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AERONAUTICAL DECISION MAKING FOR INSTRUMENT PILOTS

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16. Abstract <p>Aviation accident data indicate that the majority of aircraft mishaps are due to judgment error. This training manual is part of a project to develop materials and techniques to help improve pilot decision making. Training programs using prototype versions of these materials have demonstrated substantial reductions in pilot error rates. The results of such tests were statistically significant and ranged from approximately 10% to 50% fewer mistakes.</p> <p>This manual is designed to explain the risks associated with instrument flying activities, the underlying behavioral causes of typical accidents, and the effects of stress on pilot decision making. It provides a means for the individual pilot to develop an "Attitude Profile" through a self-assessment inventory and provides detailed explanations of preflight and in-flight stress management techniques. The assumption is that pilots receiving this training will develop a positive attitude toward safety and the ability to effectively manage stress while recognizing and avoiding unnecessary risk.</p> <p>This manual is one of a series on Aeronautical Decision Making prepared for the following pilot audiences: (1) Student and Private (2) Commercial (3) Instrument (4) Instructor (5) Helicopter (6) Multi-Crew.</p>					
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PREFACE

This instrument pilot decision-making training manual was originally prepared by Aviation Research Associates for the Federal Aviation Administration (FAA) Office of Aviation Medicine. The final version of this manual was prepared by the AOPA Air Safety Foundation under subcontract to Systems Control Technology, Inc., in support of FAA contract number DTFA01-80-C-10080.

FOREWORD

This aeronautical decision making training manual for instrument pilots is the result of ten years of research, development, testing and evaluation of the effectiveness of teaching judgment and decision making. The material in this manual was developed to improve aviation safety by Aviation Research Associates and the AOPA Air Safety Foundation with support and collaboration from the Federal Aviation Administration, Systems Control Technology, Inc., General Aviation Manufacturers Association, Flight Safety Foundation, Transport Canada, Director General of Civil Aviation (France) and Department of Aviation (Australia).

Similar training manuals have been developed for student and private pilots, instructor pilots, commercial pilots and for those pilots operating multi-crew aircraft.

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Pilot Error, Editors of Flying
Weather Flying, Robert Buck
Illusions, Richard Bach
"The Bush Pilot Syndrome," Dr. Michael Mitchell
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OSU Pilot Judgement Survey - AVN 519
List of Pilot Errors, OSU Survey, 1983
Personal Contacts
Personal Experience

AERONAUTICAL DECISION MAKING
FOR INSTRUMENT PILOTS

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1. INTRODUCTION TO AERONAUTICAL DECISION MAKING

Many factors influence a pilot's decision-making process. Knowledge, reasoning ability and skills are all important, as is the individual's emotional makeup, e g., his or her personality and attitudes. Personality traits are deeply ingrained behavioral characteristics that are usually established in childhood. These personality traits are highly resistant to change and are beyond the scope of the judgment training presented in this manual. The other elements of decision making (some of which are discussed in this manual) are outlined below.

Attitudes

Attitudes are less deeply ingrained and may be changed by training. Everyone has attitudes regarding politics, religion, people, etc. We are constantly inundated by attempts to change our attitudes by advertisers, politicians, peers, superiors, etc.

Most of our attitudes regarding flying are developed through experience. We listen to and observe instructors and other pilots, thereby developing attitudes concerning risk taking, assessing our skill and knowledge, and decision making. We also learn pilot behavior through informal methods, e.g., "hangar flying," movies, etc. These attitudes continue to be developed with experience. The exercises in this manual can help you establish safe attitudes towards flying.

Headwork

Headwork is the intellectual process used when formulating decision-making strategies and is important in aeronautical decision making. The necessary ingredients in good headwork are knowledge, vigilance, selective attention, risk identification and assessment, information processing and problem solving abilities. Headwork, when properly applied, minimizes the negative influence of attitudes and personality traits. If it were possible to separate the headwork aspect of decision making from the attitudinal part (which it is not), pilots would be able to solve all problems in much the same manner as a computer. Since the two cannot be separated, one objective of this manual is to help you develop and apply good headwork that augments or controls other aspects of decision making in the cockpit. The second objective of this manual is to teach good headwork.

Skills and Procedures

A third factor related to decision making is "airmanship" or "stick and rudder" abilities. This refers to the procedural, psychomotor and perceptual skills that are used to control an aircraft and its systems. These skills are learned during the conventional training process until they become automatic reactions, e.g., stall recovery in airplanes and autorotation procedures in helicopters. These skills are highly specific to the type of aircraft and are taught in traditional flight training programs using a variety of materials. Therefore, such information will not be duplicated in this manual.

Risk Management

Accident statistics indicate that 80-85% of all general aviation accidents involve "pilot error." This is another way of stating that the pilot is a major risk element in decision making. When evaluating flying risks, a developing or potential hazard must first be detected, then analyzed and finally resolved. As an aid to risk assessment, five risk elements are reviewed: pilot, aircraft, environment, operation and situation. The pilot has the capability and responsibility for determining the risks associated with a particular flight. Techniques for risk assessment and management are discussed in Chapter 3.

Stress Management

Pilots must learn how to deal with the various stress levels associated with flying, and must recognize the cumulative effects which stress can have on headwork (the ability to reason) at critical times. Stress coping must occur in three areas:

- 1) Life Stress Management - This is the long term approach to mental and physical health. This includes items such as diet, exercise, life style, etc., as well as recognizing the negative effects of change-in-life situations, e.g., death of a loved one, job change, divorce or financial problems;
- 2) Preflight "fitness to fly" - The pilot needs to ensure physical well being, e.g., the effects of illness or medication on performance, stress from outside pressures, the influence of alcohol, fatigue and eating habits;
- 3) In-flight Stress Coping - This includes recognizing the importance of controlling panic; focusing primarily on aircraft control and, secondarily, on navigating and communicating; and not permitting fear or anxiety to paralyze decision-making capabilities. These areas of stress coping are discussed in Chapter 8.

Cockpit Resource Management(CRM)

This element of decision making refers to the effective management of all resources available to a flight crew, and is a concept used in multi-person crews. Cockpit resource management emphasizes effective interpersonal communication among crew members and other resources that may be available. This subject area is discussed in another manual in this series.

Pilot Responsibility

When the government certifies a pilot, it grants that pilot the privilege to use public airspace and air navigational facilities. In accepting this privilege, the pilot is expected to adhere to the rules and refrain from any activities which might infringe on the rights and safety of others. The regulations require the pilot-in-command to be the final authority for the safe operation of an aircraft. Although the pilot should conduct safe aircraft operations, his or her operation of the aircraft is influenced by events and conditions, some of which have nothing to do with aircraft operation, e.g., personal problems, controllers, weather, etc.

When certificated, a pilot is presumed to be responsible in behavior and is expected to use "good judgment" to understand and interpret the rules in individual situations. However, accident statistics indicate that pilots do not always fulfill that expectation: Nearly 85 percent of all general aviation accidents may be attributed, in part or in whole, to "pilot errors." To determine why pilots make these errors, it is useful to classify pilots' activities into three categories:

- o Procedural Activities - Management of the powerplant, fuel, aircraft configuration, autopilot, displays, navigation and communication.
- o Perceptual-motor Activities - Aircraft control, judgment of distance, speed, altitude, hazard detection and geographic orientation.
- o Decisional Activities - Self-assessment of skill, knowledge, physical and psychological capabilities, hazard assessment, navigational planning and flight priority adjustment.

Below is an analysis of data for fatal and non-fatal accidents, attributed to "pilot error" during a five-year period. The data are divided into the three pilot activity categories mentioned above and the number and percentage of accidents in each category are listed below.

<u>Pilot Activity Category</u>	<u>Number/Percentage of FATAL Accidents</u>	<u>Number/Percentage of NON-FATAL Accidents</u>
Decisional	2,940 (51.6%)	9,081 (35.1%)
Perceptual-motor	2,496 (43.8%)	14,561 (56.3%)
Procedural	264 (4.6%)	2,230 (8.6%)

The majority of fatal pilot-induced accidents (51.6%) are the result of decisional behavior, also known as cognitive judgment. Cognitive judgment describes the decisional activities involved in choosing a course of action from several alternatives.

Definition of Aeronautical Decision Making

A popular belief is that judgment is good, common "sense" applied to the making of decisions, especially correct decisions. "Sense" involves an intense awareness, realization, and understanding of all the factors involved in making a decision. Sense is generally seen as a person's ability to act effectively and positively in any given situation.

The most significant aspect of pilot judgment and decision making is the "outcome." Judgment is not an end in itself, but involves both a decision to act and a response--be it an action or even an inaction. Before taking action, pilots must consider all relevant intrapersonal, aircraft, and environmental factors which have, or may have, an influence upon his or her decision-making process. Pilot judgment is thus a process which produces a thoughtful, considered decision relating to the aircraft's operation along with the ensuing response, e.g., action/inaction, to that decision.

Aeronautical Decision Making (ADM) is:

- o The ability to search for and establish the relevance of all available information regarding a flying situation, to specify alternative courses of action, and to determine expected outcomes from each alternative.

- o The motivation to choose and authoritatively execute a suitable course of action within the time frame permitted by the situation. The word "suitable" means an alternative consistent with societal norms, and "action" includes no action, some action, or action to seek more information.

The first part of this definition refers to intellectual abilities. It relies on the pilot's capabilities to sense, store, retrieve and integrate information. This part of judgment is purely rational and, if used alone, would allow problem solving in much the same manner as a computer.

The second part of the definition is where the decision is made and indicates that it can be affected by motivations and attitudes. It implies that, in part, pilot judgment is based on tendencies to use other than safety-related information when choosing courses of action. Pilots often consider non-safety items such as job demands, convenience, monetary gain, self-esteem, adventure, commitment, etc., before taking action. If properly developed, this part of pilot judgment would eliminate information unrelated to flight safety, and direct the pilot's decision to the use of more rational processes.

The term "pilot error" is often used to describe an accident cause, and is an oversimplification implying that the pilot intended to have an accident. Pilots usually intend to fly safely, but they sometimes make decisional errors. Their skill or luck is often sufficient to get them out of situations resulting from poor judgment (a term for the general concept of decisional errors). The objective of this manual is to teach instrument pilots the techniques to avoid situations that require luck or skill greater than their capabilities. Good judgment means avoiding situations that require superior skill to overcome.

2. DECISION-MAKING CONCEPTS

The following material contains concepts and terms used throughout this manual. They have been especially designed to lead you to think more carefully about your flight activities and to help improve your judgment and decision-making skills.

Five Subject Areas

Flying is a process, a combination of events, which requires pilots to make a continuous stream of decisions. The events in this process are interactions between people, the aircraft and the environment which occur over time. Therefore, the events which interact during this process can be evaluated in five subject areas:

- o Pilot--"P"
- o Aircraft--"A"
- o Environment--"E"
- o Operation--"O"
- o Situation--"S"

P = Pilot Pilots are continually making decisions about their own competency, state of health, level of fatigue, and many other variables. Any time the problem focuses on the pilot, it is included under the subject area, "PILOT". One example would be:

The pilot had only four hours of sleep the night before. A friend then asked the pilot to fly him to a meeting in a town 700 miles away. After evaluating his fatigue, the pilot made a good decision and refused to make the flight.

A = Aircraft Decisions are frequently based on evaluations of the aircraft, such as its power, equipment, or airworthiness. Any judgment about the airplane and its equipment is lumped into the subject area, "AIRCRAFT". One example would be:

During preflight, the pilot noticed the fuel cap did not seem to lock securely. The pilot decided to delay takeoff while a mechanic checked the situation. The pilot's good decision was confirmed when the mechanic had to install a new cap.

E = Environment This subject area includes items not previously considered in the pilot and aircraft subject areas. The pilot must make a separate evaluation of these items which can include: weather, air traffic control, runways, etc. Any other item which can affect the pilot and aircraft is part of the subject area called "ENVIRONMENT". One example would be:

The pilot was landing a single-engine aircraft just after a helicopter had departed. The pilot assumed that wake turbulence would not be a problem, but the plane slammed into the runway due to vortices from the helicopter.

O = Operation The interaction of the pilot, aircraft, and environment are influenced by the purpose of each flight operation. The three other subject areas must be evaluated in the context of the desirability of undertaking or continuing the flight as planned - why is the flight being made, how critical is it to undertake the mission or maintain the planned schedule - must it be done now, is the trip worth the risks? Example:

During an IFR cross-country, the pilot calculated the groundspeed and determined that he would arrive at his destination with only 20 minutes fuel remaining. He felt pressured to keep his appointment and tried to "stretch" the fuel supply instead of landing to refuel.

S = Situation Situational awareness is the accurate perception of the conditions affecting the aircraft and the pilot during a specific period of time. More simply, it is knowing what is going on around you. There is a direct relationship between situational awareness and safety. Pilots who have higher levels of situational awareness are safer pilots. Situations combine the pilot-aircraft-environment-operation subject areas. Two examples of the outcome of a lack of situational awareness are:

Pilot/Environment--P/E

With a 90-degree, 30-knot left crosswind (E), the pilot attempted to make a landing. The pilot's left leg was in a cast (P), and he had trouble using the rudder. Upon touchdown, the aircraft veered sharply to the right and collided with an embankment.

Pilot/Aircraft/Environment--P/A/E

In cruise, ideal conditions for carburetor icing existed, and ice did develop (E). However, the pilot, who was unfamiliar with this type of aircraft, concluded that the engine was running rough due to a mechanical failure, and did not apply carburetor heat (A). Instead, the pilot rushed into an emergency landing attempt, landed downwind unnecessarily, and groundlooped the airplane (P).

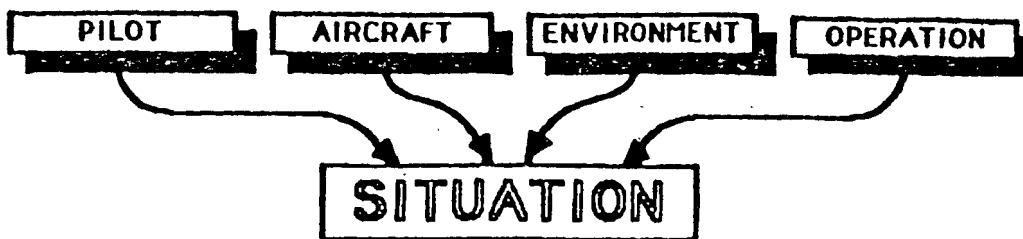


Figure 2.1

The Conventional Decision-Making Process

Conventional flight training prescribes the knowledge, experience, and skills necessary to conduct a flight within operational constraints. For the low-time pilot, the instructor attempts to teach good judgment, behavior, and performance through a set of limited, but supervised, flight situations. In doing so, the flight instructor not only teaches the necessary aviation knowledge and skills required to execute specific flight maneuvers, but also encourages the student to apply previously learned knowledge and skills to subsequent situations. Since the student cannot be taught how to handle every possible situation he or she may encounter, the instructor tries to provide a representative range of learning experiences that the prospective pilot can later apply to similar situations. As the neophyte pilot displays competence in training situations, there is an increase in ability to perform safely. In new situations, the pilot's decision will be based upon two considerations: (1) What the pilot had previously learned which may be applicable to the new situation; and (2) what the pilot chooses to consider as relevant information for arriving at a new decision while operating in "unknown territory."

An accident is the result of an unfortunate combination of events with a harmful outcome. The previous examples have demonstrated that these events are interactions between the pilot, aircraft, environment and the nature of the mission or operation. Flying requires a continuous stream of timely decisions. Recognition and understanding of these events allow a pilot to influence the outcome of the flight, thereby avoiding an accident. For example:

An instrument-rated pilot, with limited experience flying in adverse weather, wants to arrive at his destination by a certain time, and he is already 30 minutes late. In spite of his limited weather experience, he decides to fly through an area of possible thunderstorms and will reach this area just before dark. Arriving in the thunderstorm area, he encounters lightning, turbulence and heavy clouds. Night is approaching, and he inadvertently penetrates a thunderstorm.

The pilot did not evaluate several of the five subject areas: First, he let his desire to arrive at his destination on time override his concern for a safe flight. He overestimated his flying abilities by flying through an area of thunderstorm activity. Next, the pilot continued into obviously severe conditions instead of changing course or landing prior to his destination.

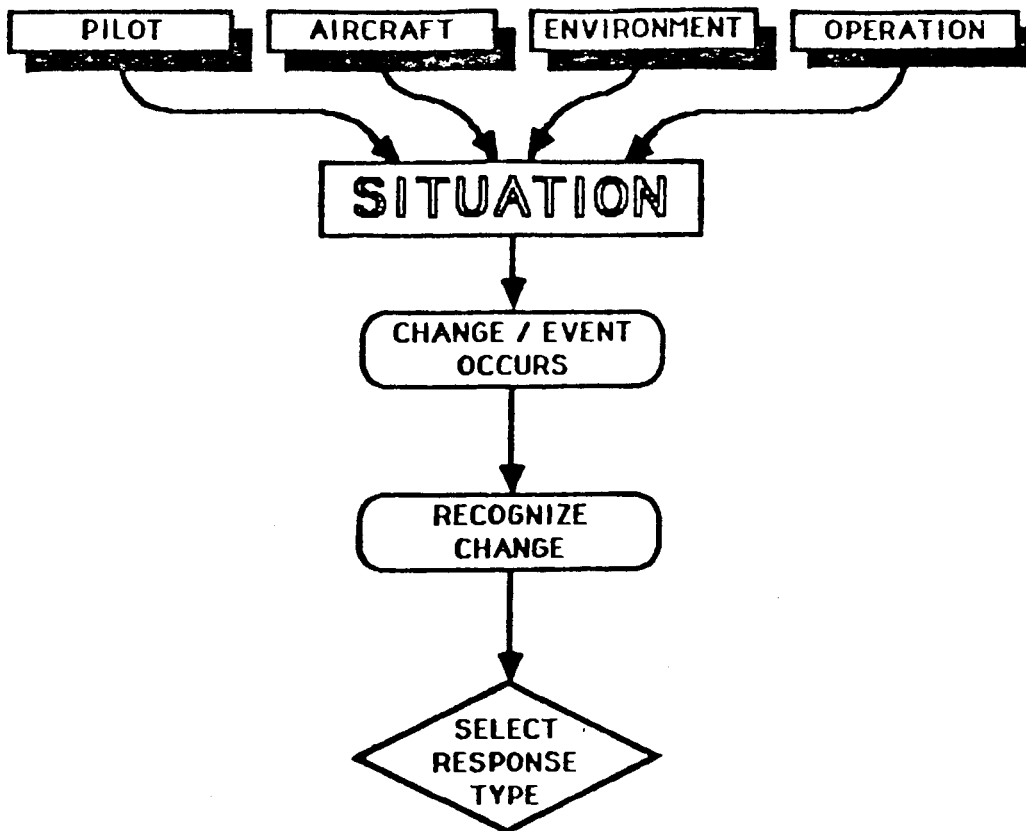


Figure 2.2

The pilot could have selected several alternate courses of action. He could have flown around the adverse weather and accepted the fact that he might be late. Good judgment could have alerted the pilot to avoid the severe weather after encountering the lightning and turbulence.

Normally, the need for a decision is triggered by recognition that something has changed, or an expected change did not occur in the five subject areas. The search for and recognition of change, e.g., groundspeed, weather and fuel, provides the opportunity to evaluate and control the change in order to produce a safe flight outcome.

Failure to search for and recognize change reduces the chance of controlling the change. As time progresses, the alternatives available may decrease, and the option to select the remaining alternatives may be lost. For example, if a pilot elects to fly into hazardous weather, the alternative to circumnavigate the weather is automatically lost.

In the conventional decision-making process, a change may indicate some action by the pilot is required. A change from normal events; or from expected events; or from desired events should alert the pilot to the action. There sometimes is a difference between what you expect to happen (implying certainty) and what you hope will happen (implying uncertainty). For example, you depart on a flight into marginal weather, hoping that conditions will improve.

The occurrence of change must be detected before a response can be selected. There can be instances when a change may remain undetected for some time. A good example is a pilot who fails to compare actual groundspeed with the planned groundspeed from the flight log. A change has occurred even though it was not detected until later when the situation became critical and the aircraft was low on fuel.

Selection of the proper response relies on a number of elements that affect every pilot's level of situational awareness. These include a pilot's physical flying skills, knowledge, experience and training.

Skills

All experienced pilots can recall their first days as a student pilot. All of their energies were devoted simply to controlling the aircraft. Little time remained for traffic watch, navigation, or deep thoughts about the philosophical aspects of the art of flying. As a result, their awareness of the situations was often extremely low. Many of them are alive today only because their awareness was just high enough to cope with the situations which developed during their initial flight training.

Experienced pilots generally possess greatly improved skills and procedures. Thus many of these actions become almost automatic. As a result, they are able to devote much less of their time to physically flying the aircraft and more time to the mental aspects of flying. Their skills are, nevertheless, still extremely important. They must always attempt to sharpen these skills to ensure that more of their energies can be devoted to other important flying tasks.

Knowledge

Knowledge is the next defense against poor judgment in conventional decision making. Pilots must base the overall safety of any flight on their basic knowledge of the aircraft, the environment (including ATC procedures), the route being flown, weather, etc. They can prepare themselves to detect change by accomplishing thorough preflight preparation and planning, e.g., preparing a flight log, reviewing aircraft performance, calculating weight and balance, obtaining a complete weather briefing, etc. During the flight, the information prepared during preflight planning can be compared to the conditions encountered to determine if anything has changed which might affect the safe completion of the flight.

Experience and Training

Experience is practical knowledge, skill, or practice derived from direct observation of, or participation in, events or in a particular activity. We draw upon our experience every time we fly. In a sense, experience creates a mental file that helps pilots establish how conditions and events are interpreted and how they respond to them.

Many of the actions taken while flying are based on experience. Pilots constantly rely on experience to determine the correct action required for a given situation. In this way, experience allows them to solve problems quickly and, therefore, devote more time to other problems requiring their attention.

Many problems faced by pilots are solved before boarding the aircraft. By constantly reviewing emergency procedures, problems are solved simply by using experience to select the appropriate solution. The procedures associated with an engine failure on takeoff become automatic to the carefully trained pilot.

Experience and training are closely related. Training is more than simply an effort to perfect our systems knowledge and physical flying skills. Training is highly structured and represents the most efficient way to build experience.

However, conventional training programs tend to focus on skills and procedures (how to manipulate controls, perform the specific procedures for operating installed equipment, etc.) with only a minimal emphasis on headwork (how to make rational, systematic decisions based on situational conditions). Unfortunately, headwork, or decision making ability, is often developed informally by listening to "hanger flying" sessions and many times through narrow escapes (experience). In addition to this informal "training," better instructors and training programs always discuss previous accidents (case studies) so pilots can learn about mistakes of others. But most of this "training" is intended to provide a systematic approach to improved decision making (headwork) and information management skills.

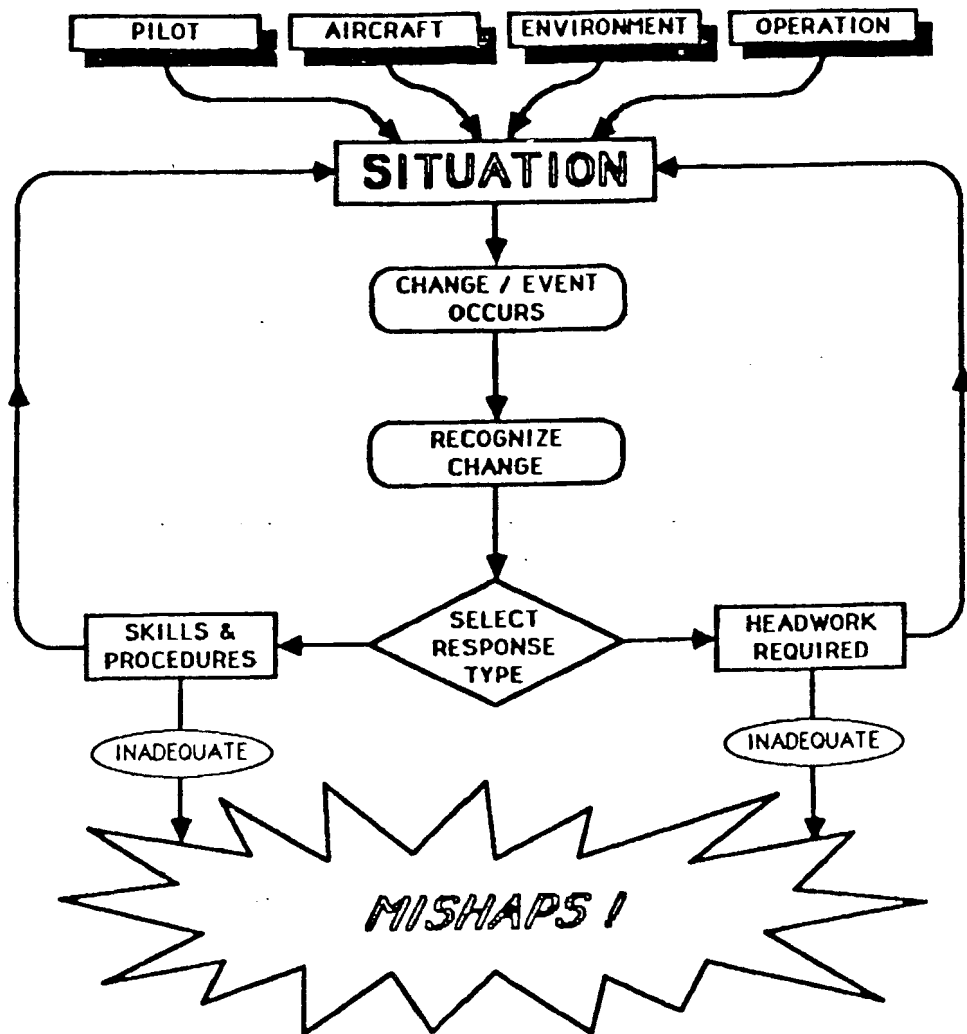


Figure 2.3 Conventional Decision-Making Process.

As shown in the figure 2.3, inadequate skills and procedures or inadequate headwork in conventional decision making leads to mishaps. Review of accident data reveals that there are several categories of pilot error. These include errors of omission - failing to do something one should have done; and those of commission - doing something one should not have done; timing errors - doing something too soon or too

late; errors involving degrees of response - overreacting or underreacting. It is worth keeping these types of mistakes in mind when examining the decision-making process.

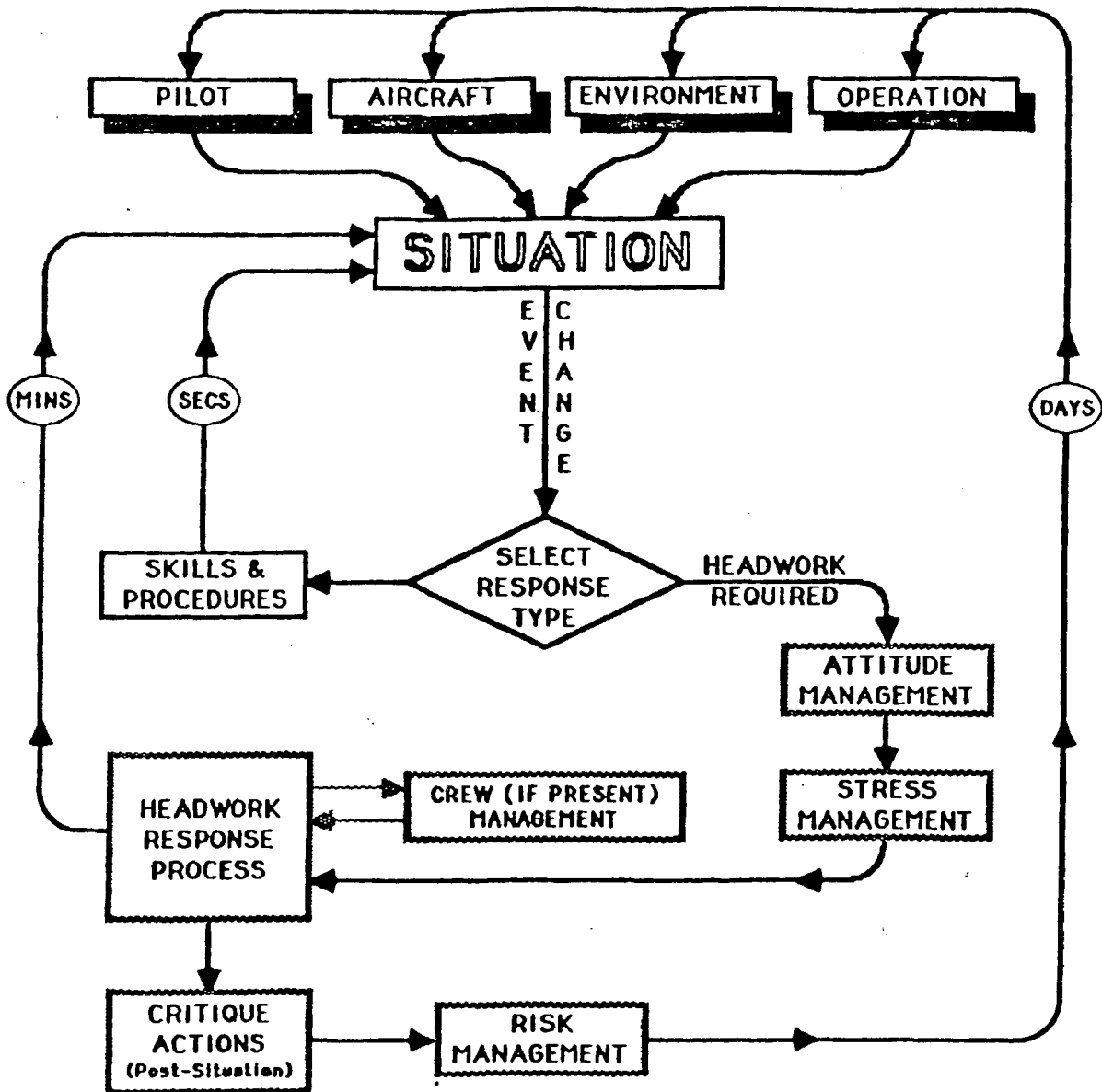


Figure 2.4 Aeronautical Decision-Making Process.

Aeronautical decision making (ADM) builds upon the foundation of conventional decision making, but modifies and enhances the process to decrease the probability of pilot error. ADM provides a structured approach to our reaction to change during a flight. This structured approach addresses all aspects of decision making in the cockpit and identifies the elements involved in good decision making. These include:

- 1) Identifying personal attitudes which are hazards to safe flight.
- 2) Learning behavior modification techniques.
- 3) Learning how to recognize and cope with stress.
- 4) Developing risk assessment skills.
- 5) Considering all resources available in a multi-crew situation.
- 6) Evaluating the effectiveness of your ADM skills.

As in conventional decision-making, such decision making skills start with recognition of change, assessment of impact/alternatives, decision to act (or not) and response. The ADM figure illustrates the interactions of these steps and how to produce a safe outcome.

Attitude Management

How a pilot handles his or her responsibilities as "pilot-in-command" depends to a large degree upon ingrained attitudes--toward safety, toward him or herself, and toward flying. Attitudes are learned and are not innate behavior. Good attitudes can be developed--again, through training--into a positive mental framework that encourages and produces good pilot judgment. On the other hand, bad pilot thinking habits created by previously learned poor attitudes can be "unlearned" or modified through training.

How positive attitudes toward flying can be learned is one aspect of this judgment and decision-making training. This aspect is discussed in detail in chapters 4, 5 and 6 of this manual.

Stress Management

Learning how to identify and cope with all aspects of stress which impact decision making is a second important aspect of ADM training. Both general life stress management and flight associated stress management are the topics discussed in Chapter 8. The importance of recognizing the presence of "stressors" in ourselves, the aircraft and the environment must be developed. The impact of stress on decision making is well documented in accident statistics. The goal of ADM training is to minimize this impact.

Headwork Response Process

The headwork response process involves orderly, timely decision making. The ADM program presents a process approach to decision making which differs from many of the traditional methods of teaching judgment based upon personality attributes. The traditional approach to pilot training is to teach student pilots the capabilities and flight characteristics of an aircraft and its systems; knowledge of the national airspace system; general knowledge of meteorology; regulations; emergency procedures and "stick and rudder" skills. The premise being that, if student pilots have this kind of information, they will be able to exercise the "good judgment" required to assure safe flight.

Since aeronautical decision making is a mental process, pilots can be taught to make good decisions in the first place or to diminish the impact of previous poor judgments. A pilot is expected to do more than skillfully resolve emergencies as they occur. It is equally important to actively avoid those situations that might lead to emergencies by recognizing early signs of impending trouble and taking corrective action before a critical situation can develop.

Finally, outcome predicting is a key element of the headwork response process. As a pilot considers an action, the consequences of taking, as well as not taking, that action must be carefully considered. To assist pilots in this process, the AOPA Air Safety Foundation has developed a decision-making training program based upon previous experience in researching the decision-making process. The initial decision model consisted of the following steps:

1. UNEXPECTED CHANGE OCCURS/EXPECTED CHANGE DOESN'T OCCUR/DESIRED CHANGE DOESN'T OCCUR - To the pilot, this begins the headwork response process. The key is that some change occurs in the flight, a change from normal, or from the expected condition, or from the desired condition. In the case of expectation, it seems that there is sometimes a difference between what a decision maker expects to happen (implying certainty) and what the decision maker may hope will happen (implying uncertainty).
2. CHANGE EMITS SIGNAL - The decision maker needs a signal from the change before reaction can begin. In many instances, the decision set is relatively brief and the change emits a signal. However, there are instances where the change may occur and the decision maker does not receive a signal for a period of time, e.g., a controller does not know if an aircraft is low on fuel until informed by the pilot. In this example, the decision set is operating even though the controller cannot act.
3. DECISION MAKER DETECTS SIGNAL - As mentioned previously, an important element in the process is the detection of change.
4. DECISION MAKER CORRECTLY PROJECTS SIGNAL MEANING - The pilot foresees the implication of the change on the outcome or success of the flight.
5. DECISION MAKER RECOGNIZED THE NEED TO COUNTER OR REACT TO CHANGE - Decision makers usually need to counter a change since many of the changes noted have potentially negative outcomes. In some instances, the change is benign in its occurrence, e.g., a controller may not react to a call from a pilot due to heavy involvement with other communications. Responding to a pilot's call is not an act of countering but is one of reaction.
6. DECISION MAKER SEEKS POSSIBLE ACTION OPTIONS - The decision maker recalls or seeks options to counter or react to the change.

7. DECISION MAKER ESTIMATES THE LIKELY OUTCOME OF THE OPTIONS SELECTED - This requires a projection of the events likely to occur from each of the selected options.
8. DECISION MAKER PICKS BEST ACTION TO CONTROL CHANGE - This is selecting an action that successfully modifies the change.
9. DECISION MAKER ACTS TO ADAPT TO THE CHANGE - Action is either taken or not taken.
10. DECISION MAKER WATCHES FOR EFFECTS OF THE COUNTERING ACTION OR REACTION - The decision maker may or may not stay involved in the decision process by monitoring his or her action to achieve the desired outcome.

For purposes of teaching pilots the elements of the decision-making process, the original model was too complex and was reduced to a six element decision process using the acronym "DECIDE." The steps in the DECIDE process are:

1. DETECT - The decision maker detects the fact that change has occurred.
2. ESTIMATE - The decision maker estimates the need to counter or react to change.
3. CHOOSE - The decision maker chooses a desirable outcome (in terms of success) for the flight.
4. IDENTIFY - The decision maker identifies actions which could successfully control the change.
5. DO - The decision maker takes action to adapt to the change.
6. EVALUATE - The decision maker evaluates the effect(s) of the action countering the change or reacting to it.

The six elements of the DECIDE model are a continuous-loop decision process which has been used during accident analysis and during the instruction of pilots of varying experience levels. Figure 2.5 graphically depicts how this condensed version of the original model provides a self-reinforcing training approach in the ADM training program.

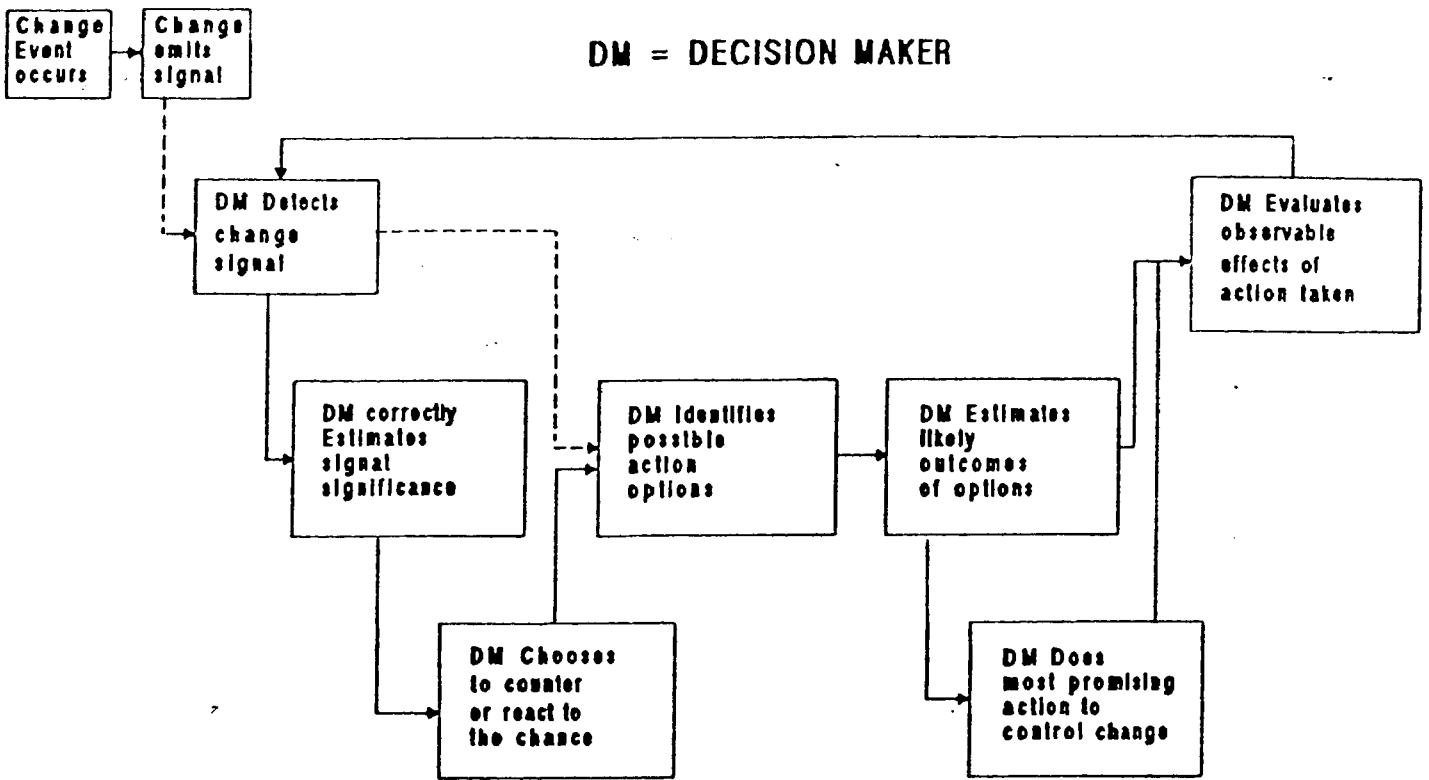
Risk Management

The effects of the change and its probable influence on the safe outcome of the flight must be continually evaluated. An assessment of the risks created by the change helps to focus on those alternatives which are realistic and will produce a safe outcome. This also forces a projection of the events likely to flow from each possible alternative, and, hopefully, will result in a rejection of those alternatives which are not realistic.

Risk management includes several previously discussed ADM subject areas such as pilot, aircraft, environment and operational pressures. It is necessary to make an educated guess how change will affect the outcome of the flight. Recognizing the need to react or counter change is the critical element in this step, regardless of whether the change is dramatic, requiring immediate attention, or the change takes place over time, allowing further analysis of the situation. Chapter 3 will discuss how to recognize, analyze and manage risk in detail.

Crew Management

This refers to cockpit resource management methods of making the best use of all crew members (when others are present) through proper communication and coordination techniques. This area is an important adjunct in individual decision making and is covered in more detail in a separate manual.



(Source: Adapted from HAZARDOUS MATERIALS EMERGENCIES, Events Analysis, Inc.)

Figure 2.5 Pilot Decision-Making Process Model.

3. BALANCING RISK WHILE FLYING

Every aspect of life involves some element of risk, regardless of whether you drive a car, ride a motorcycle--or fly an airplane. Pilots must learn to cope with the risks associated with flying to ensure years of safe flying.

The purpose of this chapter is to provide a way to manage major and minor risks that occur naturally as part of flying. No flight can be conducted without risk, so decision making is a continuous process of neutralizing that risk. The pilot should always be the one to take action in order to reduce or eliminate the effect of increased risk, and that action must be monitored to be sure it works.

Five Risk Elements

Chapter 2 presented the five subject areas and the ADM process which are important elements in assessing risk. Pilots need to have a systematic way of knowing where to look for risk. The five subject areas are also the five elements of risk in flying, which are:

- o Pilot--"P"
- o Aircraft--"A"
- o Environment--"E"
- o Operation--"O"
- o Situation--"S"

Each of these risk elements applies not only to the flight itself, but also to the "mission" or reason for the flight. For example, some risks such as unexpected precipitation may be encountered during a flight, but other risks such as the desire to reach home on a Sunday night prior to a big day at work are part of the flight before it ever leaves the ground.

When evaluating risk, a developing or potential hazard must first be detected, then the five risk elements must be reviewed. At this point, it would be useful to consider what makes up each risk element in greater detail.

Pilot

A pilot's performance may be affected in many ways during a flight. The "risk raisers," or things that affect pilots by raising the degree of risk, are called "stressors." The three types of pilot stressors are:

Physical stress - Conditions associated with the environment, such as temperature and humidity extremes, noise, vibration and lack of oxygen.

Physiological stress - Pilot physical conditions such as fatigue, lack of physical fitness, sleep loss, missed meals (leading to low blood sugar levels) and illness.

Psychological stress - Social or emotional factors such as a death in the family, a divorce, a sick child, a demotion at work, etc. This type of stress may also be related to mental workload such as analyzing a problem, navigating an aircraft, or making decisions.

Pilots must evaluate their stress level, and their ability to conduct a flight feeling adequately prepared and qualified. Chapter 8 discusses detailed methods for identifying, reducing and coping with stress while flying.

Aircraft

This risk element focuses on the aircraft equipment, its condition and its suitability for the "mission" or intended purpose of the flight. The best time to make this assessment is on the ground during preflight planning.

Part of this assessment is the condition of the aircraft. Do all of the radios work satisfactorily? Does the engine still develop adequate horsepower? Will the fuel endurance enable the flight to reach the intended destination with adequate reserve? These and other questions which relate to the aircraft form part of a pilot's assessment of the aircraft. Although many pilots already make such an assessment during preflight planning, few recognize it as part of a risk assessment process.

In flight, the assessment needs to be done continuously since conditions, such as winds aloft, change with time even if nothing dramatic appears to be happening. For example, no matter what the flight circumstances, fuel is being burned every instant the engine runs. A safe pilot frequently compares the onboard fuel load with the fuel required to bring the plane to a safe landing at the intended destination or at a diversion airport.

Environment

This risk element is wide reaching and includes situations outside the aircraft which might limit, modify or affect the aircraft, pilot and operational elements. One environmental "risk raiser" which pilots usually consider is weather. Considering the high involvement of weather in fatal general aviation accidents, this definitely deserves attention.

The regulations governing aircraft operations are another less obvious "risk raiser" that should be considered. Pilots must fly safely and legally in compliance with all applicable regulations. Another environmental aspect would be airports which may be used during the flight. Items such as density altitude, runway length, obstacles, landing aids, etc., must be considered before and during the flight.

Operation

As discussed in Chapter 2, the interaction of the pilot, aircraft and environment are influenced by the purpose of each flight operation. The three other risk elements must be evaluated in the context of the desirability of undertaking or continuing the flight as planned, e.g., pressure to arrive by a certain time, an advancing weather front, or fuel being consumed.

The passage of time can also be easily overlooked as a pilot sits in the cockpit totally involved in a problem, wondering how to cope with a worsening situation. If time is short or perceived to be short, impulsive and inappropriate actions may result. Time can complicate an already complex situation. The less time available, the greater the negative effect on the pilot.

Situation

The circumstances regarding a flight, when combined with the previous four risk elements, can increase the probability that an unsafe outcome will result. The combined effects of these risk elements lead into the overall situation which must be continuously evaluated. For example, a pilot feels pressured into keeping an appointment that is already scheduled, or to return home from a trip after traveling for several days. The weather is marginal and is not improving. After reassessing the first four risk elements, the pilot decides to delay the flight, not allowing the pressure of the situation to lead into an unsafe outcome.

How Pilots Assess Risk

Within each of the five risk elements, the individual risks which accumulate are called "risk raisers" since they work to raise the level of risk for the flight. In assessing risk, pilots must be aware of the possibilities for risk accumulation so they can determine the need for neutralizing or balancing the risk raisers. Risk can be assessed in a number of ways.

One way to become aware of risk in flying is to look at accident statistics. This can increase your awareness when evaluating the five risk elements during a particular flight. Figure 3.1 compares the accident rates for the various types of flying in general aviation. The category of personal and business flying has the second highest accident rate in general aviation next to aerial application operations.

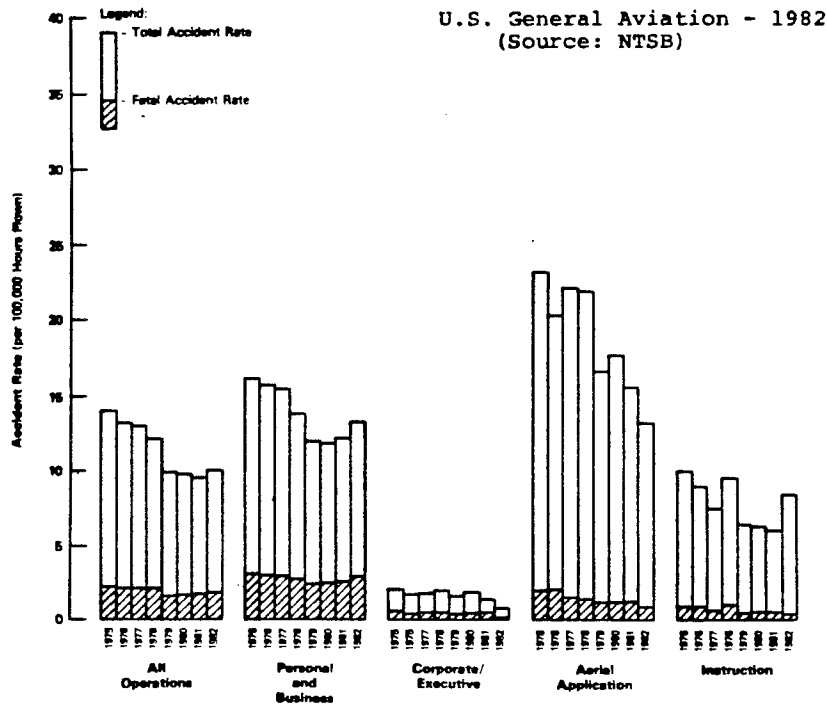


Figure 3.1 Accident Rates by Kind of Flying.

Figure 3.2 indicates that the accident rate for single-engine airplanes is the highest for all general aviation airplane operations. To help evaluate risk, it is useful to review accident data for these type airplanes. Table 3.1 lists the ten most common cause/factors of accidents in fixed-wing aircraft. The majority of these accident causes reflect the unsafe outcome of the pilot's decision-making process.

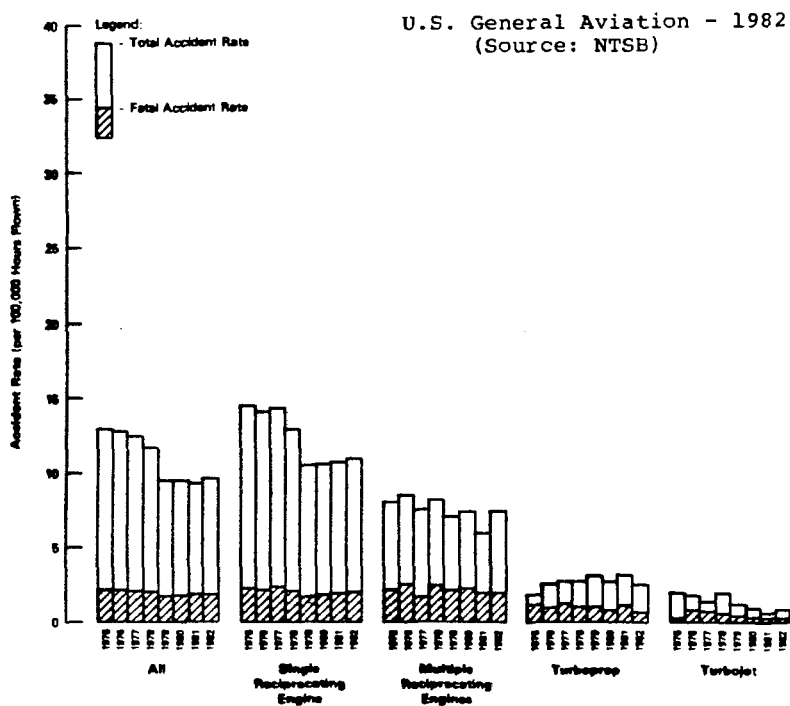


Figure 3.2 Accident Rates by Type of Power.

TOP TEN CAUSES
FOR ALL FIXED WING AIRCRAFT - 1982
(SOURCE: NTSB)

- 1) Pilot - Failed to maintain directional control.
- 2) Undetermined.
- 3) Pilot - Failed to maintain airspeed.
- 4) Pilot - Misjudged distance.
- 5) Fuel exhaustion.
- 6) Pilot - Inadequate preflight preparation and/or planning.
- 7) Pilot - Selected unsuitable terrain.
- 8) Pilot - Inadequate aircraft preflight.
- 9) Pilot - Inadequate visual lookout.
- 10) Pilot - Misjudged airspeed.

Table 3.1

Knowing the phase of operation in which accidents occur can also increase pilot awareness when evaluating the five risk elements. Figure 3.3 lists general aviation aircraft accidents by phase of flight, and indicates that during 1982, the largest number of accidents (27.1 percent) occurred during landing; 21.5 percent occurred during takeoff; and 19 percent occurred during cruise.

The data in Figure 3.3 indicate that risk should be carefully evaluated for landing, since almost 25 percent of aircraft accidents occurred during flare/touchdown and roll-out. Pilots should ask themselves before takeoff, "Am I proficient enough to safely land this airplane after evaluating all applicable landing environment items such as density altitude, obstructions, crosswind, runway lengths, surface and slope? Have I calculated the aircraft's weight and balance, reviewed the performance charts, and compared the crosswind component with the maximum crosswind limitation of the airplane?"

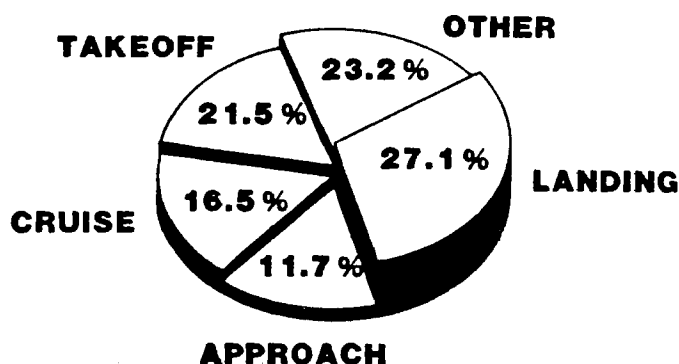


Figure 3.3 Accidents by Phase of Operation (1982).

In 1982, 14 percent of the accidents occurred during initial climb after takeoff. In addition to evaluating the previously mentioned landing items, pilots should review the procedures for responding to an emergency during takeoff, e.g., an engine failure during ground run, liftoff and initial climb. These and other possible emergencies should be reviewed and practiced with an instructor if you do not believe you are proficient.

During cruise, pilots must continue to be alert for emergencies such as engine failure, electrical or engine fire, loss of oil pressure, etc. Limits which you will not exceed must be established in the event conditions deteriorate beyond your abilities, e.g., clouds, visibility and winds.

Figure 3.4 presents accident rates for noninstrument-rated pilots flying single-engine airplanes at night in visual meteorological conditions. With some experience, most pilots learn that night flying is truly an instrument flying situation no matter if in visual or instrument flight conditions. The rates presented are for total pilot time, and indicate a high rate for pilots with less than 51 hours. The rate decreases by 50 percent once a pilot obtains 100 hours, and continues to decrease until obtaining 1,000 hours.

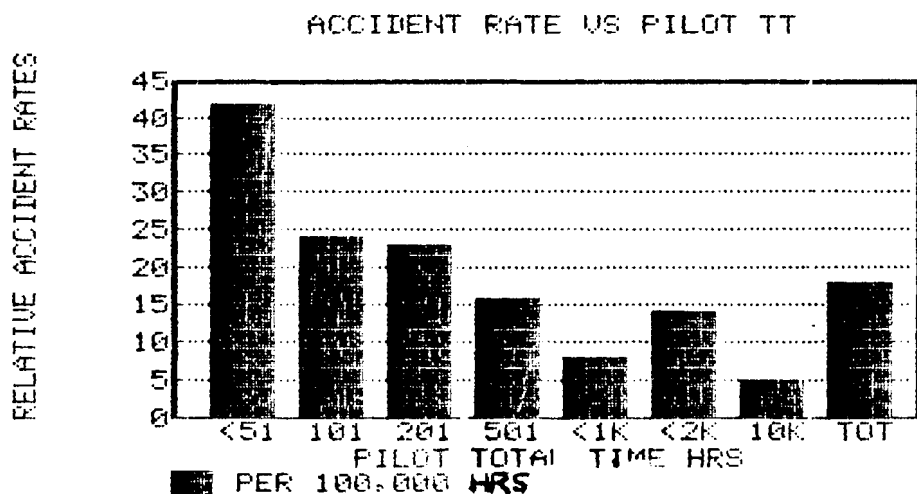


Figure 3.4 Accident Rate vs Pilot Total Time for Noninstrument-Rated Pilots Operating Single-Engine Airplanes in Night Visual Meteorological Conditions.

The data in Figure 3.4 suggests that for the first 500 hours, pilots flying at night should establish higher personal limits than are required by the regulations for VFR flight and apply instrument flying skills to this flight environment. For example, it would be risky to fly at night over mountainous terrain in marginal VFR conditions; or at night with an overcast sky over terrain with few visual references, or with precipitation. These are examples that may have lead you to obtain an instrument rating.

Deal Yourself A Good Hand

Good aeronautical decision making requires a continuous assessment of whether to start a particular flight or to continue a flight as planned. Assume that your evaluation of each of the five risk elements is now a "go/no go" decision. Assign each risk element to the fingers of one hand as shown in Figure 3.5.

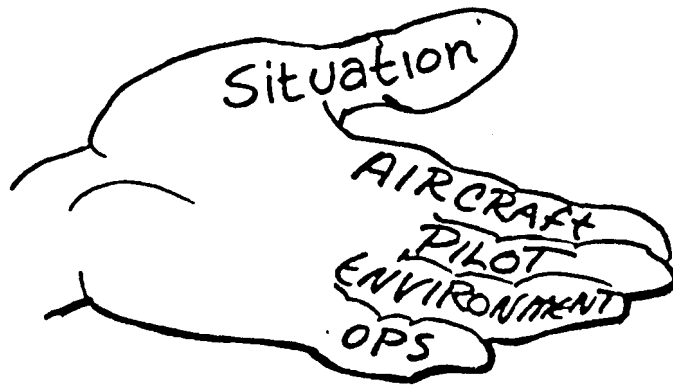


Figure 3.5 The Elements of Risk.

Begin the evaluation with a closed fist and raise one finger for each risk element that you believe is safe for the flight, e.g., raise the finger for the aircraft if you are confident that the airplane will fulfill the purpose for the flight. If you end up with less than a full hand with all fingers extended, reevaluate whether the flight should be conducted or continued. Consider how the "no go" risk elements could be changed, e.g., waiting for better weather, utilizing a more capable aircraft, taking a qualified passenger who can ease your workload by performing communications or navigation duties, etc.

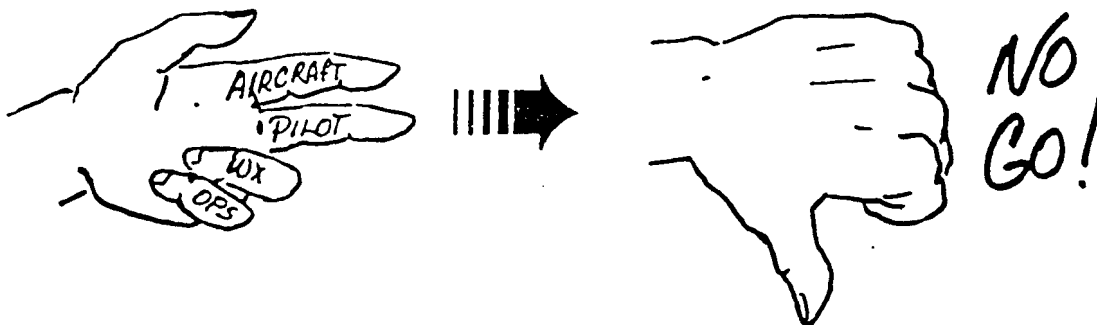


Figure 3.6 Risk Element Evaluation.

A good decision maker in aviation does not act hastily upon "gut" feelings. With an accurate assessment of the risks associated with each of the five risk elements, pilots are best able to arrive at decisions that ensure a safe conclusion to a flight, even if it means not taking off. The measure of good decision making in flying is maintaining the pilot, passengers and aircraft in good health and condition no matter the airport at which the takeoff and landing occurs.

4. THE ATTITUDE INVENTORY FOR INSTRUMENT PILOTS

Each of us develops strategies over the years to best accomplish our goals of dealing with life and the people around us. Some of these strategies become deeply ingrained and are known as personality traits. These traits are well established by the age of six and are difficult to change thereafter. Attitudes are strategies less deeply ingrained, which can be changed, especially under pressure from several sources at the same time. We are constantly bombarded with attempts to change our attitudes by teachers, theologians, advertising, parents, peers and superiors.

Attitudes can be subdivided into attributes that are known to affect pilot decision making. The following questionnaire will assist you in evaluating your own attributes as a pilot decision maker. Answer the questions as honestly as possible. Your honest responses will greatly improve your performance in this training program. There are no right or wrong answers, and you need not reveal the results to anyone. The sole purpose of this questionnaire is to help determine your decisional attributes as an instrument pilot. Following the questionnaire, you will be shown how to score and interpret the results.

The Attitude Inventory for Instrument Pilots

Instructions:

1. Use the scoring key on the next page.
2. Read over each of the five situations and the five choices. Decide which one is the most likely reason why you might make the choice that is described. Place a numeral 1 in the space provided on the answer sheet.
3. Continue by placing a 2 by the next most probable reason, and so on, until you have filled in all five blanks with ratings of 1, 2, 3, 4 and 5.
4. Do all 10 situations and fill in each blank, even though you may disagree with the choices listed. Remember, there are no correct or "best" answers.

Example:

- a. 1 (your most likely response)
- b. 3
- c. 5 (your least likely response)
- d. 2
- e. 4

THE ATTITUDE INVENTORY FOR INSTRUMENT PILOTS

Scoring Key

Situation	<u>Scale I</u>	<u>Scale II</u>	<u>Scale III</u>	<u>Scale IV</u>	<u>Scale V</u>	<u>Total</u>
1	a. ____	d. ____	e. ____	b. ____	c. ____	15
2	d. ____	c. ____	b. ____	a. ____	e. ____	15
3	c. ____	b. ____	e. ____	d. ____	a. ____	15
4	b. ____	a. ____	c. ____	d. ____	e. ____	15
5	c. ____	d. ____	b. ____	a. ____	e. ____	15
6	d. ____	a. ____	b. ____	c. ____	e. ____	15
7	d. ____	e. ____	c. ____	a. ____	b. ____	15
8	d. ____	a. ____	e. ____	b. ____	c. ____	15
9	e. ____	d. ____	a. ____	b. ____	c. ____	15
10	b. ____	e. ____	c. ____	a. ____	d. ____	<u>15</u>
Total	____	____	____	____	____	150

The sum of your scores across should be 15 for each situation. If it is not, go back and make sure that you transferred the scores correctly and check your addition. The grand total should be 150.

Situation 1

Nearing the end of a long flight, your destination airport is reporting a ceiling of 800 feet and 1/2 mile visibility, fog and haze. You have just heard another aircraft miss the approach (ILS minimums are 200 and 1/2). You decide to attempt the ILS approach. Why did you make the attempt?

- a. Ceiling and visibility estimates are often not accurate.
- b. You are a better pilot than the one who just missed the approach.
- c. You might as well try, you can't change the weather.
- d. You are tired and just want to land now.
- e. You've always been able to complete approaches under these circumstances in the past.

Situation 2

You plan an important business flight under instrument conditions in an aircraft with no deicing equipment through an area in which "light to moderate rime or mixed icing in clouds, and precipitation above the freezing level," has been forecast. You decide to make the trip, thinking:

- a. You believe that your altitudes en route can be adjusted to avoid ice accumulation.
- b. You've been in this situation many times and nothing has happened.
- c. You must get to the business meeting in two hours and can't wait.
- d. You do not allow an icing forecast to stop you; weather briefers are usually overly cautious.
- e. There's nothing you can do about atmospheric conditions.

Situation 3

You arrive at the airport for a flight with a friend and plan to meet another friend who is arriving on a commercial airplane at your destination. The airplane you scheduled has been grounded for avionics repairs. You are offered another airplane equipped with unfamiliar avionics. You depart on an instrument flight without a briefing on the unfamiliar equipment. Why?

- a. If the avionics are so difficult to operate, the FBO would not have "offered" the plane as a substitute.
- b. You are in a hurry to make the scheduled arrival.
- c. Avionics checkouts are not usually necessary.
- d. You do not want to admit that you are not familiar with the avionics.
- e. You probably won't need to use these radios anyway.

BLANK

Situation 7

You are in instrument meteorological conditions and are receiving conflicting information from the two VOR receivers. You determine that the radios are out-of-tolerance and cannot determine your position. You believe ATC will soon suggest that you are off course and request a correction. You are thinking:

- a. Try to determine your position so ATC won't find out that you are lost.
- b. You will continue to navigate on the newer VOR receiver; it should work just fine.
- c. You will get out of this jam somehow, you always do.
- d. If ATC calls, you can be non-committal. If they knew all, they would only make things worse.
- e. Inform ATC immediately that you are lost and wait impatiently for a response.

Situation 8

During an instrument approach, ATC calls and asks how much fuel you have remaining. You have only two minutes before reaching the missed approach point, and wonder why they have inquired as to your fuel status. You are concerned about severe thunderstorm activity nearby and assume that you may be required to hold. You believe that:

- a. Your fuel status is fine, but you want to land as soon as possible before the thunderstorm arrives.
- b. You are in line with the runway and believe that you can land, even in any crosswind that might come up.
- c. You will have to complete this approach; the weather won't improve.
- d. You won't allow ATC to make you hold in potentially severe weather; it's not their neck.
- e. The pilot who landed ahead of you completed the approach without any problems.

Situation 9

You are a new instrument pilot conducting an instrument flight of only twenty miles. The turn coordinator in your airplane is malfunctioning. The visibility is deteriorating, nearing approach minimums at your destination. You make this trip thinking:

- a. You've never had a need to use the turn coordinator.
- b. You recently passed the instrument flight test and believe you can handle this weather.
- c. Why worry about it; ATC will get you out anyway.
- d. You had better get going now before you get stuck here.
- e. Backup systems are not needed for such a short trip.

Situation 10

You are on an instrument flight and encounter clear air turbulence. You are not wearing a shoulder harness and do not put it on. Why not?

- a. Putting on a shoulder harness might give the appearance that you are afraid; you don't want to alarm your passengers.
- b. Shoulder harness regulations are unnecessary for en route operations.
- c. You haven't been hurt thus far by not wearing your shoulder harness.
- d. What's the use in putting on a shoulder harness; if it's your time, it's just your time.
- e. You need to maintain aircraft control; there's no time for shoulder harnesses.

THE ATTITUDE INVENTORY PROFILE

Total Raw Scores (from Scoring Key):

Place an "X" on the score that corresponds to your score on each of the scales below. You have completed your Attitude Inventory Profile. The scales and their significance to your decision making as an instrument pilot are explained in Chapter 6.

Scale I	Scale II	Scale III	Scale IV	Scale V
_____ 10	_____ 10	_____ 10	_____ 10	_____ 10
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____ 20	_____ 20	_____ 20	_____ 20	_____ 20
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____ 30	_____ 30	_____ 30	_____ 30	_____ 30
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____ 40	_____ 40	_____ 40	_____ 40	_____ 40
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____ 50	_____ 50	_____ 50	_____ 50	_____ 50

5. PRACTICE IN IDENTIFYING HAZARDOUS ATTITUDES

Better Decision Making Through Practice

This chapter is designed to help you identify and understand the five hazardous attitudes and to see how they can influence your reaction to situations requiring judgment. The five hazardous attitudes are:

I	ANTI-AUTHORITY	"The regulations are for someone else."
II	IMPULSIVITY	"I must act now-there's no time."
III	INVULNERABILITY	"It won't happen to me."
IV	MACHO	"I'll show you. I can do it."
V	RESIGNATION	"What's the use?"

The definitions for these five attitudes are:

I. Anti-authority - This attitude is found in pilots who resent any external control over their actions. It is a tendency to disregard rules and procedures.

II. Impulsivity - This attitude is found in pilots who act quickly, usually in the manner that first comes to mind.

III. Invulnerability - This attitude is found in pilots who act as though nothing bad can happen to them.

IV. Macho - This attitude is found in pilots who continually try to prove themselves better than others. They tend to act overconfident and attempt difficult tasks for the admiration it gains them.

V. Resignation - This attitude is found in pilots who feel that they have little or no control over their circumstances. They are resigned to let things be as they are. They may deny that the situation is as it appears. They are likely to fail to take charge of the situation. They may also let other people or commitments influence their decision making.

Below you will find another series of true flying situations. At the end of each situation, you will be asked to select an alternative which best illustrates the reactions of a pilot who has a particular hazardous attitude. After you select what you feel is the best alternative, look immediately at the adjacent page for the proper response. This page will tell you if your answer is correct or incorrect. If you answered correctly, go on to the next situation. If you answered incorrectly, you will be told why. Then go back to the situation and select another alternative.

KEEP SELECTING ALTERNATIVES UNTIL YOU SELECT THE CORRECT ONE. Do not be concerned if you select a wrong alternative. You will learn something from the feedback given to you. The lessons are deliberately repetitious and, thus, get easier as you go along.

THE ANTI-AUTHORITY HAZARDOUS ATTITUDE

From the five choices following each situation, pick the ONE choice that is the best example of an anti-authority hazardous attitude. Check your answers on the next page before continuing. REMEMBER --if you did not choose the correct answer, select another until you choose the correct one.

Situation 1:

You approach the VOR and the controller asks if you want to execute the entire VOR procedure or will accept a right turn of more than 90 degrees to intercept the final approach course. You state that you will make the turn directly onto final at 2,000 feet though this will press you to get established on the approach. Which of the following alternatives best illustrates the ANTI-AUTHORITY reaction?

- a. It wasn't your idea to make the approach like this.
- b. No controller is going to influence your flying.
- c. You don't need the full approach, you know you are a good instrument pilot.
- d. You are in a hurry and don't wish to bother with the full approach.
- e. You know the controllers will be impressed with this approach.

A GOOD ATTITUDE..."Make as much time available on an approach as possible, you may need it."

Situation 2:

You are advised of the current destination weather: "ceiling 400 feet, visibility two miles..." The published minimum descent altitude is 400 feet above ground level. From your communications with ATC, it is apparent you are experiencing some course problems due to a malfunctioning directional gyro (DG). In spite of this you elect to continue the approach. Which of the following alternatives best illustrates the ANTI-AUTHORITY reaction?

- a. You know you can make the approach, you've been in worse situations and have come through.
- b. Minimums are quite conservative and you know you can dip down just enough to get in.
- c. You don't like to fly with malfunctioning equipment and want to land immediately.
- d. Wait till the guys hear this one!
- e. It's not your fault the DG isn't working, so you might as well try it.

A GOOD ATTITUDE..."Stay on the ground if you find yourself with an airplane inadequate for the task at hand--especially under instrument conditions."

RESPONSE LIST 1

THE ANTI-AUTHORITY HAZARDOUS ATTITUDE

Situation 1:

Alternative a: By assuming someone else has responsibility for your approach, you exhibit a "what's the use?" attitude. Go back to Situation 1 and select another alternative.

Alternative b: Correct. "The regulations are for someone else" attitude assumes controllers are interfering with your business. You are thinking in an anti-authority manner. Go on to Situation 2.

Alternative c: Here you are taking the "it won't happen to me" stand. You think of yourself as invulnerable. Go back to Situation 1 and select another alternative.

Alternative d: This is the hazardous thought of impulsivity: "I must act now--there's no time." Go back to Situation 1 and select another alternative.

Alternative e: Whenever your wish to impress someone influences your decision, this is the macho attitude: "I'll show you. I can do it." Go back to Situation 1 and select another alternative.

Situation 2:

Alternative a: Invulnerability emphasizes "it won't happen to me." Go back to Situation 2 and select another alternative.

Alternative b: Absolutely! This is the anti-authority attitude where the rules are for someone else. Go on to Situation 3.

Alternative c: Decisions made in haste characterize the impulsivity hazardous thought pattern, "I must act now--there's no time." Go back to Situation 2 and select another alternative.

Alternative d: No. This kind of thinking typifies the macho attitude. Go back to Situation 2 and select another alternative.

Alternative e: This kind of response suggests an attitude of resignation --"What's the use?" You have no control over the events. Go back to Situation 2 and select another alternative.

THE IMPULSIVITY HAZARDOUS ATTITUDE

From the five choices following each situation, pick the ONE choice that is the best example of an impulsivity hazardous attitude. Check your answers on the next page before continuing. REMEMBER - if you did not choose the correct answer, select another until you choose the correct one.

Situation 1:

You recently had a turbocharger installed in your aircraft. At 10,000 feet on an IFR flight, you sense a slight change in the sound of the engine. Minutes later, a vibration begins and you detect an odd, hot smell in the cockpit. Which of the following alternatives best illustrates the IMPULSIVITY reaction?

- a. Nothing will happen, you just had the engine overhauled.
- b. You figure there isn't anything you can do, it is your mechanic's fault.
- c. You don't want to tell ATC, they might try to tell you what to do.
- d. You immediately chop the power, open the wastegate, push the nose over and call ATC.
- e. You immediately chop the power, open the wategate, push the nose over the call ATC.

A GOOD ATTITUDE...."Haste makes waste."

Situation 2:

You and a colleague are leaving on a business trip early one summer morning. Before visiting the flight service station, it is CAVU outside. You find out that extensive fog is forecast. When you go outside, the fog has rolled in and visibility is less than minimums. Nevertheless, you preflight and prepare for departure. Which of the following alternatives best illustrates the IMPULSIVITY reaction?

- a. You have to be on time to this meeting or your boss will not let you fly on business any more.
- b. You've never had to abort a takeoff or return to your departure point in the past; you'll be all right.
- c. Weather briefers always try to make it sound worse that it really is. They aren't usually right.
- d. This is great. You can show your colleague how good you are.
- e. You can't change the conditions, so you might as well go.

A GOOD ATTITUDE...."Always leave an option open."

RESPONSE LIST 2

THE IMPULSIVITY HAZARDOUS ATTITUDE

Situation 1:

Alternative a: No. This is the "It won't happen to me" attitude of being invulnerable. Go back to Situation 1 and select another alternative.

Alternative b: Putting the responsibility on someone else shows the attribute of resignation. Go back to Situation 1 and select another alternative.

Alternative c: Resenting the authority of someone else or thinking the "Regulations are for someone else" exhibits the anti-authority hazardous thought pattern. Go back to Situation 1 and select another alternative.

Alternative d: No. This is showing the macho attitude of "I can do it." Go back to Situation 1 and select another alternative.

Alternative e: Absolutely! "I must act now--there's no time" is the thought behind this alternative. Go on to Situation 2.

Situation 2:

Alternative a: That's correct. "I must act now--there's no time" shows you are acting impulsively. Go on to the next hazardous attitude.

Alternative b: Thinking that you have always been ok, in the past, and that "it won't happen to me" is the invulnerability hazardous thought pattern. Go back to Situation 2 and select another alternative.

Alternative c: No, This is the anti-authority attitude that the Regs and rules are for somebody else and don't really apply to you. Go back to Situation 2 and select another alternative.

Alternative d: "I'll show you, I can do it" is the macho attitude. Go back to Situation 2 and select another alternative.

Alternative e: Accepting that you cannot do anything to change the situation is using the resignation hazardous thought pattern. Go back to Situation 2 and select another alternative.

THE INVULNERABILITY HAZARDOUS ATTITUDE

From the five choices following each situation, pick the ONE choice that is the best example of an invulnerability hazardous attitude. Check your answers on the next page before continuing. REMEMBER - if you did not choose the correct answer, select another until you choose the correct one.

Situation 1:

You are en route to your destination which is five miles inside a Group I TCA. Your destination is reporting marginal VFR conditions, so you cancel the IFR flight plan and skirt in under the lower limit of the TCA, requesting a special VFR landing. Which of the following alternatives best illustrates the INVULNERABILITY reaction?

- a. There is really nothing ATC could do to help in this situation anyway.
- b. You do this all the time, no problem.
- c. TCA's are just another control device put on pilots.
- d. This is the first idea that comes to mind, you go for it.
- e. This is the way the good pilots do it.

A GOOD ATTITUDE..."Accept all the help you can get."

Situation 2:

You've made this approach at least one hundred times, many times down to minimums. The early morning ground fog these summer mornings presents an even more challenging picture. You reach the MDA, straining to see the runway environment. Just as the "TO/FROM" indicator flips, you catch a glimpse of what you know must be the end of the runway. You attempt a landing. Which of the following alternatives best illustrates the INVULNERABILITY reaction?

- a. You've made this approach so many times, you could do it with your eyes shut.
- b. You know the minimums can be fudged, just a bit.
- c. There's really nothing to this, all's well that ends well.
- d. Land it now, there's no time to waste.
- e. I hope luck is with me now, it's out of my control.

A GOOD ATTITUDE...."Make sure that the runway is in the eye of the beholder."

RESPONSE LIST 3

THE INVULNERABILITY HAZARDOUS ATTITUDE

Situation 1:

Alternative a: This is an attitude of resignation --"What's the use?"
Nobody can help me anyway. Go back to Situation 1 and select another
alternative.

Alternative b: You're right! Invulnerability hazardous thoughts include
"It won't happen to me." Go on to Situation 2.

Alternative c: No. "Regulations are for someone else" is the anti-authority
attitude. Go back to Situation 1 and select another alternative.

Alternative d: The need to "act now" is shown here. This is the impulsivity
hazardous thought pattern. Go back to Situation 1 and select another
alternative.

Alternative e: Identifying with the thought "I can do it" is the macho
attitude. Go back to Situation 1 and select another alternative.

Situation 2:

Alternative a: No. This is the macho attitude. Go back to Situation 2 and
select another alternative.

Alternative b: Thinking "the regulations are for someone else" is the
hazardous thought of anti-authority. Go back to Situation 2 and select
another alternative.

Alternative c: Correct. "It won't happen to me" is the attitude of being
invulnerable. Go on to the next hazardous attitude.

Alternative d: No. "I must act now--there's no time" is the hazardous
attitude of impulsivity. Go back to Situation 2 and select
another alternative.

Alternative e: Believing that the situation is out of your control is
the resignation hazardous attitude. Go back to Situation 2 and
select another alternative.

THE MACHO HAZARDOUS ATTITUDE

From the five choices following each situation, pick the ONE choice that is the best example of a macho hazardous attitude. Check your answers on the next page before continuing. REMEMBER - if you did not choose the correct answer, select another until you choose the correct one.

Situation 1:

On a trip to the west coast, you make an en route refueling stop at an airport in the Rockies. After refueling, the density altitude prior to your departure is reported as 10,500 feet. You are at maximum takeoff weight when you depart. At the present rate of climb, you will just barely clear the minimum crossing altitude (MCA) at the next intersection on your route of flight. Which of the following alternatives best illustrates the MACHO reaction?

- a. There is really nothing you can do about it; it is up to ATC to make sure you clear.
- b. The MCA's have plenty of leeway for clearance. So what if you're a little low.
- c. Don't worry, you're a good pilot and will make it.
- d. When you see that you cannot climb enough, you immediately inform ATC of your situation without determining your intentions.
- e. Mountain flying isn't any different and you've never run into any problems before. Nothing will happen.

A GOOD JUDGMENT THOUGHT..."Understand and use your aircraft performance Charts."

Situation 2:

On an IFR flight plan, you emerge from a cloud to find yourself within three-hundred feet of a helicopter. Which of the following alternatives best illustrates the MACHO reaction?

- a. You're not too concerned, everything will be alright.
- b. You should fly a little closer, just to show him
- c. It's not your responsibility to keep separated.
- d. You quickly turn away and dive to avoid a collision.
- e. With events like this, why should you ever follow the rules?

A GOOD ATTITUDE..."Fly defensively."

RESPONSE LIST 4

THE MACHO HAZARDOUS ATTITUDE

Situation 1:

Alternative a: Assuming someone else is responsible for you is the resignation hazardous attitude. Go back to Situation 1 and select another alternative.

Alternative b: "The regulations are for someone else" and not necessarily for you is thinking in the anti-authority mode. Go back to Situation 1 and select another alternative.

Alternative c: Right! Thinking "I'll show you. I can do it" is the macho hazardous attitude. Go on to Situation 2.

Alternative d: Acting before thinking is exercising the impulsivity hazardous attitude. Go back to Situation 1 and select another alternative.

Alternative e: Saying that nothing will happen to you is acting invulnerable. Go back to Situation 1 and select another alternative.

Situation 2:

Alternative a: No. This is the attitude that you have never had problems before and it would never happen to you. Go back to Situation 2 and select another alternative.

Alternative b: That's it. Macho hazardous thoughts include "I'll show you." Go on to the next hazardous attitude.

Alternative c: Taking for granted that you are not in control is the hazardous attitude of resignation. Go back to Situation 2 and select another alternative.

Alternative d: This is acting on impulse; "I must act now, there's no time." Go back to Situation 2 and select another alternative.

Alternative e: An attitude that the rules do not have to be followed shows the anti-authority hazardous attitude. Go back to Situation 2 and select another alternative.

THE RESIGNATION HAZARDOUS ATTITUDE

From the five choices following each situation, pick the ONE choice that is the best example of a resignation hazardous attitude. Check your answers on the next page before continuing. REMEMBER - if you did not choose the correct answer, select another until you choose the correct one.

Situation 1:

You are pilot in command of an IFR flight in instrument meteorological conditions (IMC). You have just encountered embedded thunderstorms on your route of flight. Which of the following alternatives best illustrates the RESIGNATION reaction?

- a. What's a little storm? You always come through these situations.
- b. Quick, turn around to get out of it.
- c. Though your instructor taught you to slow down in turbulence, you're going to bore right through this as fast as possible. What did he know?
- d. It's ATC's responsibility to keep you out of the weather.
- e. You can handle this like a pro.

A GOOD ATTITUDE...."If caught in a storm, follow procedures."

Situation 2:

You have just run one of your two fuel tanks dry. It is apparent that the fuel gauges and fuel flow meter are not indicating properly. You are in IMC at night. Which of the following alternatives best illustrates the RESIGNATION reaction?

- a. You can really show them now!
- b. You can still make your destination; those reserve requirements are just formalities.
- c. Well, that's the way things go. There's nothing you can do.
- d. You've been in tight spots before and everything always works out.
- e. You must land now, there is no time.

A GOOD ATTITUDE...."Cross check your fuel consumption."

RESPONSE LIST 5

THE RESIGNATION HAZARDOUS ATTITUDE

Situation 1:

- Alternative a: Assuming nothing will happen to you is the attitude of invulnerability. Go back to Situation 1 and select another alternative.
- Alternative b: No. This is acting on impulse. Go back to Situation 1 and select another alternative.
- Alternative c: Going against an authority figure is the anti-authority attitude. Go back to Situation 1 and select another alternative.
- Alternative d: Correct! This is the hazardous attitude of resignation. The acceptance of the fact that the situation is not in your control and you cannot change things typifies this attitude. Go to Situation 2.
- Alternative e: "I can do it" is the macho attitude. Go back to Situation 1 and select another alternative.

Situation 2:

- Alternative a: No. "I'll show them" reflects in the macho hazardous attitude. Go back to Situation 2 and select another alternative.
- Alternative b: "The regulations are for someone else" is the hazardous attitude of anti-authority. Go back to Situation 2 and select another alternative.
- Alternative c: Yes. This idea of not being able to control the situation is the hazardous attitude of resignation. Go on to the next exercise.
- Alternative d: The invulnerability hazardous attitude involves not believing that it could happen to you. Go back to Situation 2 and select another alternative.
- Alternative e: No. This is the attitude of impulsivity. "I must act now, there's not time." Go back to Situation 2 and select another alternative.

6. POSITIVE RESPONSES FOR HAZARDOUS ATTITUDES

From working with the five hazardous attitudes in the previous chapter, you are more aware of the need to be alert to these attitudes in your own thinking. This is the first step in eliminating these attitudes from your decision making. At the end of Chapter 4, you drew a profile of the attitudes reflected in your answers to the attitude inventory. Turn back to that profile, on page 31, and note the pattern of peaks that apply to you. The peaks indicate possible hazardous attributes in your own decision making. Remember, everyone has a full array of attitudes, including these, so your goal is not to eliminate them so much as to recognize them and learn to control them.

This chapter is designed to teach you a way to counteract hazardous attitudes so that they do not affect your actions. To do this, MEMORIZE THE ANTIDOTES for each of the hazardous attitudes. Know them so well that they will automatically come to mind when you need them.

THE FIVE ANTIDOTES

<u>Hazardous Attitude</u>	<u>Antidote</u>
Anti-authority "The regulations are for someone else."	"Follow the rules. They are usually right."
Impulsivity "I must act now, there's no time."	"Not so fast. Think first."
Invulnerability "It won't happen to me."	"It could happen to me."
Macho "I'll show you. I can do it."	"Taking chances is foolish."
Resignation "What's the use?"	"I'm not helpless. I can make a difference."

ANTIDOTE IDENTIFICATION EXERCISE

Each of the following situations contains a description of what is happening in a flight and what the pilot is thinking. Each situation contains several hazardous attitudes. After reading the situation, identify as many hazardous attitudes as you can. Underline and number each sentence containing hazardous attitudes. Then write the name of each hazardous attitude and the ANTIDOTE in the space provided at the end of the page.

Check your responses with those identified in the key after you have completed the scenario. Your responses should closely match the hazardous attitude responses found in the key. Although some situations can be interpreted in more than one way, your answers should agree with at least three of the hazardous attitudes and you should have written the antidotes WORD FOR WORD in your responses.

Situation 1

The pilot is a 31 year-old Western Texas oil field worker who is working on his instrument rating. He has minimal night experience. One Friday, he works a full shift in the oil fields and then has a friend fly him to Midland, Texas. He intends to rent an airplane, fly home to Colorado City, Texas, pick up his family and continue to Memphis, Tennessee. The FBO manager at Midland advises the pilot to stay overnight and continue to Memphis in the morning. The pilot says he wants to beat a cold front to Memphis, and likes to fly at night. He departs at 5 p.m. with full tanks.

His friend is waiting at Colorado City, and watches the pilot attempt three downwind landings. He barely gets the plane stopped before the end of the 3,000-foot runway. The pilot loads his passengers: wife, five-year-old son, and three-year-old daughter. His friend suggests waiting until the next morning. The pilot is eager to start. The friend asks if he wants the airplane fueled. The pilot says he is in a hurry and has plenty of fuel to reach Texarkana, Arkansas, where he plans to refuel. They leave at 6:20 p.m. without full tanks, and without filing a flight plan or getting a weather briefing. He doesn't usually file and the weather looks good.

At 8:35 p.m., they are approaching Texarkana. The pilot calls the Shreveport flight service station and inquires about weather at various fields in the area. Some are marginal VFR, while others are approaching IFR conditions. A ceiling is developing at 3,000 feet, with fog rolling in underneath. They are on top.

Sentence	Hazardous Attitude	Antidote
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____

KEY TO SITUATION 1

Compare your responses in Situation 1 with those given below. Remember, your responses may not be identical to those in this key. Still, you should have identified most of the hazardous attitudes indicated.

Situation 1

The pilot is a 31-year-old Western Texas oil field worker who is working on his instrument rating. He has minimal night experience. (1) One Friday, he works a full shift in the oil fields and then has a friend fly him to Midland, Texas. He intends to rent an airplane, fly home to Colorado City, Texas, pick up his family and continue to Memphis, Tennessee. The FBO manager at Midland advises the pilot to stay overnight and continue to Memphis in the morning. (2) The pilot says he wants to beat a cold front to Memphis, and likes to fly at night. He departs at 5 p.m. with full tanks.

His friend is waiting at Colorado City, and watches the pilot attempt three downwind landings. He barely gets the plane stopped before the end of the 3,000-foot runway. The pilot loads his passengers: wife, five-year-old son, and three-year-old daughter. (3) His friend suggests waiting until the next morning. The pilot is eager to start. The friend asks if he wants the airplane fueled. (4) The pilot says he is in a hurry and has plenty of fuel to reach Texarkana, Arkansas, where he plans to refuel. They leave at 6:20 p.m. without full tanks, and (5) without filing a flight plan or getting a weather briefing. He doesn't usually file and the weather looks good.

At 8:35 p.m., they are approaching Texarkana. The pilot calls the Shreveport flight service station and inquires about weather at various fields in the area. Some are marginal VFR, while others were approaching IFR conditions. A ceiling is developing at 3,000 feet, with fog rolling in underneath. (6) They are on top.

- (1) Impulsivity - "Not so fast. Think first."
- (2) Invulnerability - "It could happen to me."
- (3) Impulsivity - "Not so fast. Think first."
- (4) Anti-authority - "Follow the rules, they are usually right."
- (5) Invulnerability - "It could happen to me."
- (6) Anti-authority - "Follow the rules, they are usually right."

Situation 2

Janice and Tom are on a business trip from Chicago to Florida. She is a new instrument pilot and this is Tom's first flight in a single-engine aircraft. It looks like a great day for actual instrument conditions. The high-performance single is one of Janice's favorites, and she feels a little smug as they depart, leaving all of the "trainers" behind. She's had enough of them and has a co-worker to impress.

The departure controller informs Janice that her altitude readout is 100 feet high. She decides the best way to keep ATC off her back is to turn off the altitude reporting on the transponder. She plans to fly 100 feet higher than indicated.

During climb-out, they pass through a cloud layer and pick up 1/4 inch of ice. Janice explains to Tom that she has "lots of experience flying in icing conditions" and there is no need to be concerned. She believes that she can handle any icing situation.

At altitude, Janice engages the autopilot, and opens up some business notes to review en route. After a few minutes, she scans the panel and can't believe the altimeter is showing them 3,000 feet low. They should be flying at the minimum en route altitude. She can't believe the altimeter, but turns the Mode C back on and calls ATC to demand an altitude readout. Indeed, they are 3,000 feet low. She immediately pulls the nose up, and almost stalls the aircraft, not even thinking to add power.

The rest of the trip is uneventful, but Tom has promised himself never to ride in a small airplane again. Janice does not believe there is anything she can do about his attitude. If the autopilot worked properly, everything would have been fine.

Sentence	Hazardous Attitude	Antidote
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____
7	_____	_____

KEY TO SITUATION 2

Compare your responses in situation 2 with those given below. Remember, your responses may not be identical to those in this key. Still, you should have identified most of the hazardous attitudes indicated.

Janice and Tom are on a business trip from Chicago to Florida. She is a new instrument pilot and this is Tom's first flight in a single-engine aircraft. It looks like a great day for actual instrument conditions. The high-performance single is one of Janice's favorites, and (1) she feels a little smug as they depart, leaving all of the "trainers" behind. She's had enough of them and has a co-worker to impress.

The departure controller informs Janice that her altitude readout is 100 feet high. (2) She decides the best way to keep ATC off her back is to turn off the altitude reporting on the transponder. She plans to fly 100 feet higher than indicated.

During climb-out, they pass through a cloud layer and pick up 1/4 inch of ice. Janice explains to Tom that she has (3) "lots of experience flying in icing conditions" and there is no need to be concerned. She thinks to herself that she can handle any icing situation.

At altitude, Janice engages the autopilot, and opens up some business notes to review en route. After a few minutes, she scans the panel and (4) can't believe the altimeter is showing them 3,000 feet low. They should be flying at the MEA. She can't believe the altimeter, but turns the Mode C back on and calls ATC to (5) demand an altitude readout. Indeed, they are 3,000 feet low. (6) She immediately pulls the nose up, and almost stalls the aircraft, not even thinking to add power.

The rest of the trip is uneventful, but Tom has promised himself never to ride in a small airplane again. (7) Janice does not believe that there is anything she can do about his attitude. If the autopilot worked properly, everything would have been fine.

- (1) Macho - "Taking chances is foolish."
- (2) Anti-Authority - "Follow the rules. They are usually right."
- (3) Invulnerability - "It could happen to me."
- (4) Resignation - "I'm not helpless, I can make a difference."
- (5) Impulsivity - "Not so fast. Think first."
- (6) Impulsivity - "Not so fast. Think first."
- (7) Resignation - "I'm not helpless, I can make a difference."

Situation 3

The pilot departs on an IFR flight during a very cold winter afternoon. His girlfriend in the seat beside him is excited to be on the way to see her parents. As they gain altitude, it is obvious that the cabin heater is working minimally, if at all. The pilot tells his girlfriend to wrap up in a blanket they have on board.

The artificial horizon indicates a 10 degree left bank during level flight, but the pilot does not believe he will need that instrument. He also notices that the turn coordinator and the directional gyro are not operating. He doesn't want to admit he can't handle the situation. It is a short trip and he doesn't believe there will be any problems.

He has been informed by ATC to expect the ILS approach to runway 9 at destination. The pilot is not looking forward to a partial panel approach, but thinks he will have something to brag about to his fellow pilots. He is certain that they will be impressed.

After getting established on the localizer, ATC inquires concerning his erratic heading changes. After informing them that he is partial panel in moderate turbulence, he thinks to himself, "What business is it of theirs to ask about my flying?"

They break-out and land safely, but from a position far off of the localizer course. The pilot comments to his girlfriend that the localizer should be better aligned with the runway.

Sentence	Hazardous Attitude	Antidote
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____
7	_____	_____

KEY TO SITUATION 3

Situation 3

The pilot departs on an IFR flight during a very cold winter afternoon. His girlfriend in the seat beside him is excited to be on the way to see her parents. As they gain altitude, it is obvious that the cabin heater is working minimally, if at all. The pilot tells his girlfriend to wrap up in a blanket they have on board (1) silently cursing the last person that flew the plane for not having squawked the problem.

The artificial horizon indicates a 10 degree left bank during level flight, but (2) the pilot does not believe he will need that instrument. He also notices that the turn coordinator and the directional gyro are not operating. (3) He doesn't want to admit he can't handle the situation. It is a short trip and (4) he doesn't believe there will be any problems.

He has been informed by ATC to expect the ILS approach to runway 9 at destination. The pilot is not looking forward to a partial panel approach, but (5) thinks he will have something to brag about to his fellow pilots. He is certain that they will be impressed.

After getting established on the localizer, ATC inquires concerning his erratic heading changes. After informing them that he is partial panel in moderate turbulence, (6) he thinks to himself, "What business is it of theirs to ask about my flying?"

They break out and land safely, but from a position far off of the localizer course. The pilot (7) comments to his girlfriend that the localizer should be better aligned with the runway.

- (1) Resignation - "I'm not helpless, I can make a difference."
- (2) Invulnerability - "It could happen to me."
- (3) Macho - "Taking chances is foolish."
- (4) Invulnerability - "It could happen to me."
- (5) Macho - "Taking chances is foolish."
- (6) Anti-Authority - "Follow the rules. They are usually right."
- (7) Resignation - "I'm not helpless, I can make a difference."

Situation 4

A prominent attorney plans to testify at a highly publicized trial. He has thousands of hours in his own aircraft and flies on business quite often. On this particular day, the attorney has just finished a case in court and needs to be airborne within the hour. It is a thirty minute drive to the airport from the courthouse.

Before leaving the courthouse, the attorney phones his secretary and asks her to have his plane fueled. On the way to the airport, he mentally calculates the information for the flight. He needs to expedite his departure to arrive on time for court.

Upon arrival at the airport, a new lineman is fueling his aircraft. He asks the new lineman to check the oil level. The skies are clouding over, so he quickly calls flight service to file a flight plan. He requests an "abbreviated weather briefing." After completing his phone call, he stops at the desk and signs for the fuel. The oil was fine.

The attorney conducts a hurried preflight. He taxis to the runway, deciding to obtain his IFR clearance after takeoff. During runup, the engine (which was recently overhauled) runs a little rough. After takeoff, the engine does not develop full power and the cylinder head temperature (CHT) is almost in the red. He continues to climb and checks the CHT gauge, but is busy obtaining his clearance.

The flight is uneventful, except for the engine running hot. The attorney arrives and makes it to court on time. "See," he thinks, "I knew I could make it on time."

After court, he returns to the plane for the trip home. He is tired, but doesn't believe that will affect him, since he is accustomed to stress. He does not need additional fuel for the return trip and is anxious to depart.

While preflighting the aircraft, the attorney takes a fuel sample and notices a purplish color. That could explain the engine running hot and thinks to himself that the lineman should have been more careful. It would be the lineman's fault if an accident occurred due to a fueling mistake.

Sentence

Hazardous Attitude

Antidote

1

2

3

4

5

6

7

8

KEY TO SITUATION 4

Situation 4

A prominent attorney plans to testify at a highly publicized trial. He has thousands of hours in his own aircraft and flies on business quite often. On this particular day, the attorney (1) has just finished a case in court and needs to be airborne within the hour. It is a thirty minute drive to the airport from the courthouse.

Before leaving the courthouse, the attorney phones his secretary and asks her to have his plane fueled. On the way to the airport, he mentally calculates the information for the flight. (2) He needs to expedite his departure to arrive on time for court.

Upon arrival at the airport, a new lineman is fueling his aircraft. He asks the new lineman to check the oil level. The skies are clouding over, so he quickly calls flight service to file a flight plan. He requests an "abbreviated weather briefing." After completing his phone call, he stops at the desk and signs for the fuel. The oil was fine.

The attorney (3) conducts a hurried preflight. He taxis to the runway, deciding to obtain his IFR clearance after takeoff. During run-up, the engine (4) (which was recently overhauled) runs a little rough. After takeoff, the engine does not develop full power and the cylinder head temperature (CHT) is almost in the red. He (5) continues to climb and checks the CHT gauge, but is busy obtaining his clearance.

The flight is uneventful, except for the engine running hot. The attorney arrives and makes it to court on time. (6) "See," he thinks, "I knew I could make it on time."

After court, he returns to the plane for the trip home. He is tired, but (7) doesn't believe that will affect him, since he is accustomed to stress. He does not need additional fuel for the return trip and is anxious to depart.

While preflighting the aircraft, the attorney takes a fuel sample and notices a purplish color. That could explain the engine running hot and thinks to himself that the lineman should have been more careful. (8) It would be the lineman's fault if an accident occurred due to a fueling mistake.

- (1) Impulsivity - "Not so fast. Think first."
- (2) Impulsivity - "Not so fast. Think first."
- (3) Impulsivity - "Not so fast. Think first."
- (4) Invulnerability - "It could happen to me."
- (5) Anti-Authority - "Follow the rules. They are usually right."
- (6) Macho - "Taking chances is foolish."
- (7) Invulnerability - "It could happen to me."
- (8) Resignation - "I'm not helpless, I can make a difference."

7. UNDERSTANDING SOCIAL INFLUENCES IN AERONAUTICAL DECISION MAKING

Bush Pilot Syndrome

The pressures to compromise safety in "bush flying" are known to many pilots. This type of flying illustrates the extreme pressures that pilots can face. Passengers unfamiliar with flying safety, particularly those macho passengers who love to hunt and fish, are fond of playing on the "Macho" attitude of the pilot. The following story is an example:

An inexperienced seaplane pilot landed at a remote lake to pick up some hunters who had camped there for a week. The hunters had two moose to fly out. The pilot said "I told you when I left, that this airplane will only carry one moose!" His macho passengers responded, "The pilot who flew us out last year let us take two moose!" The pilot, feeling responsible for his macho image said, "OK, I'll give it a try." He started the engine, and taxied around to stir up the glassy water, before adding full power for takeoff. He managed to get airborne into ground effect before gaining a little altitude. He barely cleared the tree tops at the water's edge before realizing that he just could not beat the rise in the terrain. He mashed into the trees at full power about a mile beyond the edge of the lake. Fortunately, none of the passengers were hurt. He turned to his passengers and said, "I guess I just don't have what the other pilot did to get out of here." One of the hunters responded, "Oh you did very well. You made it a mile further than the pilot did last year."

An air safety investigator in Alaska, Dr. Michael Mitchel, conducted an extensive study of factors that may cause the higher accident rate in Alaskan commercial operations compared with the lower 48 States. He found that pilots are paid upon successful completion of their flights and some are even threatened with the loss of their jobs if they refuse to take a flight that they believe to be unsafe. This practice is so blatant that, in some cases, the blame for an accident should be shared with the operators. Mitchel suggested that, if it is found that a pilot is being subjected to strong pressures from superiors or economics (remuneration by commission) to fly in conditions beyond his or her skill level or the capability of the equipment, at least four forms of action should be taken to reduce the effect of these pressures:

1. Change the form of remuneration for the pilots.
2. Change the training program to reduce the effect of such pressure.
3. Evaluate pilots considering their ability to resist such pressure.
4. Transfer some of the negligence normally assigned to the pilot for poor judgment to management or others causing the pressure.

The main thrust of this book is focused on training to reduce the effects of such pressure. As an instrument pilot, you should understand that you may face similar, perhaps not as severe, pressures in your own flying. The following accident summaries illustrate these pressures.

A University Chief Pilot's Judgment

A pilot for a university transportation service was asked to make a flight to a large midwestern city. He determined that the weather was not safe for such a trip; there was moderate icing reported in the clouds at night. His chief pilot was a personal friend of the passengers and persuaded them to fly instead of drive. He was angry at the pilot's decision to cancel the trip after the passengers arrived. The chief pilot hastily loaded the passengers into a high performance single-engine airplane and departed. Nearing the destination, he was told to hold for traffic - a typical occurrence at this busy airport.

The chief pilot realized that the aircraft was not fueled prior to takeoff and was uncertain about the amount of fuel remaining. Not wanting to appear concerned and feeling that there is usually more fuel left than the gauges show, he didn't tell ATC about his uncertain fuel situation, saying only that he had limited fuel onboard. He continued in the holding pattern and did not declare an emergency until the engine quit due to fuel starvation. Luckily, he managed to crash-land the airplane in a field near a gravel quarry. He was unhurt, but one of the passengers was disabled for life.

This situation reveals most of the hazardous attitudes discussed in previous chapters. The pilot who decided not to make the flight was vindicated for his decision, but the price was high! Managers need to be aware of the pressures placed on pilots which sometimes result in poor decisions.

An Orthopedic Surgeon's Judgment

A very strong-willed orthopedic surgeon in Boise was subjected to his own internal pressure to get to Phoenix to testify in court one afternoon in January 1981 and, on the same day, felt pressure from his nurse to get to North Las Vegas to visit her dying mother. The result was a decision to take off into a snow storm in a high performance single-engine aircraft with a visibility of 1/8th mile and an inoperative turn coordinator. When the vacuum pump failed at 10,000 feet, the result was predictable if not inevitable - he lost control and the aircraft disintegrated before hitting the ground, killing the four people on board.

This accident is another example of the result of pressure to fly when the risks are very high. Professionals who fly their own airplanes as an avocation need to understand the pressures that can lead them to make the wrong decisions. They need to develop methods of defending themselves and their trusting passengers against such pressure, even if the source is the passengers themselves. Good judgment includes an accurate assessment of the pilot's own skill apart from the wishes of the passengers.

8. IDENTIFYING AND REDUCING STRESS

As a healthy pilot, you should perform at your optimum level and make decisions to the best of your ability. Numerous physical and physiological conditions in your life and the nature of flight itself can hamper this ability.

Piloting an aircraft is an individual concern. Even though you hold a medical certificate that implies you meet the health requirements for your type of flying, the decision whether you are fit to fly is strictly in your hands. You need to evaluate your well-being from a physical and emotional standpoint. Factors affecting your total health are: physical, physiological, psychological and sociological. These factors are known as "stressors."

Stressors

o Physical stressors include conditions associated with the environment, such as temperature and humidity extremes, noise, vibration and lack of oxygen. The effects of these stressors can affect your physiological being as well as your psychological health. Recall the effects of your last flight made without earphones or earplugs. After landing, were you a little irritable? Was your hearing somewhat impaired for a few hours?

o Physiological stressors include fatigue (chronic and acute), lack of physical fitness, sleep loss and missed meals (which contribute to hypoglycemia and disease). Have you ever felt "light-headed" or "shakey" during a flight when you haven't eaten properly?

o Psychological stressors are related to emotional factors such as self-imposed demands and perfectionism. The need to achieve affects your ability to perform and make decisions. The actual decision-making process is a stressor itself. Mental workload such as analyzing a problem, navigating an aircraft, or handling an emergency are psychological stressors.

o Sociological stressors include: a death in the family, divorce, sick child, demotion or pressure from your boss. Sociological stressors are also part of adhering to the rules of society and the regulations of the government.

"Stress", as used here, is a response to a stressor or set of circumstances that induces a change in your ongoing physiological and/or psychological patterns of functioning. Any internal or external stimulus that is perceived as a threat to the body's equilibrium causes a reaction (stress) with which your body must cope.

Acute, physiological reactions to stressors include the release of chemical hormones (such as adrenalin) into the blood and speeding of the metabolism to provide energy to the muscles. Blood is shunted away from the stomach and digestive tract to supply the muscles in the arms and legs with more oxygen. Blood sugar is increased. Heart rate, respiration, blood pressure, and perspiration all increase. Other

hormones improve the blood's ability to clot. The result prepares the body to "fight or flee," an ancient physiological response to threat.

Stress forces you to adapt to it. It is an inevitable and necessary part of living. It motivates life and heightens your response to meet any challenge. Some individuals actually seek out stressful situations to keep life interesting. Stress can help prevent accidents in some cases. Stress is normal and beneficial ----- complete absence of stress is death.

Stress is cumulative. In fact, performance of a task will generally improve with the onset of stress, but will peak and then begin to fall off rapidly as stress levels exceed your adaptive abilities to handle the situation. See Figure 8.1.

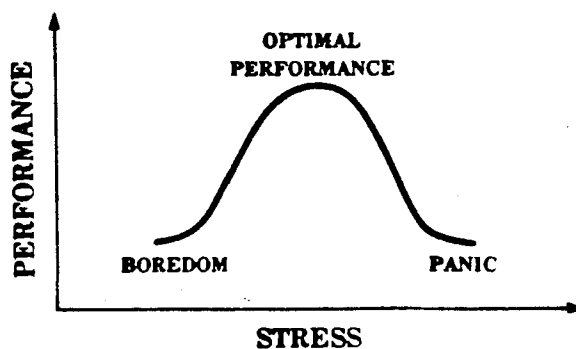


Figure 8.1 Relationship of Stress and Performance.

Accidents often occur when flying task requirements exceed pilot capabilities. The difference between pilot capabilities and task requirements, as shown in Figure 8.2, is called the "margin of safety." Note that in this idealized example, the margin of safety is minimal during the approach. Had any emergency or distraction occurred, or anything else further degraded pilot capabilities, an accident may have occurred.

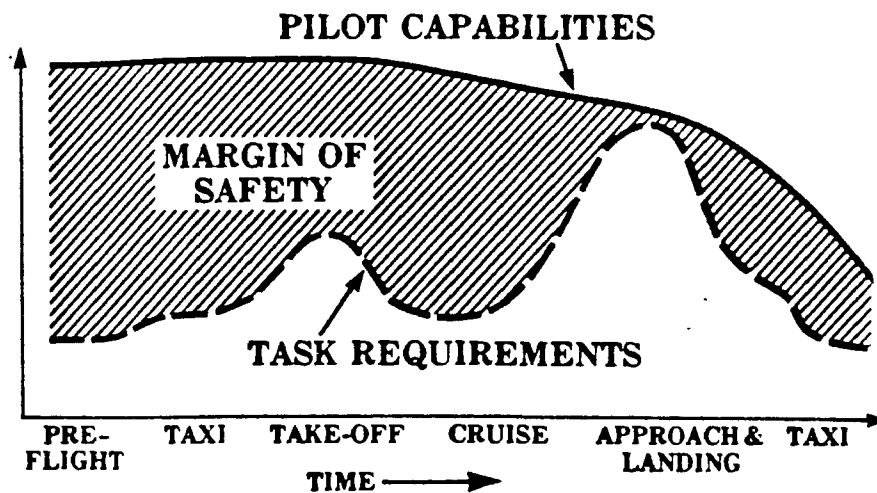


Figure 8.2 Task Requirement vs Pilot Capabilities.

Who Me? Stressed?

You didn't sleep well last night, you had the meeting on your mind. You arrive at the airport hoping your aircraft has already been preheated as you had asked. It is extremely cold and damp, though there has been no snowfall, yet.

You had to stop at the bank for some money, so you had no time for breakfast. You grab a candy bar and coffee as you head for the hangar. You wash a couple of aspirin down with the last of your coffee and climb into your plane. You must get going to be at your meeting on time, and you mentally note what time you must leave the meeting to be home for your daughter's birthday party.....

Stress is cumulative. A generalized stress reaction can develop as a result of these accumulated effects. In the above scenario, it is clear that many factors will influence your behavior and decision making throughout the trip.

...You arrive at the meeting without any problems and are preoccupied all day with whether you will get the money for the project. You are even too nervous to eat lunch, though you have another cup of coffee. You are hesitant about leaving early, but you have promised your daughter you will be home for her party. As you make your apologies and leave the meeting, you find the snow just beginning to fall. You visit flight service briefly and find the weather to be worsening. You note the freezing level and the braking action reported at your home airport. You depart for home.....

There is a limit to your adaptive nature and this limit is your stress tolerance level. It is based on your ability to cope with the situation. If the number or intensity of the stressors becomes too great, you are susceptible to "environmental overload." This is the point where your performance begins to decline and your judgment deteriorates.

....En route you encounter some light rime ice and, though darkness is setting in, you can see well enough to monitor the build-up. You're glad you are on your way home and know the approaches at the airport well; you would not want to have to wrestle with an unfamiliar instrument approach right now. As you near your destination airport, you're informed the field has gone below minimums. You opt to make at least one pass and, indeed, you reach the MDA and cannot see the field. Another airport, ten miles away, is reporting better conditions. Your head is starting to pound as you throw open the approach chart book to the correct page for the other airport.....

Personality and behavior patterns are stress related. That aggressive, dominating personality you are so proud of can go a little too far, emerging as hostility. Rigid and unbending individuals will trigger the stress response when they find themselves between the proverbial "rock and a hard place." Another typical stress provoking personality trait you may exhibit is your obsessive-compulsiveness and your attention to detail. For the most part, that perfectionism keeps you alive and allows you to be a good pilot. Just realize that

physiologically it can be triggering the stress response. To a point it is adaptive, but past that point it becomes maladaptive.

...You quickly scan the instrument approach chart while being vectored for an ILS approach. You cannot find the localizer frequency anywhere on the chart and notice that you are using the VOR approach for the same runway. You think to yourself "how dumb", and that thought just keeps repeating over and over. You turn the page and prepare for the approach....

Stress is insidious. It creeps up on you. It is cumulative. You may think you are handling everything quite well, when in fact there are subtle signs you are beyond your ability to respond appropriately.

Individuals who are overstressed (not coping adequately) can show impairment in all three pilot activity areas; procedural, perceptual-motor and decisional. The inadequate strategies employed by most people in trying to cope with stress often impose more stress. When this occurs, people can develop anxieties and become frustrated.

Frustration often leads to anger and aggression. Anger may be directed at other people or turned inward, showing up as self-destructive tendencies such as overeating, smoking, alcoholism and drug abuse. It may take the form of excessive risk-taking and accidents. When an individual directs anger toward others, the resulting problems with interpersonal relationships lead to loss of friends, trouble with the boss, marital problems, divorce, child abuse, assault and even, homicide. Aggression directed at inanimate objects can lead to damage and injury that show up as accidents.

Signs of Inadequate Coping

The indicators of excessive stress often show as three types of symptoms: (1) emotional, (2) physical and (3) behavioral. These symptoms differ depending upon whether aggression is focused inward or outward. Those individuals who typically turn their aggressive feelings inward often demonstrate the emotional symptoms of depression, preoccupation, sadness and withdrawal. Physical symptoms may show up as headaches, insomnia, appetite changes, weight gain or loss, indigestion, nausea, vomiting, diarrhea and constipation. Behavioral symptoms include: a morbid preoccupation with illness (hypochondria), self-medication, a reluctance to accept responsibility, tardiness, absenteeism, poor personal appearance and hygiene.

The individual who typically takes out frustration on other people or objects exhibits few physical symptoms. Emotional symptoms may show up as overcompensation, denial, suspicion, paranoia, agitation, restlessness, defensiveness, excess sensitivity to criticism, argumentativeness, arrogance and hostility. Behavioral symptoms include episodes of desperate "acting out" or temper tantrums (a disguised cry for attention). These individuals also tend to abuse alcohol and drugs, but, in addition, they get into fights, incur numerous traffic tickets, gamble, fall into indebtedness, and may even become child or spouse abusers. They also tend to be accident prone.

Life Stress Management

There are many techniques available that can help reduce the stress in your life or help you cope with it better. Not all of the following ideas may be the solution, but some of them should be effective for you.

- A. Become knowledgeable about stress.
 - 1. Understand the process and effects of stress.
 - 2. Identify your major sources of stress.
 - 3. Anticipate stressful periods and plan for them.
 - 4. Learn to identify the opportunities for personal growth inherent in periods of stress.
 - 5. Find the level of stress that is best for you, remembering that both insufficient and excessive stress are potentially harmful.
- B. Take a realistic assessment of yourself.
 - 1. Evaluate your capabilities and limitations.
 - 2. Recognize your limitations and work (and fly) within them.
 - 3. Establish realistic life goals.
 - 4. Identify the objectives that will lead toward those goals.
- C. Take a systematic approach to problem solving.
 - 1. Learn to recognize and avoid the heavy pressures imposed by getting behind schedule and not meeting deadlines.
 - 2. Define your problem specifically, delving beyond symptoms. Divide it into manageable components that can be dealt with easily.
 - 3. Separate tasks into three categories of action: things that must be done, those that can be delayed and those that you can forget about.
 - 4. Gather sufficient information about the problem to put it in perspective.
 - 5. Discover why the problem exists for you.
 - 6. Review your experience with the present problem or similar ones.
 - 7. Develop and evaluate a set of alternative courses of action.

8. Select a course of action, and proceed with it.
- D. Develop a life style that will buffer against the effects of stress.
1. Whenever possible, avoid stressful situations and encounters.
 2. Don't volunteer for stressful jobs when you are already overburdened.
 3. Plan your use of time on both a daily and a long-term basis.
 4. Use free time productively.
 5. Manage conflicts openly and directly.
 6. Deal with problems as soon as they appear; if you procrastinate, they may intensify.
 7. Learn to let go of stressful situations and take breaks.
- E. Practice behavioral management techniques.
1. Establish a program of physical fitness. Exercise provides the body with an outlet for the energy used by the muscles for "fight or flee," reducing stress effects such as high blood pressure, accelerated pulse and excess weight, (itself a stressor).
 2. Engage in recreational sports. Beware of increasing your stress levels through excessive competition. If you find this happening to you, then try noncompetitive sports such as jogging, swimming or biking.
 3. Evaluate your diet. Eat a balanced diet. Maintain your recommended weight.
 4. Obtain sufficient rest on a regular basis.
 5. Learn a technique to evoke the relaxation response - a condition of your body that is opposite to "fight or flee." The relaxation response brings a profound rest, much deeper than sleep. Oxygen consumption and heart rate drop markedly, and blood lactates-products of fatigue- are no longer produced and are cleansed from the body, giving it time to restore normal function. This, in turn, improves your ability to cope with ensuing stress.
 - a. Biofeedback is one relaxation technique in which your own body uses physiological "signals" to tell you what is happening to it. Through biofeedback you learn to gain voluntary control over your body to achieve the relaxation response.

- b. In autogenic training, you learn to shut down many bodily functions to achieve the relaxation response on your own body by using calming words (such as "warm", "soft", etc.), without the need for return "signals," as in biofeedback. Starting with the extremities and moving inward you learn to relax each part of your body progressively.
- c. Another readily available technique that can be used at home or wherever you can find a quiet spot is meditation. Meditation techniques can produce the relaxation response through passive concentration, cleansing the mind of anxiety-producing thoughts. This is usually done through repetitive subvocalization of a single "nonsense" syllable that does not stimulate a conscious train of thought. Meditation is best repeated twice a day, preferably for twenty minutes before breakfast and again before the evening meal.

F. Establish and maintain a strong support network.

1. Ask for direct help, and be receptive to it when it is offered. Consider professional help.
2. Use resources and information that are available. Much information is available in your library or from your physician.

Cockpit Stress Management

Good cockpit stress management begins with good life stress management. Many of the stress coping techniques practiced for life stress management are not usually practical in flight. Rather, you must condition yourself to relax and think rationally when stress appears. The following checklist outlines some thoughts on cockpit stress management.

- A. Avoid situations that distract you from flying the aircraft.
 1. When you are carrying passengers, make sure that they are calm, informed, and prepared.
 2. If you should encounter an emergency, keep them informed if you can find the time.
 3. Avoid family squabbles in flight. Assign an adult to control small children and look after their needs.
- B. Reduce your workload to reduce stress levels providing the proper environment in which to make good decisions.

1. If you feel tension mounting, loosen your collar, stretch your arms and legs, open aircraft vents.
 2. Don't hesitate to ask controllers for help such as speaking more slowly or telling you your position.
- C. If an emergency does occur, BE CALM. Think for a moment, weigh the alternatives, then act.
1. Fear and panic are your greatest enemies during an inflight emergency. REMAIN CALM.
 2. Don't hesitate to declare an emergency when necessary or let other people including passengers know your situation. Don't delay until it is too late.
- D. Maintain proficiency in your aircraft, for proficiency builds confidence. Familiarize yourself thoroughly with your aircraft its systems, and emergency procedures.
- E. Know and respect your own personal limits.
1. Give yourself plenty of leeway for an "out" when needed.
 2. Always have a "plan" and an "alternate plan."
 3. Plan stops to allow adequate time for rest, for meals, and to stretch your legs. A good rule of thumb is to stop at least every three hours to meet your physiological needs, especially, if you are in an aircraft where you can't stand up and walk around in flight.
- F. Don't let little mistakes bother you until they build into a big thing. Wait until after you land, then "debrief" and analyze past actions.
- G. If flying is adding to your stress, either stop flying or seek professional help to manage your stress within acceptable limits.

Flight Fitness

The "Go/No-Go" Decision is made before each flight. A preflight check of the aircraft is made. In addition, you should preflight yourself, each and every flight. Ask yourself, "Could I pass my medical examination, right now?" If the answer is not an absolute, "yes," don't fly. The following checklist is for your own personal preflight. You may want to carry a copy in your flight bag and in your aircraft.

- A. Do I feel well? Is there anything wrong with me at all?
- B. Have I taken any medication in the last 12 hours?
- C. Have I had as little as one ounce of alcohol in the last 12 hours?

- D. Am I tired? Did I get a good night's sleep last night?
- E. Am I under undue stress? Am I emotional right now?
- F. Have I eaten a sensible meal and taken in a good load of protein?
Do I have a protein snack, such as cheese, meat or nuts, aboard?
- G. Can I breathe easily out of my nose?
- H. Can I hear clearly, and not as if I were talking inside a barrel?
- I. At night, when it is really dark and I go outside, do my eyes
accommodate quickly to the darkness?
- J. Am I equipped with sunglasses, ear protectors, appropriate
clothing?

The following "I'M SAFE" checklist is a good way of checking for flight fitness as well:

- Illness? Do I have any symptoms?
- Medication? Have I been taking prescription or over-the-counter
drugs?
- Stress? Am I under psychological pressure from the job?
Worried about financial matters, health problems,
or family discord?
- Alcohol? Have I been drinking within eight hours?
Within 24 hours?
- Fatigue? Am I tired and not adequately rested?
- Eating? Am I adequately nourished?

Judging Your Flight Fitness

The following episodes illustrate the detrimental effects of stressors and the five hazardous attitudes. Keep in mind that "what's legal is not always safe." The evaluation of flight fitness is your individual decision.

"Heart Throb." A physician in his late fifties owns two aircraft. He practices at several small hospitals within 100 miles of his home. He is in the habit of flying to work at least three times a week. The doctor has suffered three heart attacks, one hospitalized him for two months and the most recent one was less than three months ago. He recently moved his planes from the small airport near his home to a larger airport where he plans to lease the aircraft. He continues to fly and believes nothing will happen while he's flying, though he never has a copilot along. It is not known whether he has a current medical certificate.

Analysis. In this case, a professional is practicing the invulnerability hazardous thought pattern by assuming it "won't happen to me." There is also the hint of anti-authority in the case of not having a valid medical certificate. He would probably be thinking that those medical rules really don't apply to him. He also seems to be denying the problem by not taking another pilot along for "heart attack insurance."

"Disappeared into Thin Air...." The new instrument pilot receives a complete weather briefing for her flight, estimated to take three hours, which would get her to her destination just before dark. The cloud tops are reported to be between 10,000 and 11,000 feet. She files for 12,000 feet. A particularly careful pilot, she completes her preflight and takes care of every foreseeable detail of the flight. Two hours into the flight she discovers the headwinds to be stronger than reported. Since she has six hours of fuel on board, she is not concerned. Her destination airport is IFR, and she is happy to have the opportunity to use her new rating. The flight turns out to take almost four hours, and it is after dark when she arrives at the initial approach fix. As she is cleared for an NDB approach (one she has made many times), she hears the pilot before her miss the approach. She thinks, at this time, how great she is feeling and how she knows she will make the field; she is a better pilot than the one that just missed the approach.

Analysis. The danger of hypoxia lies in its insidious onset and the euphoric feeling one can get. In this case, a pilot known to be very careful in her flying starts to exhibit traits of machoism. What she also may experience is impaired night vision due to the prolonged exposure to the "thin air" at 12,000. Unfortunately, the good judgment of this pilot disappeared into thin air on this flight.

"Battle Fatigue." The combination of the heat; the long days in the cockpit; and the noise, vibration and the strains involved in horsing around a heavily loaded, spray-equipped airplane close to the ground all added up to genuine battle fatigue by the end of a day. It was toward the end of this particularly long day when the ag pilot headed out to his last field. The field was one that he was not familiar with.

To ensure full crop coverage, the pilot often makes a special pass across the ends of the fields where buildings and power lines are found. Time is saved if that hard-to-get cotton can be sprayed on normal passes by diving sharply over the power lines or buildings or, whenever possible, by flying under the lines. All crop dusters catch an occasional line, but there is a cutting leading edge of the landing gear and a cable running between the cockpit and vertical stabilizer to ward off wires. Power lines are not always the only things stretched between tall poles and the telephone lines often found hung below them are usually too tough to cut.

The pilot could see the fence under the lines, but having not checked out this particular set of wires, and having a windshield covered with spray, he had no intention of going under. However, at the last second he decided to go under, and saw the pesky telephone lines hanging below the main lines just seconds before he hit them.

Analysis This pilot found out the hard way that when you are tired, you make mistakes. It is natural to become fatigued after long hours in the air, or after a long day. This is "acute fatigue" and can be eased by a good night's sleep. This is different from "chronic fatigue" which results from long workdays, chronic sleeping difficulties, or lack of exercise. Either sort of fatigue is hazardous for a number of reasons. They produce carelessness, forgetfulness, sloppiness, slowed or inappropriate reactions, irritability, disinterest, and the loss of timing involved in performing tasks. Fatigue erodes judgment and causes inattention, channelized attention or other disorders of attention, and distraction.

"Just One." The pilot and his fiancée had stopped in at a popular club for forty-five minutes. At the time of takeoff from the unattended airport, a heavy snowstorm was moving through the area. An instrument-rated pilot, he saw no problem in continuing the flight. As they broke into the clear above (he had not filed a flight plan), the pilot proceeded to show his wife-to-be a few tricks. Shortly after a few lazy eights and a couple of stalls, the woman said she didn't feel well and wanted to land. The pilot finally contacted ATC, and asked for vectors to the nearest airport. There was a VFR airport, ten miles north, reported to be in the clear. They made their way to the airport with the help of ATC and made three attempts to land in VFR conditions. This entire time the pilot felt he was in control and the wind and other factors were hampering his landing. In fact, the wind was calm.

Analysis. It was discovered through a toxicology examination after the crash that the pilot had a blood alcohol level of over 0.20 percent! The influence of alcohol affects judgment even before performance becomes impaired. In this case, the pilot assumed the "bottle to throttle" rules did not apply to him. He also seems to have had an air of "invulnerability" about him, mixed in with a "macho" attitude. The social influence of wanting to impress his fiancée also played on his decision making. Most importantly, though, is the fact that alcohol's effects are mental confusion; disorientation; dizziness; exaggerated emotional state; disturbance of sensation; impaired perception of color,

form, motion, or dimensions; decreased pain sense; impaired balance and muscular incoordination; staggering gait and slurred speech. These conditions can appear with as little as one ounce of eighty-proof liquor, eight ounces of beer, or eight ounces of wine.

"Flying on Empty." The pilot had obtained his commercial license two months before the flight. Normally he would abstain from solid foods on one day each week. Occasionally he would extend his fast for an extra day from the evening meal on Sunday until dinner on Tuesday evening. While fasting he would drink water or tea with lemon juice and no sugar. On the day of the flight, he had been fasting for six days. His wife had mentioned his being a bit weak and unfit to fly, but the pilot reported that he felt fine. The pilot loaded his aircraft and departed on his chartered flight,

Analysis. The plane was found on a bush-clad slope, where it had first contacted the trees thirty feet above the ground with wings level. A small quantity of partially digested food in the pilot's stomach was disclosed in the autopsy report. It is ironic that this pilot's overt denial of food corresponded to his denial that anything was really wrong. In fact, the pilot was not aware of the possible insidious effects of fasting on his flying ability; he felt in normal health. When he finally ate the candy bar, it only aggravated his already existing hypoglycemia. One of the mechanisms that regulate release of insulin into the blood is activated through the stomach. This insulin release, with its blood sugar lowering effect, precedes by half an hour or so the increase in blood sugar that results from digestion of the food.

This may seem like an extreme case, but even the missing of two meals can cause you to be susceptible to hypoglycemia. The symptoms include light-headedness, disorientation, sweating, salivation and shivering. Poor nutrition in general increases your susceptibility to the stresses of flight. Hypoxia, hyperventilation, and fatigue are some of the stresses which missed meals and inadequate nutrition can aggravate.

Most of the foregoing discussion relates to psychological factors in aeronautical decision making. However, there is one aspect of pilot thinking that deserves greater emphasis. To the naive public, pilots often hold the "Macho" image. The fact is that a large segment of the pilot population does not have this attribute. Even those who do, can have it shattered quite easily by a failure.

There are numerous examples of incidents of poor aeronautical decision making in which the pilot simply failed to take charge in a situation where action was needed. These types of situations are difficult to reveal in scenarios. They are best placed under the hazardous decisional attribute, "Resignation." However, the explanation offered for this attribute, "What's the use," is almost a positive statement in comparison with the next aspect of the problem to be illustrated.

This problem aspect was revealed in a survey of Ohio pilots by students and faculty at the Ohio State University. In this survey pilots were asked to give 10-word descriptions of all errors that they had made or that they had seen other pilots make during their flying careers. The descriptions were grouped in eight different categories roughly corresponding to the most important 1,500 errors revealed by 77 pilots. Of these, 300 were found to be unique. The following abbreviated list of observed pilot errors in this area of "Failure to take charge" indicates that this is a serious problem in aviation.

1. Flying into clouds while waiting for an IFR clearance.
2. Descent below ATC assigned altitude while looking for airport on a visual approach.
3. Failure to recognize that basic aircraft control is first priority.
4. Failure to declare an emergency due to fear of FAA sanction.
5. Failure to contact ATIS prior to entry into busy terminal area.
6. Failure to ask for information when it is needed (e.g., uncomfortable with talking to FSS about problem).
7. Unclear division of cockpit responsibilities.
8. Not thinking before doing (e.g., speaking on mike).
9. Getting behind the airplane.
10. Not having alternate plans of action formulated in case of weather problems.
11. Failure to provide margin of safety.
12. Proper decision made too late.
13. Failure to recognize that an emergency has occurred.
14. Out of order priorities (e.g., "gethomeitis").
15. Failure to make decisions concerning weather minimums. Expecting ATC to tell them what to do.
16. Continued VFR into IFR weather.
17. False sense of security from two engines led to increased risk taking.

The Tentative Pilot

The following illustrates the feeling most pilots have faced at one time or another in their flying. A young private pilot was transitioning from a tricycle gear airplane (in which he received all of his training) to tailwheel airplanes. Although he had soloed a tailwheel airplane for a few hours, he had not learned the proper deliberate control technique for making "wheel" landings in a strong crosswind. He found himself needing to make a crosswind landing on the north runway with a moderate wind from the west. As the airplane bounced down the runway, he had that helpless feeling as the aircraft became uncontrollable after the first two or three touchdowns. He recovered the landing without incident and gained a receptive attitude to receive more dual instruction in crosswind landings.

Forcing it on the Runway

The following illustrates the other side of the coin --- the pilot who forces the airplane to the runway. An interesting experiment on pilot judgment was performed recently by some students at The Ohio State University. In a survey of pilot judgment errors, they found a description of an incident that involved landing judgment. In this scenario, after making several successful touch-and-go landings, the pilot prepared for an approach to a full-stop landing. Realizing that she was high, she made a go-around and set up for another approach. Again, she found herself too high, so she abandoned the approach. On the third approach, she was still too high, but in frustration over the two previous approaches, she decided to do everything possible to get the airplane on the ground. This time she did that, but landed very close to the opposite end of the runway. The incident frightened her enough to report that she would "never again force an airplane to the runway."

The students decided to give her a test to see whether or not she had meant what she said. They asked her to help them in their class project which they said was an experiment involving simulated landings. She agreed to participate in a flight simulator with a visual landing display and video recorder. They asked her to make several landing approaches, each initiated from base leg at pattern altitude. The first was a normal no-wind landing which she conducted at an airspeed that was 10 knots below the recommended approach speed. She touched-down just past the numbers.

On the second approach, the weight of the simulated aircraft was reduced and a tailwind was gradually introduced on final. The pilot recognized that she was too high and opted for a go-around. This is significant because the pilot had been told that a go-around was an acceptable option if she deemed it necessary. It also demonstrates that a judgment was made in accordance with the proper procedures that would be followed in an aircraft under the same circumstances.

On the third approach, the aircraft was positioned much closer to the runway giving the pilot less time to make her decision. She continued the approach and attempted a landing after using two-thirds of the runway. After reviewing the tape, she realized that it might not have been possible to stop an aircraft safely on the remaining useable runway.

On the fifth approach, covert psychological pressure was applied. The pilot was told that this was the last approach and that it should be a good one. The simulated aircraft weight was reduced to a minimum and the tailwind was increased to a maximum just as the pilot started to flare. The pilot brought the aircraft down, but only after flying over more than three-quarters of the useable runway. She finally nosed the airplane over and flew it onto the runway. The nose wheel impacted first which would likely have damaged the aircraft.

After the fifth approach, the pilot was told that something had gone wrong with the video equipment and that another approach was needed. On this approach the weight and tailwind component were left unchanged. This time, on final approach, the wind was gradually shifted to a crosswind that exceeded the capabilities of the simulated aircraft. On this approach, even after it was apparent that the crab angle into the wind was doing little good, the pilot elected to continue the approach rather than go around. The aircraft impacted the ground to the right of the runway at a rate of descent exceeding 500 feet per minute at a speed of 60 knots. The pilot's last words were, "Where did the wind come from?"

The purpose of this experiment was to determine whether or not the pilot had learned from her previous experience. When questioned after the experiment, she stated that there was a "little voice" in her head telling her to get the airplane down no matter what. She also said that, as she became more frustrated or felt more pressure to succeed, "the words got louder".

Although this informal experiment does not provide scientifically reliable conclusions, it illustrates that this pilot did not learn from previous mistakes. It seems likely that the experience would have some impact on her "little voice". This pilot was fortunate, since not all pilots have the opportunity to learn from their mistakes.

The Lesson

The lesson from these examples is that both the tentative and the macho attitudes can lead to decisional errors in flying. You must know the factors that can lead to these attitudes, such as shattered egos and the need to prove yourself to others. Both of these attitudes are the result of insecurities. Pilots need to learn to discipline their thinking to put aside these insecurities when they are faced with marginal flying situations.

9. APPLYING THE DECISION-MAKING CONCEPTS

Much of the discussion to this point has focused on the negative aspects of poor pilot judgment. It is useful to initially show the negative side of pilots' decision making so that you can learn the hazardous attitudes and antidotes. However, you may be saying to yourself, "I think that I know what bad judgment is, but what is good judgment?" Most decisions that pilots make are good, not only because they result in a safe conclusion to the flight, but also because the decisions are made based on risks that are acceptable in our society. Since you can now identify hazardous attitudes and know how to counterbalance them with an antidote, you should also be able to identify the good decisions found in these scenarios. It is important to recognize when you have made a series of good decisions and remember to give yourself a pat on the back and an "atta boy/girl" for not falling prey to the acting-out of hazardous attitudes.

In the following discussion you will find a series of good judgment examples under pressure from various sources. Hopefully, these final examples of good pilot decision making will leave you with a firm idea of how critical situations can be handled or avoided by leaving your hazardous attitudes on the ground.

Management Pressure

A newly hired pilot was making a trip to attend an early spring meeting in Colorado Springs, along with his new boss and two other of his new colleagues. The first leg of the trip to Kansas City was uneventful, except for a trace of ice on the wings. However, the weather at Colorado Springs was learned to be very poor, below published approach minimums. The weather at Denver, which was within easy driving distance of Colorado Springs, was CAVU. The boss said, "Let's file for Colorado Springs and check the weather en route." The new hire was a bit uneasy about it, not wanting to question the judgment of his very experienced boss, so he agreed and filed for Colorado Springs with Denver as the alternate.

After reaching cruise altitude, they discussed the situation and decided to make their "final" decision at a place where they could go either to Denver or to Colorado Springs and "try it, we can always miss the approach and go to our alternate." The new hire, feeling more uneasy, said, "Let's go to Denver and decide, when we get there, whether we should try for Colorado Springs. It's not that far out of the way." The boss then agreed and they changed course for Denver.

On the way, the boss continued to seek information to justify making an attempt at Colorado Springs. "No, the weather had not changed." "No, no one has landed all day. One Lear Jet had tried the approach several hours ago, but missed." Even when they had the Arapahoe Airport in sight, the boss, feeling the need to impress his new hire with his instrument skill, said, "Let's go to Colorado Springs and give it a try." The new hire by this time had made up his mind. He did not want to be faced with the situation on final approach in which he and his boss disagreed about whether they could see the runway sufficiently to land. He said, "We're going to Arapahoe."

Lesson: Do not allow yourself to be placed into a situation where a decision must be made very quickly under pressure from a superior. It is important to break the poor judgment chain with a superior well before your options are gone.

Economic Pressure

A pilot was on a return trip from Baltimore, MD, with two friends who were sharing the expenses of the trip. The weather forecast called for light to moderate icing in the clouds, but no reports of greater than light icing had been received. It was very important to all concerned that they get back to the Midwest that night to avoid the expense of an overnight in Baltimore. Thus, when the forecaster said, "Light to moderate icing," the pilots heard "Light icing." Thus, they decided to give it a try.

After reaching their en route altitude of 6,000 feet just west of Baltimore, in their Cessna 182, they were still clear of the clouds and felt that they would have no problems. However, a few minutes later they found themselves in the clouds picking up ice fairly rapidly. They asked for and received 5,000 feet to cruise and were relieved to find that they were again clear of clouds. However, they knew that they would soon need to go back to 6,000 feet to clear the mountains.

They began to discuss the alternatives. If they continued past Martinsburg, WV, the next possible stop would be Parkersburg, WV, almost an hours flight. At the rate they had been picking up ice at 6,000 feet, they could be spending the night on a West Virginia mountain top. On the other hand, a night in Martinsburg could not be very expensive. After Martinsburg, ATC cleared them to 6,000 feet, again, to cross the mountains. They complied but again found that they were picking up ice. They then decided to ask for a clearance back to Martinsburg; the clearance was received almost immediately. They landed and spent the night in Martinsburg (quiet and not too expensive). The next day, they proceeded to fly home without incident.

Lesson: Turning back in the face of deteriorating weather is good judgment in spite of economic pressure and prior commitments. It is a far easier decision to make, again, after you have made it the first time.

"They're Counting on Us"

In the next example, a corporate pilot reported, "We had just departed Downtown Airport with a 100-foot ceiling and one-half mile visibility in blowing snow, and had been cleared to 17,000 feet. All was well until we passed through 10,000 feet, when I saw smoke entering the cockpit.

My eyes started burning, and the smoke was making it hard to breathe. Our passenger (employer), whom we were flying to a business meeting, quickly came forward to report that there was smoke in the cabin. What was on fire? I told the copilot to declare an emergency and request a clearance to Regional Airport. He was having trouble breathing, but he quickly got the clearance.

I knew the weather would prevent our returning to Downtown Airport. Apart from the ceiling and visibility, there was a mixture of slush, ice and snow on the runway following six inches of snowfall. Regional Airport also had 100-foot overcast and half-mile visibility, but a full ILS, too. Our destination was VFR, but the smoke demanded immediate action.

All instruments appeared normal, so we went through the emergency checklist. I carefully pulled circuit breakers to isolate systems, in the hope of stopping the burning. I took everything off line except the radios that we needed for the approach. The smoke kept coming. I didn't want to dump the cabin pressure because my passenger had recently been seriously ill. He could do without the shock of a sudden pressure change.

Fortunately, everything continued to work and we broke out at 100 feet, lined up nicely. We made a normal landing, and opened the windows during the rollout for badly needed fresh air. The hot toxic fumes had given me a headache and sore throat.

Upon inspection of the aircraft, we discovered that the air inlet in the center section was plugged with ice. The air cooler had become packed with slush and snow thrown up from the runway by the nosewheel during takeoff and had subsequently frozen solid. Without cooling, the engine bleed air was hot enough to melt the sealant material, causing hot toxic fumes and smoke."

Comment: Slush and snow can be a hazard in any aircraft in many ways. This particular flight shows several examples of good judgment. The fact that the passenger is the "boss" and is on his way to a business meeting could have influenced the pilot to push on and try to "please his passenger." Add to that the possibility of an impulsive attitude, one might have thought, "I must land now," even though the situation was still under control. This pilot evaluated the situation carefully and made a decision -- quickly, but not without careful consideration.

This pilot also took responsibility for the safety of his passenger. He was careful not to lower the cabin pressure due to the passenger's recent illness. Had he been susceptible to the resignation hazardous attitude, he may have disregarded his control over the situation, figuring whatever happened was not his fault anyway.

Another aspect of good judgment was the use of the emergency procedure checklists. A pilot with the anti-authority attitude may have held to the thought that checklists are an unnecessary burden. That was not the case for this pilot in his emergency situation.

The final good decision in this series is the fact that the pilot learned from the situation and established his own personal limitations with respect to taking off in slush and snow. This decision will contribute to the prevention of a similar occurrence and is actually the first step in the next "good judgment chain."

The Instrument Approach Breakout

Approach practice is one of the most important aspects of instrument training. However, as it is normally conducted in VFR conditions under the hood, such practice fails to provide some essential conditions for the instrument approach in actual conditions. After reaching decision height or MDA and announcing that the time is up, your instructor tells you to take off the hood and land the airplane. You take off your hood, see the runway in full view ahead, and land VFR as you have done many times before.

This type of training fails to expose the student to the conditions that he or she must face in actual conditions such as, seeing the ground but not the runway or seeing, faintly, approach lights oriented in a very strange way but no runway. These conditions can lead to very serious problems and have led to many accidents. The final VFR segment of the instrument flight is by far the most hazardous and most students are not exposed to these hazards. Furthermore, although most aspects of this problem are in the area of perceptual judgment, e.g., optical illusions, visual cues, and vertigo, and are not covered in this book, some aspects of this segment of the flight fit under the topic of cognitive judgment as we have seen in the illustration, given above, entitled "management pressure."

As indicated earlier, the airlines recognize the dangers of the instrument approach to published minimums. They do not permit pilots to execute an ILS approach to Category II minimums unless an autopilot or dual-display flight director is used. Recognizing the additional risk in flying an unfamiliar airplane, captains checking out in new airplanes are required to have "high minimums," 100 feet above published minimums for the first 100 hours in that airplane.

General aviation pilots need to place similar personal minimums on their own instrument flying. If you are flying but once-a-week, you should not have the skill to do an approach to published minimums -- and it is not good judgment to try to prove that you do. If you are flying on instruments very rarely, you should raise your minimums further for accepting a flight. If you are flying with equipment that is malfunctioning or of questionable reliability, you should raise your minimums even further. If you are flying with no more than one nav/com radio, you should probably risk no more than to fly through a thin broken cloud layer regardless of your instrument skills.

Preparation for an instrument approach is at least as important as actually flying it. It should include studying the approach and the missed-approach procedures. Study the lighting aids for the runway to be used. Know what to expect when you break out of the clouds in low visibility. From a knowledge of the wind you should know your crab angle and the position of the runway in the windscreen to expect -- it will not necessarily be straight ahead! Know and relate your pitch and bank angles to the orientation that you expect to see the runway or the approach lights. Realize that as sparse visual cues become available, they can cause disorientation problems such as confusion or vertigo until they are sufficiently clear to be used for a landing.

Know that there is a natural tendency to very much want to make a landing following an approach. This temptation can lead you to descend below minimums or "duck under" when even a few visual cues become available. However, when you do this, you are departing from the good quality cues presented on your flight instruments, that you have been using, to uncertain outside visual cues that can cause the problems mentioned above. When a runway sighting is first made, it should be used only to confirm the instruments. NASA conducted a simulator study which revealed that airline pilots could be coerced into continuing an approach beyond safe limits by covert, subtle pressure from peers.

When decision height is reached, you must look outside and determine whether there is enough visibility to make a landing. If not, a missed approach should be initiated. If the approach can be continued, cross-check the instruments and the outside environment to confirm agreement. If there is conflicting information between these two sources, execute the missed approach. After reaching decision height, use the VASI to resist the urge to lower the nose to obtain a better look (duck under).

Cockpit Design Problems

Human factors principles have only recently been considered when evaluating cockpit safety. Years ago, airplanes were manufactured with less than ideal cockpit designs. It would go far beyond the scope of this manual to outline all of the human factors design inadequacies, but a few should be mentioned to illustrate the problem.

RNAV input devices. An outstanding example of a potential problem for the IFR pilot is the insertion of information into an RNAV computer. Some of these devices do not provide adequate feedback to permit the pilot to know at a glance the position to which he or she is navigating. The pilot is responsible for the correct input of the location of the fixes to which he or she will fly, and should always cross-check flight progress using other navigation methods. An example of the problems that this type of automated navigation can cause, even in multi-person crews, is the off-course flight of Korean Airline Flight 007.

OBS readout. A number of omni bearing selector (OBS) readout cards are oriented in such a way that the proper setting is read at the top of the card. Other VOR indicators present the readout at the bottom. What makes this even more confusing is that most cards show the reciprocal course at the opposite side from the correct OBS selection. In these cases, the correct setting is identified with a triangle and the reciprocal with a dot. If the pilot is under time pressure which requires the checking or setting of the instrument at a glance, the pilot would have trouble making this distinction. This problem is further compounded by a pilot who is unfamiliar with the aircraft.

Approaches at Unfamiliar Airports

Every pilot eventually becomes familiar with his home airport and the approach procedures used. For these reasons, some compromises in preparation for the execution of approaches could be considered good judgment. For example, some airlines coming into their homebase can safely accept a greater angle of turn onto final approach, perhaps to avoid a noise sensitive area, than at unfamiliar airports. Similar criteria could be used by general aviation pilots. Preparation for approaches into unfamiliar airports requires a greater amount of preparation and no compromises of procedures, even if they are offered by ATC.

Cockpit Organization

Cockpit resource management (CRM) is becoming an important aspect of air carrier training. CRM is the ability to manage all resources available in the cockpit in an efficient and effective manner for both routine and emergency procedures. The resources include: pilots' attention capacity, other crew members, the instruments, the avionics, and the computer or flight management system. Airlines are being driven to train their pilots in this way by the new computer management systems (and the accidents caused by cockpit management errors). General aviation operators should consider ways to improve the organization of the single-pilot cockpit. Planning ahead for busy times such as terminal area flying, "cleaning up" the cockpit, noting navigation aids for crosschecking, checking weather and ATIS information well ahead of time, and use of the autopilot are a few ideas to improve organization in the single-pilot IFR environment. Use of nonflying passengers to hold or find charts can also be useful.

Autopilots

The use of the autopilot has been mentioned above as an effective device to ease pilot workload and improve safety during instrument approaches. There are two precautions concerning the use of autopilots which should be considered. Some pilots become overly dependent on autopilots to the extent that they have no confidence in conducting an approach without them. This is the result of never flying a "hands-on" approach. In some cases, these pilots have lost their ability to make a manual approach -- a problem also being recognized and addressed by the airlines. It is possible for autopilots to fail in ways that cannot easily be detected. Too much dependency on a working autopilot could lead to complacency that would prevent the detection of a malfunction.

Boom Mikes

Communication is a workload problem during single-pilot IFR operations, especially in terminal areas. This burden can be reduced by using a boom mike. This not only eliminates the problem of finding the mike, but it also reduces the time required to start a communication when the frequency is uncongested, a task that is difficult in busy areas. This is a significant enough factor that it should be considered in preparation for flights into busy terminal areas.

Pilots' Weather

The information provided in weather forecasts is essential to safe flight in instrument flight conditions. However, it is not always perfect. Pilots sometimes think that it is never right, and may not give it proper attention. However, a few statistics regarding the probability of a correct forecast are worth mentioning to improve your assessment of the risks involved in a given flight.

Characteristics of Forecast Products

How good are our forecasts and services? A pilot should understand the limitations as well as the capabilities of present day meteorology. Otherwise he may request the impossible while overlooking the attainable. The meteorologist understands some atmospheric behaviors and has watched them long enough to know that knowledge of the atmosphere certainly is not complete. Weather when compared with some other sciences is quite imprecise, despite spectacular progress in recent years. It is much less exact than anyone in aviation likes.

- To have complete faith in weather forecasts would be as bad as to have no faith at all. Pilots who understand the limitations of observations and forecasts usually are the ones who make most effective use of the weather forecast service. The safe pilot continually views aviation forecasts with an open mind. He or she knows that weather always is changing and that, consequently, the older the forecast, the greater chance that some part of it will be wrong. The weather-wise pilot looks upon a forecast as professional advice rather than absolute certainty.

Forecast Accuracy

Forecast accuracy stems from what we know and what we measure. These two limitations determine the reliability factor of various weather situations and the amount and quality of detail; both change with time. Important to remember is the fact that forecast accuracy decreases as time passes after forecast issuance.

Remember that the forecaster must consider a complex combination of many factors. Information on many of these factors may be partially or completely lacking.

Limitations of Aviation Forecasts

Recent studies of the aviation forecasts indicate the following:

1. Up to 12 hours and even beyond, a forecast of good weather (ceiling 3,000 feet or more and visibility 3 miles or greater) is much more likely to be correct than a forecast of conditions below 1,000 feet or below 1 mile.

THIS IS VFR?

2. However, for 3 to 4 hours in advance, the probability that below VFR conditions will occur is more than 80 percent if below VFR is forecast.
3. Forecasts of single reportable values of ceiling or visibility instead of a range of values imply an accuracy that the present forecasting system does not possess beyond the first 2 or 3 hours of the forecast period.
4. Forecasts of poor flying conditions during the first few hours of the forecast period are most reliable when there is a distinct weather system, such as a front, a trough, precipitation, etc., which can be tracked and forecast, although there is a general tendency to forecast too little bad weather in such circumstance.
5. The weather associated with fast-moving cold fronts and squall lines is the most difficult to forecast accurately.
6. Errors in forecasting the time of occurrence of bad weather are more prevalent than errors in forecasting whether it will occur or will not occur with a span of time.
7. Surface visibility is more difficult to forecast than ceiling height. Visibility in snow is the most difficult of all visibility forecasts. Skill in these forecasts leaves much to be desired.

Available evidence shows that forecasters CAN predict the following at least 75 percent of the time:

- The passage of fast-moving cold fronts or squall lines within plus or minus 2 hours as much as 10 hours in advance.
- The passage of warm fronts or slow-moving cold fronts within plus or minus 5 hours up to 12 hours in advance.
- The rapid lowering of ceiling below 1,000 feet in pre-warm front conditions within plus or minus 200 feet and within plus or minus 4 hours.
- The onset of a thunderstorm 1 to 2 hours in advance if radar is available.
- The time rain or snow will begin within plus or minus 5 hours

Forecast CANNOT predict the following with an accuracy which satisfies present aviation operational requirements:

- The time freezing rain will begin.
- The location and occurrence of severe or extreme turbulence.
- The location of the occurrence of a tornado.
- Ceilings of 100 feet or zero, before they exist.

- The onset of a thunderstorm which has not yet formed.
- The position of a hurricane center to nearer than 80 miles for more than 24 hours in advance.
- The occurrence of ice and fog.

Studies at the Severe Local Storm Center (SELS) reveal the following verification statistics concerning severe local storms:

1. One out of two tornado forecasts are verified.
2. The SELS Center can forecast with reasonable accuracy about 40% of the storms, that is 40% of all storms fall within the selected areas during the time specified. Another 30% are close to the selected areas and times. The remaining 40% do not even come close

You may think at first glance that these tornado verification statistics indicate poor forecasting. But consider that tornado forecasts include less than 1% of space-time distribution, while the 30% that miss occur scattered throughout more than 99%. Actually, tornado forecasts are very good.

As an added note, can you fly safely through an area for which severe storms have been forecast? Sometimes, with the aid of a briefer. Severe weather rarely occurs simultaneously throughout the forecast area. The briefer can help you select a route and time through the area that will avoid the hazardous weather. But always be ready to scamper to safety if his advice proves wrong.

Limitations of Icing and Turbulence Forecasts

Occurrences of both icing and turbulence are local in extent and transient in character. Once a pilot receives a forecast of these hazards, he or she usually plans the flight to avoid them. Since aircraft are the only instruments with which to observe these phenomena, no means are readily available to verify the forecasts on a routine basis. As yet, verification statistics are not possible. With the present state of the science, forecasts of icing and turbulence specify volumes of airspace which are quite small when compared to the total volume used by aviation, but relatively large compared to the localized extent of the hazards. Verification of the hazards in these relatively large forecast volumes is fairly accurate - occurring perhaps 50% to 75% of the time - but intensity forecasts typically are less reliable.

This does not mean that within a volume of airspace for which these hazards have been forecast the probability of encountering them is 50% to 75%. Since the regions of icing or turbulence are small compared to the overall volume specified in the forecast, the probability of actual encounter is much lower - more on the order of 5% to 15%. Nevertheless, the possibility of the hazards exists, and any pilot must use judgment and avoid such areas unless the pilot and the plane have the capabilities to cope with the worst that normally can be expected.

Forecast Revisions

Since accuracy of forecast diminishes with time, the forecaster frequently must revise forecasts to reflect unexpected changes. The forecaster may amend a forecast at any time it's important to flying safety; and, in addition, specific, published guidelines indicate the need for amendments.

Terminal Forecasts (FT)

Terminal forecasts (FT) serve primarily landing and takeoff operations in the terminal area. The forecaster must consider hazards affecting the local minimums for terminals and also must consider hazards affecting the local weather. Weather watch bulletins and hurricane advisories often must be incorporated into the amendments.

Area Forecasts (FA)

Area Forecasts may be amended as needed. There are no specific criteria since the forecasts are more general than the FT's. In addition, SIGMET and AIRMET weather advisories issued by selected Weather Service Field Offices (WSFOs), severe weather watch bulletins (WW) issued by the Severe Local Storm Center and abbreviated hurricane advisories (WH) issued by Hurricane Forecast Centers, serve as amendments to area forecasts.

Using Aviation Forecasts

Why do we have different types of forecasts and why do we sometimes reference heights to ground level and other times to sea level? Since terminal forecasts primarily support takeoff and landing operations, you are interested in terrain clearance and, therefore, will want height reference to ground level. FTs help you decide whether to fly VFR, IFR, or whether you should fly at all. Height references in FTs always are above ground.

Area Forecasts (FA), TWEB Route Forecasts, SIGMETs (WS), AIRMETs (WA), and winds and temperatures aloft forecasts (FD) supply mostly en route information. There, at cruising altitude, you have your altimeter set to indicate altitude above sea level. Height references in these en route forecasts generally are in feet above sea level. Exceptions occur in FAs, TWEBs, WSs, and WAs when references occasionally are in feet above ground. Text of these forecasts clearly indicate the exceptions (a reference to ceilings always means above ground). Above ground references in FAs help the low-level VFR pilot and also aid in estimating landing conditions at airports for which no FT is prepared.

Help yourself and the Weather Service....get weather-wise!

THERE PROBABLY IS NO BETTER INVESTMENT IN PERSONAL SAFETY, FOR THE PILOT AS WELL AS THE SAFETY OF OTHERS, THAN THE EFFORT SPENT TO INCREASE KNOWLEDGE OF BASIC WEATHER PRINCIPLES AND TO LEARN TO INTERPRET AND USE THE PRODUCTS OF THE WEATHER SERVICE.

Be SPECIFIC When Requesting a Briefing

When you request a weather briefing, whether face-to-face or by telephone, you greatly assist the briefer and get faster service by giving the following to the briefer. :

1. That you are a pilot. (Many requests for weather information are not related to aviation. Airline passengers often also enquire about flying weather.)
2. Your aircraft number and your name (for the record).
3. The type of aircraft you are planning to fly. (Light single engine, high performance multi-engine, and jets all present different briefing problems.)
4. Your destination.
5. Your estimated departure time and your time en route.
6. Whether or not you can go IFR.

Get a COMPLETE Weather Briefing

After receiving your request, the briefer may inform you of especially hazardous weather that can cause you to alter, postpone, or cancel your flight. However, most often you will elect to fly, and you will want a complete briefing. Your briefing is incomplete unless it contains all of the following:

1. Hazardous weather (may cause you to postpone or alter your flight).
2. Weather Synopsis (positions of lows, fronts, ridges, current weather, etc.)
3. En route forecast
4. Destination forecast
5. Alternate routes (if necessary).
6. Forecast winds aloft.

If you don't get all of this information, ask for it. However, you very likely will get a complete briefing because the above items are part of the briefer's checklist. You will help by allowing the briefer to finish the presentation before asking questions.

Have an ALTERNATE Course of Action.

Always have an alternate course of action in mind in the event unsuitable weather develops. It is impossible to overemphasize the importance of planning a way to escape.

THE FIVE ANTIDOTES

Hazardous Attitude

Antidote

ANTI-AUTHORITY:

"Don't tell me"

"Follow the rules. They are usually right."

IMPULSIVITY:

"Do something - quickly!"

"Not so fast. Think first."

INVULNERABILITY:

"It won't happen to me."

"It could happen to me."

MACHO:

"I can do it."

"Taking chances is foolish."

RESIGNATION:

"What's the use?"

"I'm not helpless. I can make a difference."

AERONAUTICAL DECISION MAKING PROCESS

