.

Any pilot may find him- or herself in a predicament either of not having all the information wanted or required or of being uncertain whether received information has been properly understood. In either case, the appropriate behaviour is to ask questions and continue to do so until you are sure you have the information you want. Pilots must overcome their reluctance to question.

Stating your position.

The second major skill in good communications is making sure that your position or viewpoint is understood. This not only means stating it clearly but also—and more difficult—stating it continually until it no longer is an issue.

To state your position, you must assert your message. If you take the following measures when stating your position, you will likely get your message across without offending anyone:

[Slide # 28]

- Make sure you get the person's attention.
- State your concern clearly.
- State the problem clearly.
- Offer a suggestion for solving or dealing with the problem.
- Work to reach agreement.

The second component of good communication, then, is to ensure that you state your opinion clearly, letting people know how you feel about a given situation. They should not have to guess where you are coming from.

Listening.

The third skill in becoming a good communicator is learning how to listen to other people.

Most of our listening is quite **passive**: we hear what the other person says and absorb it without a great deal of thought or effort. **Active listening**, on the other hand, is hard work. It means that you cannot make assumptions about a speaker's intentions or background, or assume that others are good at conveying what they really mean. It means that you take the responsibility for understanding what the other person means, both in the words and in the feelings behind the words.

[Slide # 29]

Indicators of bad listening:

- Interrupting,
- Diverting,



- Debating,
- Tuning out, and
- Dismissing.

[Slide # 30]

Improving your listening:

- Be patient,
- Question,
- Observe,
- Paraphrase, and
- Be supportive (make the speaker feel comfortable).

Resolving differences.

The fourth characteristic of a good communicator is the ability to resolve differences. In most situations in which two or more people are involved, differences of opinion will arise, particularly if all parties have the opportunity to speak their minds openly. Such differences may be constructive or destructive, depending on how they are handled. You should listen to all the available opinions, as well as express your own. At some stage, you may have to choose between opposing recommendations. You should always try to base your decision on the merits of the arguments, not on factors irrelevant to the situation.

Disregarding or slighting an opinion because the holder is young or inexperienced, for example, may lead to a bad decision on your part. Your prejudice may deny you valuable information. An associate whose person you have disparaged as a basis for dismissing an argument will, quite rightly, lose respect for you and, more importantly, will probably stop offering information and opinions. Thus, like captains of so many aircraft that have crashed, you could lose a vital lifeline to safety.

[Slide # 31]

Improving the skill:

- Listen well,
- Keep to the issue,
- Bring out the differences,
- Acknowledge feelings, and
- Build respect.

Seldom do complex problems have easy solutions. Consequently, creative brainstorming is very helpful in resolving such problems. The differences of opinion that will inevitably arise are at the heart of brainstorming. They are valuable because no one person can think of all the options. In deciding among the alternatives, ensure that you acknowledge and value the contributions everyone has made. This will build trust and team spirit and, therefore, enhance co-operation in the future.

Providing feedback.

The final, and most difficult, aspect of good communication is providing constructive feedback. It is in this area that we all have severe conflicts between our hearts and minds, both as givers and as receivers of feedback.

When we receive feedback, our brains often know that feedback is helpful and deserved, but our hearts hate to hear it. Though we know that feedback is helpful for improving our skills, simultaneously we may resent being told that we have made a mistake or could improve some aspect of our performance.



When we give feedback, the situation is even more difficult if the receiver is above you in rank or has some authority over you. In such situations, you may be especially concerned that your feedback will be taken in the wrong spirit and that you will suffer consequences. Such concern is entirely reasonable in our society, which has no strong tradition of accepting input and advice of underlings.

Even so, whether the recipient is above or below you in rank, if you give feedback properly, the benefits will outweigh the disadvantages.

[Slide # 32]

Improving the skill:

- Create a climate for feedback,
- Ask for feedback,
- Ask to give feedback, and
- Give feedback to help, not to put down.

[Slide # 33]

6. Cultural Factors

Culture can be defined as the values, beliefs, assumptions, rituals, symbols and behaviours that define a group.

[Slide # 34]

Culture can be said to possess both norms and values.

Norm—*Human Performance in Aviation Maintenance Workshop*

- A **norm** is a customary behaviour; an unwritten rule dictated and followed by the majority of a group.
- A **value**, put simply, is what is and is not important to us.

When people successfully perform a risky act on the job, they often change their view about the personal risk involved. They may discount the risk and come to believe that the activity is not risky, or they may develop a sense of their own invulnerability. The more often they are successful at the dangerous act, the more likely they are to believe that, although the practice may be dangerous in a general sense, nothing bad will happen to them.

This behaviour can lead them to repeat the act and a vicious circle can be set up. It is ironic that the odds of an accident happening are actually increasing as the subjective evaluation of personal risk decreases.

The effect can spread. As more pilots do something—like buzz the bunkhouse to let someone know they need a vehicle at the airport—a group value can develop. Pretty soon people are competing to see who can buzz the best. The behaviour becomes normal and accepted, but even though everyone does it, it is still risky.

Except when non-compliance has become a largely automatic way of working (as sometimes happens in the case of routine shortcuts), violations involve a conscious decision on the part of the individual to break or bend the rules. However, while the actions may be deliberate, the possible bad consequences are not.

According to Robert L. Helmreich and Ashleigh C. Merritt in their book “*Culture at Work in Aviation and Medicine*”, there are largely 3 cultural dimensions:

- Organizational;
- Professional; and



- National.

All can display both strong “surface” cultures and “sub-culture”. For example, it can be said that the pilot community possesses norms and values that make it a distinct culture vis-à-vis other professions. This professional culture can also be sub-divided into fixed and rotary wing pilots, military versus civilian, jet versus piston, etc. all exhibiting somewhat different set of norms and values.

Culture at Work in Aviation and Medicine Chapter 4, page 109, Box 4.1 Tribes and organizations

Organizational culture. In *Culture at Work in Aviation and Medicine*, Robert L. Helmreich and Ashleigh Merritt, provide the following:

“Borrowing from anthropology, we can say that organizational members are like members of a tribe. The elders of the tribe are entrusted to lead wisely, to set the rules for the rest of the tribe to follow, and to set an example that others can respect (senior management). Members of the tribe may be easily identifiable by their unique apparel (uniforms), their dialect (jargon), their distinctive weapons and tools (aircraft types) and their housing arrangements (office and hangar). There are rituals that celebrate initiation into the tribe and rites of passage that establish one’s place in the tribe (recruited by an airline). Finally, revered members are entrusted to remember and recount the myths and legends of the tribe’s origin, the early hardships, the battles, the heroes and the victories that have shaped the tribe’s history and identity. Tribes that survive have a strong sense of their culture—who they were and who they have become.”

They go on to say: *“The cultural strength of an organization relates to whom and how many accept the dominant values, how strongly or intensely the values are held and how long the values have been dominant. What is interesting about this is that it does not seem to matter what the values and beliefs are, only that everyone agrees on them”.*

Every organization possesses a unique and socially constructed culture and is affected by various influences and complex processes. These have a tendency to shape employees’ attitudes and behaviours toward safety. In this sense, organizational culture can affect safety.

Professional culture. One of the defining attributes of a profession is that its members have a special expertise: they can perform actions or deliver services that the layperson cannot.

Culture at Work in Aviation and Medicine: National, Organizational and Professional Influences
By Robert L. Helmreich and Ashleigh C. Merritt, Ashgate Publishing

The process of acquiring this expertise usually requires undergoing demanding training, often with significant failure. Studies suggest that pilots have a strong and distinctive professional culture with both strengths and weaknesses.

Strengths

Dedication to the job and maintenance of composure under extreme circumstances has saved many lives. The esteem in which professionals are held is justified by real accomplishments.

Weaknesses

Pride in doing the job well can lead to taking unnecessary risks such as flying when fatigued or ill. The same pride may make pilots reluctant to admit error, which, in turn, can keep valuable information about human limitations from the organization.

Strength page 34
An example of effective behaviour was the performance of a United Airlines crew when their DC-10 lost all flight controls after the



catastrophic failure of the engine. Their performance was singled out as minimizing the loss of life in a near-impossible situation.

Confidence can turn into arrogance, leading to a disregard for others' opinions and a failure to consider alternative courses of action.

Pilots' sense of invulnerability and denial of weakness can also have grave consequences. A high percentage of pilots have unrealistic opinions about their performance when faced with various stressors.

In addition, professional cultures have considerable inertia and change requires both strong interventions and time.

National culture. Studies have shown that another factor came into play beyond organizational and professional culture: national culture.

These studies focused on a variety of attributes such as:

- Leadership;
- Communication;
- Perceptions of risk;
- Stress; and
- Decision-making.

Generally, good leadership was someone who is both task and relationship-oriented. But this varies across different cultures. The same leader behaviour that is seen as harsh and inconsiderate in one culture can be interpreted as paternalistic and encouraging in another.

Communication styles also differ culturally. The preferred communication style in some countries is direct and specific, while in others it is indirect and relies on context.

Helmreich and Merritt conclude: "*The influence of national culture on social interactions is often unseen by members within the culture, and can be seen as unpredictable and 'nonsensical' from the outsiders' perspective. Consequently, the potential for misunderstandings in cross-cultural encounters is enormous: it ranges from a misreading of emotions to an escalation of conflict because of an inappropriate apology or intervention*".

They go on to state: "*To imply that a pilot's national culture propels him or her toward greater or lesser safety is implausible, simplistic and ethnocentric*". . .

[Slide # 35]

Human Factors for Aviation—*Basic Handbook*, Chapter 10, pages 145–157

7. Factors Affecting Judgment

Judgment is the process of choosing which alternative will give the safest outcome given the situation.

Judgment is important in flying because the pilot is given a great deal of latitude in making decisions.

Some aviation regulations are based on the assumption that pilots will interpret them in accordance with their own skill. Though applying at face value to all pilots, the regulations are actually geared to the pilot who is extremely proficient and is flying a well-equipped aircraft. Thus, whereas any pilot may be legally entitled to fly a cross-country flight in marginal visual meteorological conditions (VMC), it is up to the individual pilot to judge whether such a situation exceeds his or her own personal limits, based on experience and currency.



[Slide # 36]

The key to exercising good judgment is to learn to recognize the factors that affect good judgment and learn how to overcome their influence. These factors include:

1. Lack of vigilance;
2. Distraction;
3. Peer pressure;
4. Insufficient or incorrect knowledge;
5. Unawareness of consequences;
6. Forgetfulness of consequences;
7. Ignoring consequences; and
8. Overconfidence.

Lack of vigilance. Vigilance is one of the fundamental skills of PDM and is the basis for situational awareness and environmental scans. Good vigilance not only allows you to see other traffic but also alerts you to emerging problems. Though relying heavily on vision and all the other senses, vigilance is also to a large extent mental: once a thing is sensed, the mind must then apprehend whether it is or is not as it should be. For example, it is not enough simply to see a needle indicating low oil pressure, you must also consciously realize that the oil pressure is low and that such an indication is cause for concern (e.g., impending engine failure).

If vigilance is necessary for safe flight, lack of it is a recipe for problems. If you fly oblivious of what is around you, you are not likely to notice a problem creeping up on you. For example, if you do not pay attention to the fuel gauges, you may run out of fuel, with unwanted consequences. On the other hand, if you routinely monitor the fuel gauges, you will notice a problem long before it becomes serious. You will then be able to do something about it and, thereby, prevent drastic consequences.

Developing vigilance. If you find that you tend to notice things late or not at all, you may wish to consider developing a routine to improve your vigilance. One good method consists of making a checklist of items to be observed and considered and periodically going through the checklist while you fly. This may seem tedious at first, but it will not be long before you find yourself checking items automatically as part of a natural scan. As this scan improves, you can rely less on the checklist until you finally reach the stage of confidence in your own vigilance.

Distraction. Distraction figures most largely in the awareness phase of the decision-making process. If something distracts a pilot from noticing a problem that arises, decision making in respect of that problem cannot even begin.

The classic example of distraction is an L-1011 crash into the Everglades in 1972. The crew was so intent on dealing with a minor problem concerning the landing gear lights that they failed to notice that the airplane was in a shallow descent. So intense was their focus on the initial problem that they did not even hear the altitude warnings in the cockpit.

The antidote.

The antidote to distraction is to force yourself, after a few moments of attention to any problem that arises, to pull back mentally and scan all other systems in order to reinforce your awareness of what is happening on the flight. In a crew situation, one person should be assigned responsibility for flying the aircraft, and the other can deal with the problem at hand. If you are the only pilot, your primary task is to control the aircraft.



Peer pressure. One of the most compelling influences on pilots is peer pressure. This comes in many forms, ranging from the desire to impress friends and colleagues to the need to satisfy the requests of employers or customers. It may even take the form of a hankering for stories to tell to fellow pilots.

In the cold light of day, motives such as these appear to be a foolish basis for making judgments about flying safely. But the reality is that such motives figure prominently in a large proportion of accidents.

The most difficult situation occurs when your employer or your passengers ask you to do something that you do not think is safe, such as flying in marginal weather, flying when you are excessively tired, or loading the aircraft beyond its maximum gross weight. Usually, you will feel that your job is on the line in such situations. The problem is that it may be.

An Example of Pressure to Fly

What would you do, for example, if the group you were to fly into a distant lake for hunting or fishing trip arrived with so much gear that it would put your airplane well over gross weight? If you flew with everything, you would be dangerously overloaded and in violation of regulations. On the other hand, if you refused to take everything on one flight, who would pay for the second flight? Usually these charters are prepaid, and asking the customers to pay more is out of the question. Nor is the charter operator likely to cover any extra costs because it would eat into or eliminate the profits. And, of course, there is no way you can foot the bill.

Some pilots in this situation would choose to load everything and go for it, as long as they thought there was enough runway or water to get airborne. Fewer pilots would refuse to fly. Basically, your employment might depend on your willingness both to “bust the reg” and to compromise safety. Moreover, your refusal to fly could disappoint the vacation group who may have been planning the trip for months or even years.

Dealing with Pressure to Fly

Unfortunately, in this scenario, there are no quick remedies for the pilot finding him- or her in this dilemma. Perhaps the best option would be to explain the pilot's responsibility for the safety of the passengers and just what that entails: legal and moral responsibility, performance capability of the aircraft, insufficient information when booking, etc. Having clearly explained the situation to all concerned, the pilot could lay out the possible alternatives with the associated risks and ask for help in making the safest decision (collaborative decision making (CDM)). The pilot's best chance of persuading other people lies in basing the appeal on safety.

If, after all of this, the pressure persists to fly over gross weight or into bad weather, you will have to make your own final determination, which may end up being a choice between an unsafe flight and unemployment.

If such predicaments are recurring or seem familiar within your company, you should consider taking pre-emptive action. There are many mitigating measures a pilot could take. For example, you could suggest that the brochures advertising your services include a section on safety, mentioning allowable baggage limits and stating that excess baggage cannot be taken. You could initiate discussion with the person responsible for safety, such as the chief pilot or owner, about the difficult situation you sometimes find yourself in when you believe a flight to be unsafe. Give reasons for



your discomfort and ask advice on dealing with the situation.

Pressure from social relationships.

Another difficult type of peer pressure comes from people with whom you have a social relationship. These can range from long-time friends to customers who invite you for a drink the night before a flight. With people you know, you may fear losing their respect if you appear to be afraid of flying in difficult situations. With friends in particular, you may also fear losing their friendship if you do not do what they want of you.

Having a drink with the customers the night before a trip can produce other unwanted pressures. First, if you have a few drinks, the alcohol will make you feel more capable of handling situations than you really are. Second, judgment is impaired by alcohol, and under its influence you may be swayed into making promises that you will feel compelled to keep the next day. Third, when you later prepare to fly, even if it has been more than eight hours after your last drink, you may still be under the influence and still be suffering from impaired judgment.

Final comment.

Peer pressure happens all the time and is often difficult to resist. Whenever, you feel yourself under pressure, ask yourself whether you are prepared to deal with the consequences of a hazardous and possibly fatal flight. This will help you gain proper perspective for your decision.

Insufficient or incorrect knowledge. If you are in Class B airspace and lose your radios, you have to decide what to do. In this case, the procedure is laid out for you in the regulations. However, if you do not know what the relevant regulations say about the situation, you may decide upon a solution in conflict with what air traffic control (ATC) expects and, thus, incurs great risks to yourself, your passengers and even other aircraft.

Every facet of flying has a great amount of associated information and procedures. Sometimes, we do not have occasion to make use of this information for ages. But when we do, the system expects us to be as competent as if we had just learned it yesterday. Keeping up your mental currency is just as important as your flying proficiency because when things go wrong the range of options available to you may be determined by your grasp of the appropriate knowledge and procedures.

Unawareness of consequences. A corollary of insufficient knowledge is unawareness of consequences. In a situation demanding some action on your part, your ability to make an effective decision will be hampered if you do not know the consequences of the various actions under consideration. For example, if you need to top off your tanks but the local airport is sold out of fuel of the proper octane for your airplane, you may be tempted to use a lower octane fuel if you do not understand the consequences of doing so. Similarly, if your landing gear fails to retract, you may decide to continue a cross-country flight unless you understand the impact the unretracted gear will have on airspeed and fuel consumption.

Unless you have a good grasp of the consequences of potential actions, your ability to choose well among the actions becomes more a matter of luck than skill.

Forgetfulness of consequences. The outcome of forgetting consequences is the same as that of not knowing them in the first place: the unavailability of educated judgment in choosing among options because of the impossibility of accurately



assessing the associated risks. When unexpected things happen to you, try to remember what ensues so that if the same situation occurs again, you will be better prepared to deal with it.

Ignoring consequences. Ignoring consequences differs from forgetting them or otherwise being unaware of them only in that the former implies a willful action. In other words, the pilot makes a certain choice despite knowing full well that the consequences may not be good.

This type of behaviour figures frequently in weather-related accidents. Despite knowing of bad weather en route, the pilot feels some pressure to fly, perhaps because of an important meeting or just a need to be home (“get-home-itis”). For whatever reason, the pilot makes him- or her believe that the weather is manageable and heads into it. In any other situation, the same pilot would tell you that flying into that sort of weather was risky at best.

Overconfidence. Flight instructors have noted that private pilots with 100–200 hr. and instrument pilots with 300–500 hr. tend to exhibit overconfidence. Pilots in these ranges, the instructors say, do not yet know what they do not know; they are still in the stage of thinking they know it all.

The problem with overconfidence is twofold. First, it tends to make you a little careless, not paying as much attention to detail as a more experienced pilot would. This carelessness could apply to such things as the pre-flight, flight planning, or vigilance during flight. Second, if a problem occurs, overconfidence may cause you to be hasty in decision-making, not bothering to generate all possible solutions before choosing among them.

Moderating overconfidence is difficult because it requires some of the opposite—self doubt (humility). One suggestion for monitoring your confidence level is to continually ask yourself whether you have evaluated all the alternatives. Ask yourself as many what-if questions as you can. Such questioning will help you focus on what can go wrong and thus keep you mentally prepared. Another suggestion is to always follow standard procedures and, in particular, use checklists whenever available. Such practices will minimize your chances of overlooking some essential detail.

8. Countermeasures

Before proceeding in building our countermeasures, let’s review what we have discussed to date:

In Module 2, we examined the basic decision-making process. It consisted of 4 steps:

1. Situational awareness – requiring knowledge (gathering information) and vigilance;
2. Evaluating options – diagnosis, generating solutions, assessing risks;
3. Choosing an option – plan, indicators, backup plan; and
4. Implement and monitor – look for desired results, if not, repeat process.

In this last module, we examined those human performance factors that can have an effect on our ability to follow this decision-making process. These are:



PILOT DECISION MAKING

HUMAN PERFORMANCE FACTORS

- Physical – environment, climate, temperature, time, air quality, noise, vibration, turbulence, ergonomics;
- Physiological – hypoxia, carbon monoxide, fatigue, diet, use of stimulants, diet and exercise;
- Psychological – visual, aural processing factors, stress;
- Organizational – poor or conflicting goals, conflicting or inadequate policies and procedures, inadequate resources, poor supervision, poor or inadequate planning, commercial pressures;
- Communication – reluctance to question, failure to state your case, influence of authority, being ignored, difficulty listening
- Cultural – organizational, professional and national; and
- Judgment – lack of vigilance, distraction, peer pressure, insufficient or incorrect knowledge, unawareness of consequences, forgetfulness of consequences, ignoring consequences and overconfidence.

[Use a flip chart, white board or blackboard for the brainstorming exercise. Consider using a simple scenario at first. Or use Slide # 37]

We can now begin to construct a “countermeasures matrix”. For each step in the decision-making process, we can list the factors that can have an effect. And for each factor, we can generate some ideas as to how to either eliminate their effect or mitigate their consequences.



Countermeasures Matrix

| Step in the decision-making process | Factors | Countermeasures |
|--|----------------|------------------------|
| Situational Awareness | Physical | |
| • Gathering information | | |
| | Physiological | |
| | Psychological | |
| | Organizational | |
| | Cultural | |
| | Communication | |
| | Judgment | |

| Step in the decision-making process | Factors | Countermeasures |
|--|----------------|------------------------|
| Evaluating options | Physical | |
| • Diagnosis | | |
| • Generating solutions | Physiological | |
| • Assessing risks | | |
| | Psychological | |
| | Organizational | |
| | Cultural | |
| | Communication | |
| | Judgment | |

| Step in the decision-making process | Factors | Countermeasures |
|--|----------------|------------------------|
| Choosing an option | Physical | |
| • Plan | | |
| • Criteria | Physiological | |
| • Indicators | | |
| • Back up plan | Psychological | |
| | Organizational | |
| | Cultural | |
| | Communication | |



PILOT DECISION MAKING

HUMAN PERFORMANCE FACTORS

| | | |
|--|----------|--|
| | | |
| | Judgment | |

| Step in the decision-making process | Factors | Countermeasures |
|--|----------------|------------------------|
| Implement & monitor | Physical | |
| | Physiological | |
| | Psychological | |
| | Organizational | |
| | Cultural | |
| | Communication | |
| | Judgment | |



REVIEW

The objective of this module was to become acquainted with the factors that can affect the pilot decision-making process with a view of devising appropriate countermeasures to offset their effects.

These factors included:

- Physical factors;
- Physiological factors;
- Psychological factors;
- Organizational factors;
- Cultural factors;
- Communications factors; and
- Judgment.

LINK

In module 2, we examined pilot performance and the decision-making process. In this module we explored those factors that can affect the process. In the next module, we will examine how all of these variable interplay play to cause human error.