CHAPTER 1

Introduction to Glider Flying

Welcome to the world of soaring. The Glider Flying Handbook is designed to help you achieve your goals in aviation and to provide you with the knowledge and practical information needed to attain private, commercial, and flight instructor category ratings in gliders.

GLIDERS — THE EARLY YEARS

The fantasy of flight led people to dream up intricate designs in an attempt to imitate the flight of birds. Leonardo da Vinci sketched a vision of flying machines in his 15th century manuscripts. His work consisted of a number of wing designs including a human-powered ornithopter, derived from the Greek word for bird. Centuries later, when others began to experiment with his designs, it became apparent that the human body could not sustain flight by flapping wings like birds. [Figure 1-1]

GLIDER OR SAILPLANE?

The Federal Aviation Administration (FAA) defines a glider as a heavier-than-air aircraft that is supported in flight by the dynamic reaction of the air against its lifting surfaces, and whose free flight does not depend on an engine. The term glider is used to designate the rating that can be placed on a pilot certificate once a person successfully completes required glider knowledge and practical tests.

Another widely accepted term used in the industry is sailplane. Soaring refers to the sport of flying sailplanes, which usually includes traveling long distances and remaining aloft for extended periods of time. Gliders were designed and built to provide short flights off a hill down to a landing area. Since their wings provided relatively low lift and high drag, these simple gliders were generally unsuitable for sustained flight using atmospheric lifting forces. The most well known example of a glider is the space shuttle, which literally glides back to earth. The space shuttle, like gliders, cannot sustain flight for long periods of time. Early gliders were easy and inexpensive to build, and they played an important role in flight training.

Self-launch gliders are equipped with engines, but with the engine shut down, they display the same flight characteristics as non-powered gliders. The engine allows them to be launched under their

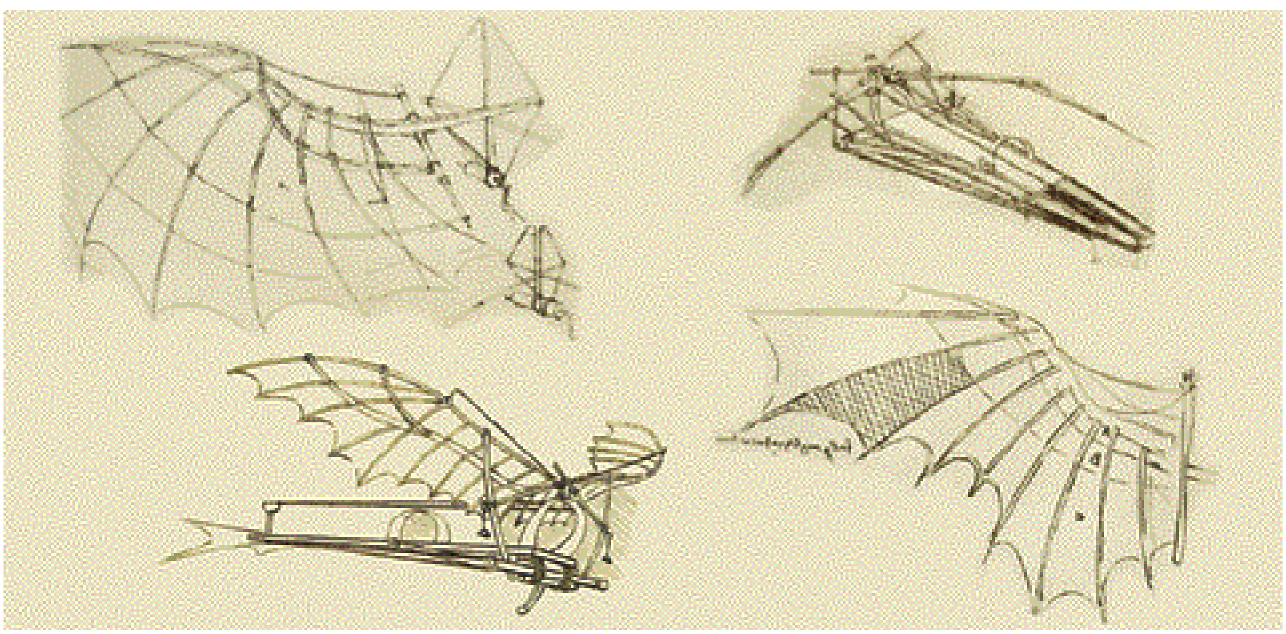

Figure 1-1. A human-powered ornithopter is virtually incapable of flight due to the dramatic difference in the strength-to-weight ratio of birds compared to humans.

own power. Once aloft, pilots of self-launch gliders can shut down the engine and fly with the power off. The additional training and procedures required to earn a self-launch endorsement are covered later in this handbook.

GLIDER CERTIFICATE ELIGIBILITY REQUIREMENTS

To be eligible to fly a glider solo, you must be at least 14 years of age and demonstrate satisfactory aeronautical knowledge on a test developed by your instructor. You also must have received and logged flight training for the maneuvers and procedures in Title 14 of the Code of Federal Aviation Regulations (14 CFR) part 61 that are appropriate to the make and model of aircraft to be flown, as well as demonstrate satisfactory proficiency and safety. Only after all of these requirements are met, can your instructor endorse your student certificate and logbook for solo flight.

To be eligible for a private pilot certificate with a glider rating, you must be at least 16 years of age, complete the specific training and flight time requirements described in 14 CFR part 61, pass a knowledge test, and successfully complete a practical test.

To be eligible for a commercial or flight instructor glider certificate, you must be 18 years of age, complete the specific training requirements described in 14 CFR part 61, pass the required knowledge tests, and pass another practical test. If you currently hold a pilot certificate for a powered aircraft and are adding a glider category rating on that certificate, you are exempt from the knowledge test but must satisfactorily complete the practical test. Certificated glider pilots are not required to hold an airman medical certificate to operate a glider.

AERONAUTICAL DECISION MAKING

Aeronautical decision making (ADM) is a systematic approach to the mental process used by pilots to consistently determine the best course of action in response to a given set of circumstances. The importance of learning effective ADM skills cannot be overemphasized. While progress is continually being made in the advancement of pilot training methods, aircraft equipment and systems, and services for pilots, accidents still occur. Despite all the changes in technology to improve flight safety, one factor remains the same—the human factor. It is estimated that 65 percent of the total glider accidents are human factors related.

Historically, the term "pilot error" has been used to describe the causes of these accidents. Pilot error means that an action or decision made by the pilot was the cause of, or a contributing factor that lead to, the accident. This definition also includes the pilot's failure to make a decision or take action. From a broader perspective, the phrase "human factors related" more aptly describes these accidents since it is usually not a single decision that leads to an accident, but a chain of events triggered by a number of factors.

The poor judgment chain, sometimes referred to as the "error chain," is a term used to describe this concept of contributing factors in a human factors related accident. Breaking one link in the chain normally is all that is necessary to change the outcome of the sequence of events. The following is an example of the type of scenario illustrating the poor judgment chain.

An experienced glider pilot returning from a cross-country flight is approaching a jagged mountain ridge that lies between him and his home airport located in the valley below. As he nears the ridge he sees people on the top waving to him in excitement. Overjoyed with having flown over 400 kilometers, he decides to do a low pass over the peak. He is flying into a 30 knot headwind that is blowing across the peak. Holding what he feels is adequate airspeed as he nears the lee side of the peak, he realizes his altitude is not very high in relation to the peak of the ridge. As he nears the peak he finds himself in a strong downdraft created by the strong wind blowing over the ridge. In an attempt to make a 180° turn to avoid contacting the ridge, the pilot puts his glider into a steep right turn and pulls back hard on the control stick resulting in an accelerated stall/spin. In the ensuing crash, the pilot is fatally injured and the glider is completely destroyed.

By discussing the events that led to this accident, we can understand how a series of judgmental errors contributed to the final outcome of this flight. For example, one of the first elements that affected the pilot's flight was his inability to realize that his decision-making skills were probably dulled by the long distance flight, which preceded the accident. The pilot had flown over this ridge a number of times and was aware that downdrafts are often present on the lee side of the peak but had never had problems in the past.

Next, he let his desire to show-off for the people on the mountain peak override his concern for arriving safely at his home airport, and he failed to recognize the threat posed by the strong wind blowing over the ridge. Rather than heading straight for the airport, he decided to make a low pass over the ridge with insufficient altitude to maintain the FAA mandatory minimums in dangerous wind conditions. Next, rather than aborting his attempt to make the pass over the peak when he realized his altitude was not sufficient, he continued to fly toward the peak rather than making a 180° turn away from it.

On numerous occasions during the flight, the pilot could have made effective decisions that may have prevented this accident. However, as the chain of events unfolded, each poor decision left him with fewer and fewer options.

ORIGINS OF ADM TRAINING

The airlines developed some of the first training programs that focused on improving ADM. Human factors-related accidents motivated the airline industry to implement crew resource management (CRM) training for flight crews. The focus of CRM programs is the effective use of all available resources—human resources, hardware, and information. Human resources include all groups routinely working with the cockpit crew (or pilot) who are involved in decisions required to operate a flight safely. These groups include, but are not

DEFINITIONS

ADM is a systematic approach to the mental process used by pilots to consistently determine the best course of action in response to a given set of circumstances.

ATTITUDE is a personal motivational predisposition to respond to persons, situations, or events in a given manner that can, nevertheless, be changed or modified through training as sort of a mental shortcut to decision making.

ATTITUDE MANAGEMENT is the ability to recognize hazardous attitudes in oneself and the willingness to modify them as necessary through the application of an appropriate antidote thought.

CREW RESOURCE MANAGEMENT (CRM) is the application of team management concepts in the flight deck environment. It was initially known as cockpit resource management, but as CRM programs evolved to include cabin crews, maintenance personnel, and others, the phrase crew resource management was adopted. This includes single pilots, as in most general aviation aircraft. Pilots of small aircraft, as well as crews of larger aircraft, must make effective use of all available resources; human resources, hardware, and information. A current definition includes all groups routinely working with the cockpit crew who are involved in decisions required to operate a flight safely. These groups include, but are not limited to: pilots, dispatchers, cabin crewmembers, maintenance personnel, and air traffic controllers. CRM is one way of addressing the challenge of optimizing the human/machine interface and accompanying interpersonal activities.

HEADWORK is required to accomplish a conscious, rational thought process when making decisions. Good decision making involves risk identification and assessment, information processing, and problem solving.

JUDGMENT is the mental process of recognizing and analyzing all pertinent information in a particular situation, a rational evaluation of alternative actions in response to it, and a timely decision on which action to take.

PERSONALITY is the embodiment of personal traits and characteristics of an individual that are set at a very early age and extremely resistant to change.

POOR JUDGMENT CHAIN is a series of mistakes that may lead to an accident or incident. Two basic principles generally associated with the creation of a poor judgment chain are: (1) one bad decision often leads to another; and (2) as a string of bad decisions grows, it reduces the number of subsequent alternatives for continued safe flight. ADM is intended to break the poor judgment chain before it can cause an accident or incident.

RISK ELEMENTS IN ADM take into consideration the four fundamental risk elements: the pilot, the aircraft, the environment, and the type of operation that comprise any given aviation situation.

RISK MANAGEMENT is the part of the decision making process which relies on situational awareness, problem recognition, and good judgment to reduce risks associated with each flight.

SITUATIONAL AWARENESS is the accurate perception and understanding of all the factors and conditions within the four fundamental risk elements that affect safety before, during, and after the flight.

SKILLS and PROCEDURES are the procedural, psychomotor, and perceptual skills used to control a specific aircraft or its systems. They are the airmanship abilities that are gained through conventional training, are perfected, and become almost automatic through experience.

STRESS MANAGEMENT is the personal analysis of the kinds of stress experienced while flying, the application of appropriate stress assessment tools, and other coping mechanisms.

Figure 1-2. These terms are used in AC 60-22 to explain concepts used in ADM training.

limited to: ground, maintenance, and flight personnel. Although the CRM concept originated as airlines developed ways of facilitating crew cooperation to improve decision making in the cockpit, CRM principles, such as workload management, situational awareness, communication, the leadership role of the captain, and crewmember coordination have direct application to the general aviation cockpit. This also includes single pilot operations, since pilots of small aircraft, as well as crews of larger aircraft, must make effective use of all available resources—human resources, hardware, and information. You can also refer to AC 60-22, Aeronautical Decision Making, which provides background references, definitions, and other pertinent information about ADM training in the general aviation environment. [Figure 1-2]

THE DECISION-MAKING PROCESS

An understanding of the decision-making process provides you with a foundation for developing ADM skills. Some situations, such as towrope breaks, require you to respond immediately, using established procedures, with little time for detailed analysis. Traditionally, pilots have been well trained to react to emergencies, but are not as well prepared to make decisions that require a more reflective response. Typically during a flight, you have time to examine any changes that occur, gather information, and assess risk before reaching a decision. The steps leading to this conclusion constitute the decision-making process.

DEFINING THE PROBLEM

Problem definition is the first step in the decision-making process. Defining the problem begins with recognizing that a change has occurred or that an expected change did not occur. A problem is perceived first by the senses, then is distinguished through insight and experience. These same abilities, as well as an objective analysis of all available information, are used to determine the exact nature and severity of the problem.

While going through your pre-landing checklist, you discover that your landing gear is stuck in the retracted position.

CHOOSING A COURSE OF ACTION

After the problem has been identified, you must evaluate the need to react to it and determine the actions that need to be taken to resolve the situation in the time available. The expected outcome of each possible action should be considered and the risks assessed before you decide on a response to the situation.

Your first thought was to try to thermal back up to buy yourself some time and see if you could get the landing gear freed. After weighing the consequences of not finding lift and not focusing on flying the glider, you realize your only course is to make a gear-up landing. You plan to land on the grass runway to the east of the paved runway to avoid causing extensive damage to your glider and allow for a softer touchdown.

DECIDE MODEL
Detect the fact that a change has occurred.
Estimate the need to counter or react to the change.
Choose a desirable outcome for the success of the flight.
Identify actions which could successfully control the change.
Do the necessary action to adapt to the change.
Evaluate the effect of the action.

Figure 1-3. The DECIDE model can provide a framework for effective decision making.

IMPLEMENTING THE DECISION AND EVALUATING THE OUTCOME

Although a decision may be reached and a course of action implemented, the decision-making process is not complete. It is important to think ahead and determine how the decision could affect other phases of the flight. As the flight progresses, you must continue to evaluate the outcome of the decision to ensure that it is producing the desired result.

As you make your turn to downwind, you realize a tractor mowing the field is in the middle of the grass runway. At this point you make the decision to land on the paved runway with as smooth a touchdown as possible. You make a normal pattern and approach to landing and perform a minimum energy touchdown, at which point the glider's belly contacts the pavement and grinds to a stop wings level, causing only minor damage to the glider's underside.

The decision making process normally consists of several steps before you choose a course of action. To help you remember the elements of the decision-making process, a six-step model has been developed using the acronym "DECIDE." [Figure 1-3]

RISK MANAGEMENT

During each flight, decisions must be made regarding events that involve interactions between the four risk elements—the pilot in command, the aircraft, the environment, and the operation.

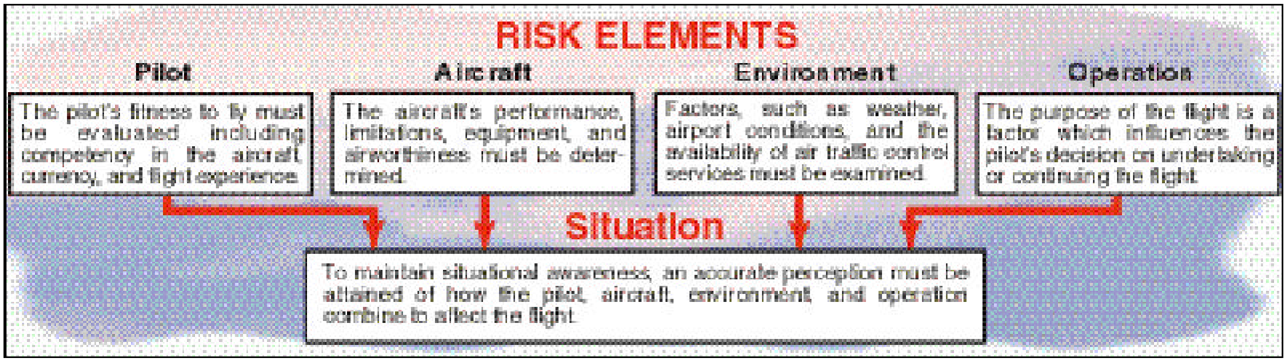

Figure 1-4. When situationally aware, you have an overview of the total operation and are not fixated on one perceived significant factor.

ation. The decision-making process involves an evaluation of each of these risk elements to achieve an accurate perception of the flight situation. [Figure 1-4]

One of the most important decisions that a pilot in command must make is the go/no-go decision. Evaluating each of these risk elements can help you decide whether a flight should be conducted or continued. Let us evaluate the four risk elements and how they affect our decision making regarding the following situations.

Pilot—As a pilot, you must continually make decisions about your own competency, condition of health, mental and emotional state, level of fatigue, and many other variables. For example, you plan for an extended cross-country flight. You have had only a few hours of sleep, and you are concerned that the congestion you feel could be the onset of a cold. Are you safe to fly?

Aircraft—You will frequently base decisions on your evaluations of the aircraft, such as performance, equipment, or airworthiness. Picture yourself in the following situation. You are on a cross-country flight and have begun to fly over extremely rugged terrain, which covers the next 20 miles of your planned route and will not allow you to land safely should the need arise. The thermals are beginning to dissipate and your altitude is 3,000 feet above ground level (AGL). Should you continue to fly over this terrain?

Environment—This encompasses many elements not pilot or aircraft related. It can include such factors as weather, air traffic control, navaids, terrain, takeoff and landing areas, and surrounding obstacles. Weather is one element that can change drastically over time and distance. Imagine you are flying on a cross-country flight when you encounter unexpected snow squalls and declining visibility in an area of rising terrain. Do you try to stay aloft and stay clear of the snow or land at the airport located in the valley below as soon as possible?

Operation—The interaction between you as the pilot, your aircraft, and the environment is greatly influ-

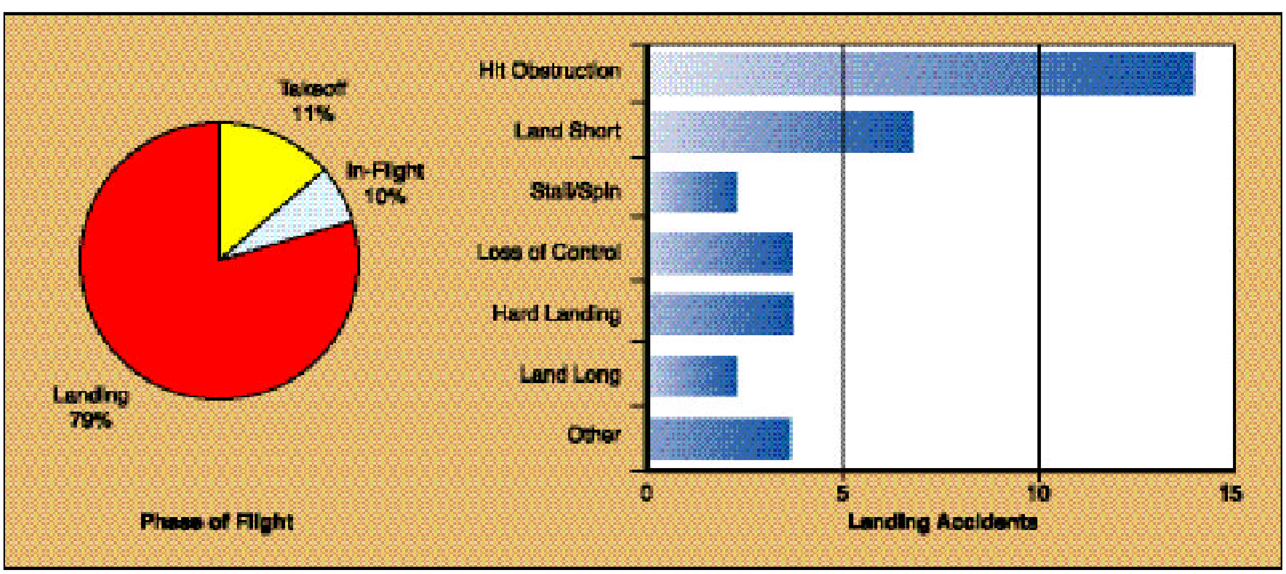

Figure 1-5. Statistical data can identify operations that have the highest risk.

enced by the purpose of each flight operation. You must evaluate the three previous areas to decide on the desirability of undertaking or continuing the flight as planned. It is worth asking yourself why the flight is being made, how critical is it to maintain the schedule, and is the trip worth the risks? For instance, you are giving glider rides at a busy commercial glider operation located near a mountain range on an extremely windy and turbulent day with strong downdrafts. Would it be better to wait for better conditions to ensure safe flight? How would your priorities change if your boss told you he only wanted you to take one more flight and then you could call it a day?

ASSESSING RISK

Examining National Transportation Safety Board (NTSB) reports and other accident research can help you to assess risk more effectively. For example, studies indicate the types of flight activities that are most likely to result in the most serious accidents. For gliders, takeoff and landing accidents consistently account for over 90 percent of the total number of accidents in any given year.

Causal factors for takeoff accidents are evenly divided between loss of directional control, collision with obstructions during takeoff, mechanical factors, and a premature termination of the tow. Accidents occurring during the landing phase of flight consistently account for an overwhelming majority of injury to pilots and damage to aircraft. This has proven to be especially true during recent years in which approximately 80 percent of all glider accidents occurred during the landing phase of flight. Accidents are more likely during takeoff and landing because the tolerance for error is greatly diminished and opportunities for pilots to overcome errors in judgment and decision-making become increasingly limited. The most common causal factors for landing accidents include collision with obstructions in the intended landing area. [Figure 1-5]

I'M SAFE CHECKLIST

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 8 hours? Within 24 hours?

Fatigue—Am I tired and not adequately rested?

Eating—Am I adequately nourished?

Figure 1-6. Prior to flight, you should assess your fitness, just as you evaluate the aircraft's airworthiness.

HAZARDOUS ATTITUDES	ANTIDOTES
Macho—Brenda often brags to her friends about her skills as a pilot and wants to impress them with her abilities. During her third solo flight she decides to take a friend for a glider ride.	**Taking chances is foolish.**
Anti-authority—In the air, she thinks "It's great to be up here without an instructor criticizing everything I do. His do-it-by-the-book attitude takes all of the fun out of flying."	**Follow the rules. They are usually right.**
Invulnerability—Brenda soon realizes that the lift is not as strong as she had thought. But she feels confident that her skill in thermaling will still allow a long flight several miles from the gliderport so she can show her friend the countryside. She thinks, "It's no more difficult than many of the flights with my instructor."	**It could happen to me.**
Impulsivity—While returning to the gliderport, Brenda notices a lot of her glider friends sitting outside watching the activities. She decides to "buzz" the field and impress her friends, as well as Sarah, her passenger. As she pulls up from her performance she realizes she is running out of airspeed, altitude and ideas.	**Not so fast. Think first.**
Resignation—After returning at a low altitude during a local soaring flight Brenda does not realize that she is landing with a tailwind. Brenda makes a fast approach followed by a hard landing and nearly hits the fence before the glider stops. As she and her passenger exit the glider, she says to herself, "Oh well, it's all part of learning to fly."	**I'm not helpless. I can make a difference.**

Figure 1-7. You must be able to identify hazardous attitudes and apply the appropriate antidote when needed.

FACTORS AFFECTING DECISION MAKING

It is important to point out the fact that being familiar with the decision-making process does not ensure that you will have the good judgment to be a safe pilot. The ability to make effective decisions as pilot in command depends on a number of factors. Some circumstances, such as the time available to

THE FIVE HAZARDOUS ATTITUDES	
1. Anti-Authority: "Don't tell me."	This attitude is found in people who do not like anyone telling them what to do. In a sense, they are saying, "No one can tell me what to do." They may be resentful of having someone tell them what to do, or may regard rules, regulations, and procedures as silly or unnecessary. However, it is always your prerogative to question authority if you feel it is in error.
2. Impulsivity: "Do it quickly."	This is the attitude of people who frequently feel the need to do something, anything, immediately. They do not stop to think about what they are about to do; they do not select the best alternative, and they do the first thing that comes to mind.
3. Invulnerability: "It won't happen to me."	Many people feel that accidents happen to others, but never to them. They know accidents can happen, and they know that anyone can be affected. They never really feel or believe that they will be personally involved. Pilots who think this way are more likely to take chances and increase risk.
4. Macho: "I can do it."	Pilots who are always trying to prove that they are better than anyone else are thinking, "I can do it —I'll show them." Pilots with this type of attitude will try to prove themselves by taking risks in order to impress others. While this pattern is thought to be a male characteristic, women are equally susceptible.
5. Resignation: "What's the use?"	Pilots who think, "What's the use?" do not see themselves as being able to make a great deal of difference in what happens to them. When things go well, the pilot is apt to think that it is good luck. When things go badly, the pilot may feel that someone is out to get him, or attribute it to bad luck. The pilot will leave the action to others, for better or worse. Sometimes, such pilots will even go along with unreasonable requests just to be a "nice guy."

Figure 1-8. You should examine your decisions carefully to ensure that your choices have not been influenced by a hazardous attitude.

make a decision, may be beyond your control. However, you can learn to recognize those factors that can be managed and learn skills to improve decision-making ability and judgment.

PILOT SELF-ASSESSMENT

The pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft. In order to effectively exercise that responsibility and make effective decisions regarding the outcome of a flight, you must have an understanding of your limitations. Your performance during a flight is affected by many factors, such as health, recency of experience, knowledge, skill level, and attitude.

Exercising good judgment begins prior to taking the controls of an aircraft. Often, pilots thoroughly check their aircraft to determine airworthiness, yet do not evaluate their own fitness for flight. Just as a checklist is used when preflighting an aircraft, a personal checklist based on such factors as experience, currency, and comfort level can help determine if you are prepared for a particular flight. Specifying when refresher training should be accomplished and designating weather minimums, which may be higher than those listed in Title 14 of the Code of Federal Regulations (14 CFR) part 91, are elements that may be included on a personal checklist. In addition to a review of personal limitations, you should use the I'M SAFE Checklist to further evaluate your fitness for flight. [Figure 1-6]

RECOGNIZING HAZARDOUS ATTITUDES

Being fit to fly depends on more than just your physical condition and recency of experience. For example, attitude affects the quality of your decisions. Attitude can be defined as a personal

STRESSORS

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

Physiological Stress—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, or a demotion at work. This type of stress may also be related to mental workload, such as analyzing a problem, navigating an aircraft, or making decisions.

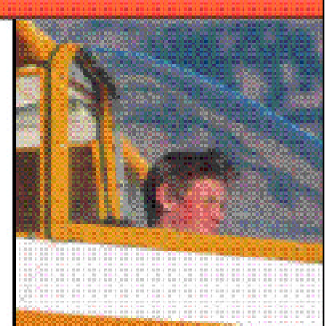

Figure 1-9. The three types of stressors that can affect a pilot's performance.

motivational predisposition to respond to persons, situations, or events in a given manner. Studies have identified five hazardous attitudes that can interfere with your ability to make sound decisions and exercise authority properly. [Figure 1-7]

Hazardous attitudes can lead to poor decision making and actions that involve unnecessary risk. You must examine your decisions carefully to ensure your choices have not been influenced by hazardous attitudes, and you must be familiar with positive alternatives to counteract the hazardous attitudes. These substitute attitudes are referred to as antidotes. During a flight operation, it is important to be able to recognize a hazardous attitude, correctly label the thought, and then recall its antidote. [Figure 1-8]

STRESS MANAGEMENT

Everyone is stressed to some degree all the time. A certain amount of stress is good since it keeps a person alert and prevents complacency. However, effects of stress are cumulative and, if not coped with adequately, eventually add up to an intolerable burden. Performance generally increases with the onset of stress, peaks, and then begins to fall off rapidly as stress levels exceed a person's ability to cope. The ability to make effective decisions during flight can be impaired by stress. Factors, referred to as stressors, can increase a pilot's risk of error in the cockpit. [Figure 1-9]

There are several techniques to help manage the accumulation of life stresses and prevent stress overload. For example, including relaxation time in a busy schedule and maintaining a program of physical fitness can help reduce stress levels. Learning to manage time more effectively can help you avoid heavy pressures imposed by getting behind schedule and not meeting deadlines. Take an assessment of yourself to determine your capabilities and limitations and then set realistic goals. In addition, avoiding stressful situations and encounters can help you cope with stress.

USE OF RESOURCES

To make informed decisions during flight operations, you must be aware of the resources found both inside and outside the cockpit. Since useful tools and sources of information may not always be readily apparent, learning to recognize these resources is an essential part of ADM training. Resources must not only be identified, but you must develop the skills to evaluate whether you have the time to use a particular resource and the impact that its use will have upon the safety of flight. For example, the assistance of air traffic control (ATC) may be very useful if you are not sure of your location. However, in an emergency situation when action needs be taken quickly, time may not be available to contact ATC immediately.

INTERNAL RESOURCES

Internal resources are found in the cockpit during flight. Since some of the most valuable internal resources are ingenuity, knowledge, and skill, you can expand cockpit resources immensely by improving these capabilities. This can be accomplished by frequently reviewing flight information publications, such as the CFRs and the Aeronautical Information Manual (AIM), as well as by pursuing additional training.

A thorough understanding of all the equipment and systems in the aircraft is necessary to fully utilize all resources. For example, satellite navigation systems are valuable resources. However, if pilots do not fully understand how to use this equipment, or they rely on it so much that they become complacent, it can become a detriment to safe flight.

Checklists are essential cockpit resources for verifying that the aircraft instruments and systems are checked, set, and operating properly, as well as ensuring that the proper procedures are performed if there is a system malfunction or in-flight emergency. Other valuable cockpit resources include current aeronautical charts, and publications, such as the Airport/Facility Directory (A/FD).

Passengers can also be a valuable resource. Passengers can help watch for traffic and may be able to provide information in an irregular situation, especially if they are familiar with flying. A strange smell or sound may alert a passenger to

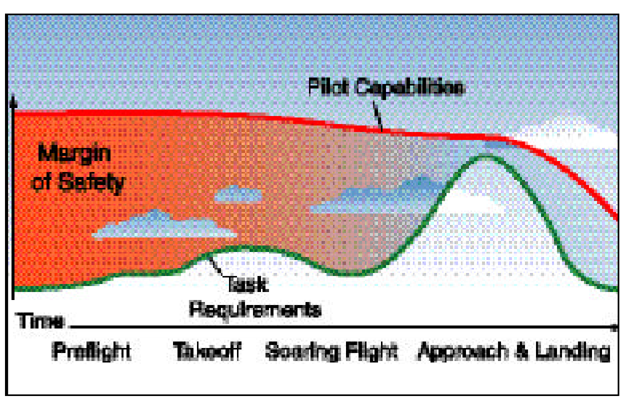

Figure 1-10. Task requirements vs. pilot capabilities.

a potential problem. As pilot in command, you should brief passengers before the flight to make sure they are comfortable voicing any concerns.

EXTERNAL RESOURCES

Possibly the greatest external resources during flight are air traffic controllers and flight service specialists. ATC can help decrease pilot workload by providing traffic advisories, radar vectors, and assistance in emergency situations. Flight service stations can provide updates on weather, answer questions about airport conditions, and may offer direction-finding assistance. The services provided by ATC can be invaluable in enabling you to make informed in-flight decisions.

WORKLOAD MANAGEMENT

Effective workload management ensures that essential operations are accomplished by planning, prioritizing, and sequencing tasks to avoid work overload. As experience is gained, you learn to recognize future workload requirements and can prepare for high workload periods during times of low workload. Reviewing the appropriate chart and setting radio frequencies well in advance of when they are needed helps reduce workload as your flight nears the airport. In addition, you should listen to the Automatic Terminal Information Service (ATIS), Automated Surface Observing System (ASOS), or Automated Weather Observing System (AWOS), if available, and then monitor the tower frequency or the Common Traffic Advisory Frequency (CTAF) to get a good idea of what traffic conditions to expect. Checklists should be performed well in advance so there is time to focus on traffic and ATC instructions. These procedures are especially important prior to entering a high-density traffic area, such as Class B airspace.

To manage workload, items should be prioritized. For example, during any situation, and especially in an emergency, you should remember the phrase "aviate, navigate, and communicate." This means that the first thing you should do is make sure the glider is under control. Then begin flying to an acceptable landing area. Only after the first two items are assured, should you try to communicate with anyone.

Another important part of managing workload is recognizing a work overload situation. The first effect of high workload is that you begin to work faster. As workload increases, attention cannot be devoted to several tasks at one time, and you may begin to focus on one item. When you become task saturated, there is no awareness of inputs from various sources, so decisions may be made on incomplete information, and the possibility of error increases.

Accidents often occur when flying task requirements exceed pilot capabilities. The difference between these two factors is called the margin of safety. Note that in this example, the margin of safety is minimal during the approach and landing. At this point, an emergency or distraction could overtax pilot capabilities, causing an accident. [Figure 1-10]

OPERATIONAL PITFALLS

Peer Pressure—Poor decision making may be based upon an emotional response to peers, rather than an objective evaluation of a situation.

Mind Set—A pilot displays mind set through an inability to recognize and cope with changes in a given situation.

Get-There-Itis—This disposition impairs pilot judgment through a fixation on the original goal or destination, combined with a disregard for any alternative course of action.

Scud Running—This occurs when a pilot tries to maintain visual contact with the terrain at low altitudes while instrument conditions exist.

Continuing VFR Into Instrument Conditions—Spatial disorientation or collision with ground/obstacles may occur when a pilot continues VFR into instrument conditions. This can be even more dangerous if the pilot is not instrument-rated or current.

Getting Behind the Aircraft—This pitfall can be caused by allowing events or the situation to control pilot actions. A constant state of surprise at what happens next may be exhibited when the pilot is getting behind the aircraft.

Loss of Positional or Situational Awareness—In extreme cases, when a pilot gets behind the aircraft, a loss of positional or situational awareness may result. The pilot may not know the aircraft's geographical location, or may be unable to recognize deteriorating circumstances.

Flying Outside the Envelope—The assumed high performance capability of a particular aircraft may cause a mistaken belief that it can meet the demands imposed by a pilot's overestimated flying skills.

Neglect of Flight Planning, Preflight Inspections, and Checklists—A pilot may rely on short- and long-term memory, regular flying skills, and familiar routes instead of established procedures and published checklists. This can be particularly true of experienced pilots.

Figure 1-11. All experienced pilots have fallen prey to, or have been tempted by, one or more of these tendencies in their flying careers.

When becoming overloaded, you should stop, think, slow down, and prioritize. It is important that you understand options that may be available to decrease workload.

SITUATIONAL AWARENESS

Situational awareness is the accurate perception of the operational and environmental factors that affect the aircraft, pilot, and passengers during a specific period of time. Maintaining situational awareness requires an understanding of the relative significance of these factors and their future impact on the flight. When situationally aware, you have an overview of the total operation and are not fixated on one perceived significant factor. Some of the elements inside the aircraft to be considered are the status of aircraft systems, you as the pilot, and passengers. In addition, an awareness of the environmental conditions of the flight, such as spatial orientation of the glider, and its relationship to terrain, traffic, weather, and airspace must be maintained.

To maintain situational awareness, all of the skills involved in aeronautical decision making are used. For example, an accurate perception of your fitness can be achieved through self-assessment and recognition of hazardous attitudes. A clear assessment of the status of navigation equipment can be obtained through workload management, and establishing a productive relationship with ATC can be accomplished by effective resource use.

OBSTACLES TO MAINTAINING SITUATIONAL AWARENESS

Fatigue, stress, and work overload can cause you to fixate on a single perceived important item rather than maintaining an overall awareness of the flight situation. A contributing factor in many accidents is a distraction that diverts the pilot's attention from monitoring the instruments or scanning outside the aircraft. Many cockpit distractions begin as a minor problem, such as a gauge that is not reading correctly, but result in accidents as the pilot diverts attention to the perceived problem and neglects to properly control the aircraft.

Complacency presents another obstacle to maintaining situational awareness. When activities become routine, you may have a tendency to relax and not put as much effort into performance. Like fatigue, complacency reduces your effectiveness in the cockpit. However, complacency is harder to recognize than fatigue, since everything is perceived to be progressing smoothly. For example, you have been flying multiple glider rides out of an uncontrolled airport. The wind has been calm, and you have been using the same runway all day. Without thinking, you enter downwind without taking the wind direction into account. As you make your turn to final, you realize that your groundspeed is extremely fast. You overshoot the runway and collide with a fence, causing extensive damage to the glider and injuring your passenger.

OPERATIONAL PITFALLS

There are a number of classic behavioral traps into which pilots have been known to fall. Pilots, particularly those with considerable experience, as a rule, always try to complete a flight as planned, please passengers, and meet schedules. The basic drive to meet or exceed goals can have an adverse effect on safety, and can impose an unrealistic assessment of piloting skills under stressful conditions. These tendencies ultimately may bring about practices that are dangerous and often illegal, and may lead to a mishap. You will develop awareness and learn to avoid many of these operational pitfalls through effective ADM training. [Figure 1-11]

MEDICAL FACTORS ASSOCIATED WITH GLIDER FLYING

A number of physiological effects can be linked to flying. Some are minor, while others are important enough to require special attention to ensure safety of flight. In some cases, physiological factors can lead to in-flight emergencies. Some important medical factors that you should be aware of as a glider pilot include hypoxia, hyperventilation, middle ear and sinus problems, spatial disorientation, motion sickness, carbon monoxide poisoning, stress and fatigue, dehydration, and heatstroke. Other subjects include the effects of alcohol and drugs, and excess nitrogen in the blood after scuba diving.

HYPOXIA

Hypoxia occurs when the tissues in the body do not receive enough oxygen. The symptoms of hypoxia vary with the individual. Hypoxia can be caused by several factors, including an insufficient supply of oxygen, inadequate transportation of oxygen, or the inability of the body tissues to use oxygen. The forms of hypoxia are divided into four major groups based on their causes; hypoxic hypoxia, hypemic hypoxia, stagnant hypoxia, and histotoxic hypoxia.

HYPOXIC HYPOXIA

Although the percentage of oxygen in the atmosphere is constant, its partial pressure decreases proportionately as atmospheric pressure decreases. As you ascend during flight, the percentage of each gas in the atmosphere remains the same, but there are fewer molecules available at the pressure required for them to pass between the membranes in your respiratory system. This decrease of oxygen molecules at sufficient pressure can lead to hypoxic hypoxia.

Altitude	Time of Useful Consciousness
45,000 ft. MSL	9 to 15 seconds
40,000 ft. MSL	15 to 20 seconds
35,000 ft. MSL	30 to 60 seconds
30,000 ft. MSL	1 to 2 minutes
28,000 ft. MSL	2 1/2 to 3 minutes
25,000 ft. MSL	3 to 5 minutes
22,000 ft. MSL	5 to 10 minutes
20,000 ft. MSL	30 minutes or more

Figure1-12. This illustration shows the symptoms of hypoxia and time of useful consciousness as altitude increases.

HYPEMIC HYPOXIA

When your blood is not able to carry a sufficient amount of oxygen to the cells in your body, a condition called hypemic hypoxia occurs. This type of hypoxia is a result of a deficiency in the blood, rather than a lack of inhaled oxygen, and can be caused by a variety of factors. For example, if you have anemia, or a reduced number of healthy functioning blood cells for any reason, your blood has a decreased capacity for carrying oxygen. In addition, any factor that interferes or displaces oxygen that is attached to the blood's hemoglobin can cause hypemic hypoxia. The most common form of hypemic hypoxia is carbon monoxide poisoning, which is discussed later. Hypemic hypoxia also can be caused by the loss of blood that occurs during a blood donation. Your blood can take several weeks to return to normal following a donation. Although the effects of the blood loss are slight at ground level, there are risks when flying during this time.

STAGNANT HYPOXIA

Stagnant hypoxia is an oxygen deficiency in the body due to the poor circulation of the blood. Several different situations can lead to stagnant hypoxia, such as shock, the heart failing to pump blood effectively, or a constricted artery. During flight, stagnant hypoxia can be the result of pulling excessive positive Gs. Cold temperatures also can reduce circulation and decrease the blood supplied to extremities.

HISTOTOXIC HYPOXIA

The inability of the cells to effectively use oxygen is defined as histotoxic hypoxia. The oxygen may be inhaled and reach the cell in adequate amounts, but the cell is unable to accept the oxygen once it is there. This impairment of cellular respiration can be caused by alcohol and other drugs, such as narcotics and poisons. Research has shown that drinking one ounce of alcohol can equate to about an additional 2,000 feet of physiological altitude.

High-altitude flying, which glider pilots encounter when mountain wave soaring or thermal soaring at high elevations, can place you in danger of becoming hypoxic. Oxygen starvation causes the brain and other vital organs to become impaired. One particularly noteworthy attribute of the onset of hypoxia is the fact that the first symptoms are euphoria and a carefree feeling. With increased oxygen starvation, your extremities become less responsive, and your flying becomes less coordinated. The following are common symptoms of hypoxia.

- Headache
- Decreased Reaction Time
- Impaired Judgment
- Euphoria
- Visual Impairment
- Drowsiness
- Lightheaded or Dizzy Sensation
- Tingling in Fingers and Toes
- Numbness
- Blue Fingernails and Lips (Cyanosis)
- Limp Muscles

As hypoxia worsens, your field of vision begins to narrow, and instruments can start to look fuzzy. Even with all these symptoms, the intoxicating effects of hypoxia can cause you to have a false sense of security and deceive you into believing you are flying as well as ever. The treatment for hypoxia includes flying at lower altitudes and/or using supplemental oxygen.

All pilots are susceptible to the effects of oxygen starvation, regardless of your physical endurance or acclimatization. When flying at high altitudes, it is paramount that you carry aviator's breathing oxygen in your glider and have it readily accessible. The term "time of useful consciousness" is used to describe the maximum time you have to make rational, life-saving decisions and carry them out at a given altitude without supplemental oxygen. As altitude increases above 10,000 feet, the symptoms of hypoxia increase in severity, while the time of useful consciousness rapidly decreases. [Figure 1-12]

Since symptoms of hypoxia vary in an individual, the ability to recognize hypoxia can be greatly improved by experiencing and witnessing the effects of it during an altitude chamber "flight." The FAA provides this opportunity through aviation physiology training, which is conducted at the FAA Civil Aerospace Medical Institute (CAMI) and at many military facilities across the United States. To attend the Physiological Training Program at CAMI telephone (405) 954-6212 or write:

FAA/AAM-400
Aerospace Medical Education Division
P.O. Box 25082
Oklahoma City, OK 73125

HYPERVENTILATION

Hyperventilation occurs when you are experiencing emotional stress, fright, or pain, and your breathing rate and depth increase although the carbon dioxide is already at a reduced level in the blood. The result is an excessive loss of carbon dioxide from your body, which can lead to unconsciousness due to the respiratory system's overriding mechanism to regain control of breathing.

Glider pilots encountering extreme, unexpected turbulence, or strong areas of sink over rough terrain or water, may unconsciously increase their breathing rate. If you are flying at higher altitudes, either with or without oxygen, you may have a tendency to breathe more rapidly than normal, which often leads to hyperventilation.

Since many of the symptoms of hyperventilation are similar to those of hypoxia, it is important to correctly diagnose and treat the proper condition. If you are using supplemental oxygen, check the equipment and flow rate to ensure you are not suffering from hypoxia. The following are common symptoms of hyperventilation.

- Headache
- Decreased Reaction Time
- Impaired Judgment
- Euphoria
- Visual Impairment
- Drowsiness
- Lightheaded or Dizzy Sensation
- Tingling in Fingers and Toes
- Numbness
- Pale, Clammy Appearance
- Muscle Spasms

Hyperventilation may produce a pale, clammy appearance and muscle spasms compared to the cyanosis and limp muscles associated with hypoxia. The treatment for hyperventilation involves restoring the proper carbon dioxide level in the body. Breathing normally is both the best prevention and the best cure for hyperventilation. In addition to slowing the breathing rate, you also can breathe into a paper bag or talk aloud to overcome hyperventilation. Recovery is usually rapid once the breathing rate is returned to normal.

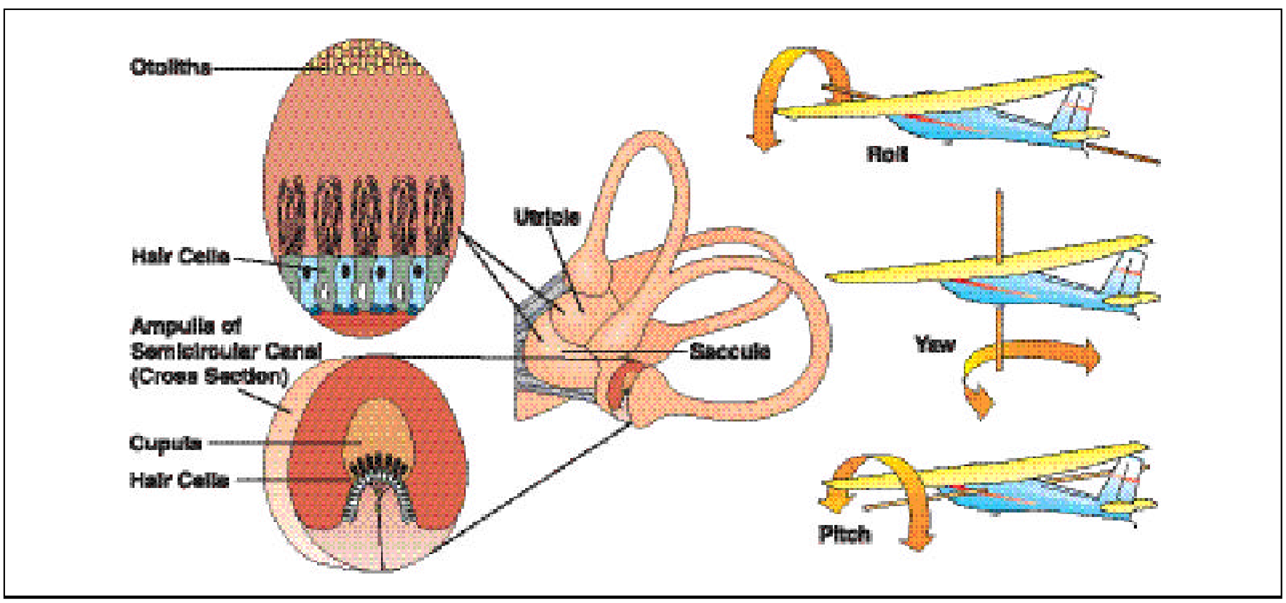

Figure 1-13. The semicircular canals lie in three planes, and sense the motions of roll, pitch, and yaw.

MIDDLE EAR AND SINUS PROBLEMS

Since gliders are not pressurized, pressure changes affect glider pilots flying to high altitudes. Inner ear pain and a temporary reduction in your ability to hear is caused by the ascents and descents of the glider. The physiological explanation for this discomfort is a difference between the pressure of the air outside your body and that of the air inside your middle ear. The middle ear cavity is a small cavity located in the bone of the skull. While the external ear canal is always at the same pressure as the outside air, the pressure in the middle ear often changes more slowly. Even a slight difference between external pressure and middle ear pressure can cause discomfort.

During a climb, as the glider ascends, middle ear air pressure may exceed the pressure of the air in the external ear canal, causing the eardrum to bulge outward. You become aware of this pressure change when you experience alternate sensations of "fullness" and "clearing." During descent, the reverse happens. While the pressure of the air in the external ear canal increases, the middle ear cavity, which equalized with the lower pressure at altitude, is at lower pressure than the external ear canal. This results in the higher outside pressure, causing the eardrum to bulge inward.

This condition can be more difficult to relieve due to the fact that air must be introduced into the middle ear through the eustachian tube to equalize the pressure. The fact that the inner ear is a partial vacuum tends to constrict the walls of the eustachian tube. To remedy this often painful condition, which causes temporary reduction in hearing sensitivity, pinch your nostrils shut, close your mouth and lips, and blow slowly and gently in the mouth and nose.

This procedure, which is called the Valsalva maneuver, forces air up the eustachian tube into the middle ear. If you have a cold, an ear infection, or sore throat, you may not be able to equalize the pressure in your ears. A flight in this condition can be extremely painful, as well as damaging to your eardrums. If you are experiencing minor congestion, nose drops or nasal sprays may reduce the chance of a painful ear blockage. Before you use any medication, check with an aviation medical examiner to ensure that it will not affect your ability to fly.

During ascent and descent, air pressure in the sinuses equalizes with the pressure in the cockpit through small openings that connect the sinuses to the nasal passages. Either an upper respiratory infection, such as a cold or sinusitis, or a nasal allergic condition can produce enough congestion around an opening to slow equalization and, as the difference in pressure between the sinus and the cockpit mounts, eventually plug the opening. This "sinus block" occurs most frequently during descent. Slow descent rates can reduce the associated pain. A sinus block can occur in the frontal sinuses, located above each eyebrow, or in the maxillary sinuses, located in each upper cheek. It will usually produce excruciating pain over the sinus area. A maxillary sinus block can also make the upper teeth ache. Bloody mucus may discharge from the nasal passages.

You can prevent a sinus block by not flying with an upper respiratory infection or nasal allergic condition. Adequate protection is usually not provided by decongestant sprays or drops to reduce congestion around the sinus openings. Oral decongestants have side effects that can impair pilot performance. If a sinus block does not clear shortly after landing, a physician should be consulted.

SPATIAL DISORIENTATION

Spatial disorientation specifically refers to the lack of orientation with regard to position in space and to other objects. Orientation is maintained through the body's sensory organs in three areas: visual, vestibular, and postural. The eyes maintain visual orientation; the motion sensing system in the inner ear maintains vestibular orientation; and the nerves in the skin, joints, and muscles of the body maintain postural orientation.

During flight in visual meteorological conditions (VMC), the eyes are the major orientation source and usually prevail over false sensations from other sensory systems. When these visual cues are taken away, as they are in instrument meteorological conditions (IMC), false sensations can cause the pilot to quickly become disoriented.

The vestibular system in the inner ear allows you to sense movement and determine your orientation in the surrounding environment. In both the left and right inner ear, three semi-circular canals are positioned at approximate right angles to each other. Each canal is filled with fluid and has a section full of fine hairs. Acceleration of the inner ear in any direction causes the tiny hairs to deflect, which in turn stimulates nerve impulses, sending messages to the brain. The vestibular nerve transmits the impulses from the utricle, saccule, and semicircular canals to the brain to interpret motion. [Figure 1-13]

The postural system sends signals from the skin, joints, and muscles to the brain that are interpreted in relation to the Earth's gravitational pull. These signals determine posture. Inputs from each movement update the body's position to the brain on a constant basis. "Seat of the pants" flying is largely dependent upon these signals. Used in conjunction with visual and vestibular clues, these sensations can be fairly reliable. However, because of the forces acting upon the body in certain flight situations, many false sensations can occur due to acceleration forces overpowering gravity.

Under normal flight conditions, when you have reference to the horizon and ground, these sensitive hairs allow you to identify the pitch, roll, and yaw movement of the glider. When you become disoriented and lose visual reference to the horizon and ground, the sensory system in your inner ear is no longer reliable. Lacking visual reference to the ground, your vestibular system may lead you to believe you are in level flight, when, in reality, you are in a turn. As the airspeed increases, you may experience a postural sensation of a level dive and pull back on the stick. This increased back-pressure on the control stick tightens the turn and creates ever-increasing g-loads. If recovery is not initiated, a steep spiral will develop. This is sometimes called the graveyard spiral, because if the pilot fails to recognize that the aircraft is in a spiral and fails to return the aircraft to wings-level flight, the aircraft will eventually strike the ground. If the horizon becomes visible again, you will have an opportunity to return the glider to straight-and-level flight. Continued visual contact with the horizon will allow you to maintain straight-and-level flight. However, if you lose contact with the horizon again, your inner ear may fool you into thinking you have started a bank in the other direction, causing the graveyard spiral to begin all over again.

For glider pilots, prevention is the best remedy for spatial disorientation. If the glider you are flying is not equipped for instrument flight, and you do not have many hours of training in controlling the glider by reference to instruments, you should avoid flight in reduced visibility or at night when the horizon is not visible. You can reduce your susceptibility to disorienting illusions through training and awareness, and learning to rely totally on your flight instruments.

MOTION SICKNESS

Motion sickness, or airsickness, is caused by the brain receiving conflicting messages about the state of the body. You may experience motion sickness during initial flights, but it generally goes away within the first 10 lessons. Anxiety and stress, which you may feel as you begin flight training, can contribute to motion sickness. Symptoms of motion sickness include general discomfort, nausea, dizziness, paleness, sweating, and vomiting.

It is important to remember that experiencing air sickness is no reflection on your ability as a pilot. Let your flight instructor know if you are prone to motion sickness since there are techniques that can be used to overcome this problem. For example, you may want to avoid lessons in turbulent conditions until you are more comfortable in the glider, or start with shorter flights and graduate to longer instruction periods. If you experience symptoms of motion sickness during a lesson, you can alleviate some of the discomfort by opening fresh air vents or by focusing on objects outside the glider. Although medication like Dramamine can prevent airsickness in passengers, it is not recommended while you are flying since it can cause drowsiness.

CARBON MONOXIDE POISONING

One factor that can affect your vision and consciousness in flight and poses a danger to self-launch glider pilots is carbon monoxide poisoning. Since it attaches itself to the hemoglobin about 200 times more easily than does oxygen, carbon monoxide (CO) prevents the hemoglobin from carrying oxygen to the cells. It can take up to 48 hours for the body to dispose of carbon monoxide. If the poisoning is severe enough, it can result in death. Carbon monoxide, produced by all internal combustion engines, is colorless and odorless. Aircraft heater vents and defrost vents may provide carbon monoxide a passageway into the cabin, particularly if the engine exhaust system is leaky or damaged. If you detect a strong odor of exhaust gases, you can assume that carbon monoxide is present. However, carbon monoxide may be present in dangerous amounts even if you cannot detect exhaust odor. Disposable, inexpensive carbon monoxide detectors are widely available. In the presence of carbon monoxide, these detectors change color to alert you to the presence of carbon monoxide. Some effects of carbon monoxide poisoning include headache, blurred vision, dizziness, drowsiness, and/or loss of muscle power. Anytime you smell exhaust odor, or any time you experience these symptoms, immediate corrective actions should be taken. These include turning off the heater, opening fresh air vents, windows and using supplemental oxygen, if available.

STRESS

Stress can be defined as the body's response to physical and psychological demands placed upon it. Reactions of your body to stress include the release of chemical hormones (such as adrenaline) into the blood and the speeding of the metabolism to provide energy to the muscles. In addition, blood sugar, heart rate, respiration, blood pressure, and perspiration all increase. The term stressor is used to describe an element that causes you to experience stress.

Stress falls into two categories: acute stress (short-term) and chronic stress (long-term). Acute stress involves an immediate threat that is perceived as danger. This is the type of stress that often involves a "fight or flight" response in an individual, whether the threat is real or imagined. Stressors are categorized on page 1-7 within the stress management discussion. Examples include noise (physical stress), fatigue (physiological stress), and difficult work or personal situations (psychological stress). Normally, a healthy person can cope with acute stress and prevent stress overload. However, on-going acute stress can develop into chronic stress.

Chronic stress can be defined as a level of stress that presents an intolerable burden, exceeds the ability of an individual to cope, and causes performance to fall sharply. Unrelenting psychological pressures such as loneliness, financial worries, and relationship or work problems, can produce a cumulative level of stress that exceeds a person's ability to cope with the situation. When stress reaches these levels, performance falls off rapidly. Pilots experiencing this level of stress are not safe and should not exercise their airman privileges. The stress management discussion on page 1-7 contains several recommendations for coping with stress. If you suspect you are suffering from chronic stress, consult your doctor.

FATIGUE

Fatigue is frequently associated with pilot error. Some of the effects of fatigue include degradation of attention and concentration, impaired coordination, and decreased ability to communicate. These factors can seriously influence your ability to make effective decisions. Physical fatigue can result from sleep loss, exercise, or physical work. Factors, such as stress and prolonged performance of cognitive work, can result in mental fatigue.

Fatigue falls into two broad categories; acute fatigue (short-term) and chronic fatigue (long-term). Acute fatigue is short-lived and is a normal occurrence in everyday living. It is the kind of tiredness people feel after a period of strenuous effort, excitement, or lack of sleep. Rest after exertion and eight hours of sound sleep ordinarily cures this condition.

A special type of acute fatigue, skill fatigue has two main effects on performance:

- Timing disruption—You appear to perform a task as usual, but the timing of each component is slightly off. This makes the pattern of the operation less smooth, because you perform each component as though it were separate, instead of part of an integrated activity.
- Disruption of the perceptual field—You concentrate your attention upon movements or objects in the center of your vision and neglect those in the periphery. This may be accompanied by loss of accuracy and smoothness in control movements.

Acute fatigue has many causes, but the following are among the most important for the pilot.

- Mild hypoxia (oxygen deficiency)
- Physical stress
- Psychological stress
- Depletion of physical energy resulting from psychological stress

Acute fatigue can be prevented by a proper diet and adequate rest and sleep. A well-balanced diet prevents the body from having to consume its own tissues as an energy source. Adequate rest maintains the body's store of vital energy.

Sustained psychological stress accelerates the glandular secretions that prepare the body for quick reactions during an emergency. These secretions make the circulatory and respiratory systems work harder, and the liver releases energy to provide the extra fuel needed for brain and muscle work. When this reserve energy supply is depleted, the body lapses into chronic fatigue.

Chronic fatigue, extending over a long period of time, usually has psychological roots, although an underlying disease is sometimes responsible. Continuous high stress levels, for example, can produce chronic fatigue. Chronic fatigue is not relieved by proper diet and adequate rest and sleep, and usually requires treatment from your doctor. You may experience this condition in the form of weakness, tiredness, palpitations of the heart, breathlessness, headaches, or irritability. Sometimes chronic fatigue even creates stomach or intestinal problems and generalized aches and pains throughout the body. When the condition becomes serious enough, it can lead to emotional illness.

If you find yourself suffering from acute fatigue, stay on the ground. If you become fatigued in the cockpit, no amount of training or experience can overcome the detrimental effects. Getting adequate rest is the only way to prevent fatigue from occurring. You should avoid flying when you have not had a full night's rest, when you have been working excessive hours, or have had an especially exhausting or stressful day. If you suspect you are suffering from chronic fatigue, consult your doctor.

DEHYDRATION AND HEATSTROKE

Dehydration is the term given to a critical loss of water from the body. The first noticeable effect of dehydration is fatigue, which in turn makes top physical and mental performance difficult, if not impossible. As a glider pilot, you often fly for a long period of time in hot summer temperatures or at high altitudes. This makes you particularly susceptible to dehydration for two reasons: the clear canopy offers no protection from the sun and, at high altitude, there are fewer air pollutants to diffuse the sun's rays. The result is that you are continually exposed to heat that your body attempts to regulate by perspiration. If this fluid is not replaced, fatigue progresses to dizziness, weakness, nausea, tingling of hands and feet, abdominal cramps, and extreme thirst.

Heatstroke is a condition caused by any inability of the body to control its temperature. Onset of this condition may be recognized by the symptoms of dehydration, but also has been known to be recognized only by complete collapse. To prevent these symptoms, it is recommended that you carry an ample supply of water and use it at frequent intervals on any long flight, whether you are thirsty or not. Wearing light colored, porous clothing and a hat provides protection from the sun, and keeping the cockpit well ventilated aids in dispelling excess heat.

ALCOHOL

Everyone knows that alcohol impairs the efficiency of the human mechanism. Studies have positively proven that drinking and performance deterioration are closely linked. Pilots must make hundreds of decisions, some of them time-critical, during the course of a flight. The safe outcome of any flight depends on your ability to make the correct decisions and take the appropriate actions during routine occurrences, as well as abnormal situations. The influence of alcohol drastically reduces the chances of completing your flight without incident. Even in small amounts, alcohol can impair your judgement, decrease your sense of responsibility, affect your coordination, constrict your visual field, diminish your memory, reduce your reasoning power, and lower your attention span. As little as one ounce of alcohol can decrease the speed and strength of your muscular reflexes, lessen the efficiency of your eye movements while reading, and increase the frequency at which you commit errors. Impairments in vision and hearing occur at alcohol blood levels as low as .01 percent.

The alcohol consumed in beer and mixed drinks is simply ethyl alcohol, a central nervous system depressant. From a medical point of view, it acts on

Figure 1-14. Scuba divers must not fly for specific time periods following dives to avoid the bends.

your body much like a general anesthetic. The "dose" is generally much lower and more slowly consumed in the case of alcohol, but the basic effects on the system are similar. Alcohol is easily and quickly absorbed by the digestive tract. The bloodstream absorbs about 80 to 90 percent of the alcohol in a drink within 30 minutes on an empty stomach. The body requires about three hours to rid itself of all the alcohol contained in one mixed drink or one beer.

When you have a hangover, you are still under the influence of alcohol. Although you may think that you are functioning normally, the impairment of motor and mental responses still remains. Considerable amounts of alcohol can remain in the body for over 16 hours, so you should be cautious about flying too soon after drinking.

The effect of alcohol is greatly multiplied when a person is exposed to altitude. Two drinks on the ground are equivalent to three or four at altitude. The reason for this is that, chemically, alcohol interferes with the brain's ability to utilize oxygen. The effects are rapid because alcohol passes so quickly into the bloodstream. In addition, the brain is a highly vascular organ that is immediately sensitive to changes in the blood's composition. For a pilot, the lower oxygen availability at altitude, along with the lower capability of the brain to use what oxygen is there, adds up to a deadly combination.

Intoxication is determined by the amount of alcohol in the bloodstream. This is usually measured as a percentage by weight in the blood. 14 CFR part 91 requires that your blood alcohol level be less than .04 percent and that eight hours pass between drinking alcohol and piloting an aircraft. If you have a blood alcohol level of .04 percent or greater after eight hours, you cannot fly until your blood alcohol falls below that amount. Even though your blood alcohol may be well below .04 percent, you cannot fly sooner than eight hours after drinking alcohol. Although the regulations are quite specific, it is a good idea to be more conservative than the regulations.

DRUGS

Pilot performance can be seriously degraded by both prescribed and over-the-counter medications, as well as by the medical conditions for which they are taken. Many medications, such as tranquilizers, sedatives, strong pain relievers, and cough-suppressants, have primary effects that may impair judgment, memory, alertness, coordination, vision, and the ability to make calculations. Others, such as antihistamines, blood pressure drugs, muscle relaxants, and agents to control diarrhea and motion sickness, have side effects that may impair the same critical functions. Any medication that depresses the nervous system, such as a sedative, tranquilizer, or antihistamine, can make a pilot much more susceptible to hypoxia.

Pain killers can be grouped into two broad categories: analgesics and anesthetics. Over-the-counter analgesics, such as aspirin and codeine, are drugs that decrease pain. The majority of the drugs that contain acetylsalicylic acid (Aspirin), acetaminophen (Tylenol), and ibuprofen (Advil) have few side effects when taken in the correct dosage. Although some people are allergic to certain analgesics or may suffer from stomach irritation, flying usually is not restricted when taking these drugs. However, flying is almost always precluded while using prescription analgesics, such as Darvon, Percodan, Demerol, and codeine, since these drugs may cause side effects such as mental confusion, dizziness, headaches, nausea, and vision problems.

Anesthetics are drugs that deaden pain or cause a loss of consciousness. These drugs are commonly used for dental and surgical procedures. Most local anesthetics used for minor dental and outpatient procedures wear off within a relatively short period of time. The anesthetic itself may not limit flying so much as the actual procedure and subsequent pain.

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

Depressants are drugs that reduce the body's functioning in many areas. These drugs lower blood pressure, reduce mental processing, and slow motor and reaction responses. There are several types of drugs that can cause a depressing effect on the body, including tranquilizers, motion sickness medication, some types of stomach medication, decongestants, and antihistamines. The most common depressant is alcohol.

Some drugs, which can neither be classified as stimulants nor depressants, have adverse effects on flying. For example, some forms of antibiotics can produce dangerous side effects, such as balance disorders, hearing loss, nausea, and vomiting. While many antibiotics are safe for use while flying, the infection requiring the antibiotic may prohibit flying. In addition, unless specifically prescribed by a physician, you should not take more than one drug at a time, and you should never mix drugs with alcohol, because the effects are often unpredictable.

The danger of illegal drugs also are well documented. Certain illegal drugs can have hallucinatory effects that occur days or weeks after the drug is taken. Obviously, these drugs have no place in the aviation community.

Federal Aviation Regulations prohibit pilots from performing crewmember duties while using any medication that affects the faculties in any way contrary to safety. The safest rule is not to fly as a crewmember while taking any medication, unless approved to do so by the FAA. If there is any doubt regarding the effects of any medication, consult an Aviation Medical Examiner (AME) before flying.

SCUBA DIVING

The reduction of atmospheric pressure that accompanies flying can produce physical problems for scuba divers. This is because the increased pressure of the water during a dive causes excess nitrogen to be absorbed into the body tissues and bloodstream. When flying, reduced atmospheric pressures at altitude allow this nitrogen to come out of solution in the bloodstream and body tissues at a rapid rate. This rapid outgassing of nitrogen is called the bends and is painful and incapacitating. The bends can be experienced from as low as 8,000 feet mean sea level (MSL), with increasing severity as altitude increases. As noted in the AIM, the minimum recommended time between scuba diving on nondecompression stop dives and flying is 12 hours, while the minimum time recommended between decompression stop diving and flying is 24 hours. [Figure 1-14]