

Flight Environment

Key Terms

collision avoidance

NOTAM

right-of-way rule

IFR

blind spot

VFR

traffic pattern

Maintaining the safety of flight is your number one priority as a pilot. There are some safety issues which you must be aware of during every flight, such as collision avoidance and maintaining minimum safe altitudes. Other safety considerations only apply in certain situations; for example, taxiing in wind, flight over hazardous terrain, and effective exchange of flight controls with your instructor. Every flight is different and, as pilot in command, you need to consider the factors which can affect your flight and take the appropriate actions to ensure safety.

3.1 Safety of Flight

3.1.1 Collision Avoidance

Learning collision avoidance procedures begins with your first flight. The risk of an inflight collision exists for all pilots, but you can take action to avoid this type of accident. Studies show that the majority of midair collisions occur within five miles of an airport, during daylight hours, and in VFR conditions. You will hear the terms VFR and IFR used frequently in several different ways. If you are operating under visual flight rules (VFR), you are governed by specific FARs which include minimum cloud clearance and visibility requirements, also referred to as weather minimums. In comparison, instrument flight rules (IFR) are rules which are established to govern flight operations in weather



conditions below VFR weather minimums. The terms VFR and IFR are also used to define weather conditions. For example, visual meteorological conditions (VMC) are often referred to as VFR conditions, and instrument meteorological conditions (IMC) are sometimes called IFR conditions. In addition, the terms VFR and IFR can define the type of flight plan under which an aircraft is operating. It is possible for an aircraft to be an IFR flight plan in VFR weather conditions.

Although there are many resources which can be used to avoid midair collisions in VFR conditions, including use of exterior lights, radio transmissions, and air traffic control services, the most important is your ability to effectively see and avoid other aircraft. Early detection of aircraft is crucial to avoiding a collision. For example, if your aircraft is flying at a speed of 150 knots on a head-on collision course with another aircraft also traveling at 150 knots, the closure rate is one quarter of a mile in the three seconds that is usually required for you or the other pilot to take action.

3.1.2 Visual Scanning

To see and avoid other aircraft, you must develop an effective visual scanning pattern which is compatible with the function of your eyes. Two normal healthy eyes provide the average person with a field of vision of approximately 200° . However, the area in which the eye can focus sharply and perceive detail is a relatively narrow cone (usually only about 10° wide) directly in the center of the field of vision. Beyond this area, visual acuity decreases sharply in all directions. Since your eyes require time to focus on this narrow viewing area, scanning is most effective when you use a series of short, regularly-spaced eye movements. This helps to bring successive areas of the sky into your central visual field. The FAA recommends that your eye movements do not exceed 10° , and that you focus for at least one second on each segment of the sky. Be sure that the scan pattern you develop covers all of the sky that you can see from the cockpit, both horizontally and vertically.

The further objects are from your central visual field, the smaller the amount of detail that can be discerned. You may not notice objects in your peripheral vision unless there is some relative motion. An airplane on a converging course from one side does not have any relative motion unless there is a significant speed difference, and therefore, may not catch your attention. When scanning for traffic, you should be especially alert for an aircraft which shows no movement, induce this indicates that it is most likely on a collision course with your airplane. If the other aircraft shows no lateral or vertical motion, but is increasing in size, take immediate evasive action.

As you scan, it may take several seconds for your eyes to refocus when switching from the instrument panel to distant objects outside the airplane. To counter eye fatigue, it helps to focus on exterior parts of the aircraft as a transition from inside to outside the cockpit.



Sky conditions also have an effect on your ability to see traffic. In bright sunlight, a clean windshield and sunglasses can help you see objects more clearly. If the outside visibility is good, you have a better chance of spotting a hazard since haze or reduced visibility tends to make traffic and terrain features appear farther away than their actual distance. Another phenomenon which can occur in reduced visibility is called empty field myopia. When you are looking at a featureless sky that is devoid of objects, contrasting colors, or patterns, your eyes tend to focus at only 10 to 30 feet ahead. This means that spots on the windshield which are out of focus could appear to be airplanes, and distant traffic may go undetected.

Night myopia, or night-induced nearsightedness, is similar to empty field myopia, but is more pronounced because of the lack of visual references. With nothing to focus on, your eyes automatically focus on a point three to six feet in front of you. Searching out and focusing on distant light sources, no matter how dim, helps prevent the onset of night myopia.

When you encounter traffic, remember that the other pilot may be occupied with tasks other than scanning and may not react in the manner that you anticipate. As you take evasive action, watch the other aircraft to see if it makes any unusual maneuvers and, if so, plan your reaction accordingly. You should also be aware that there may be more than one potential collision hazard in an area at the same time. The more time you spend on developing your scan in the early part of flight training, the more natural it will become later. The scanning techniques described here will help you see potential conflicts earlier and allow you to take the proper action to avoid a collision. Also, being familiar with the blind spots in your aircraft's design will improve your awareness of potential hazards.

3.1.3 Blind Spots

Airplanes, like automobiles, have problems associated with blind spots. In both high wing and low-wing aircraft designs, portions of your view are blocked by the fuselage and wings.

This can make it difficult to see conflicting traffic. For example, in a high-wing airplane, your view is blocked as soon as you lower the wing to start a turn. Prior to beginning the turn, you can check the area for other aircraft by lifting the wing and looking in the direction of the turn.

In a high-wing airplane it is easy to see below the airplane, but difficult to see the area above the airplane. The reverse is true for low-wing airplanes. These blind spots can develop into a serious problem, particularly during the approach and landing phases of flight. A good way to reduce the impossibility of a collision during extended climbs or descents is to make shallow S- turns and avoid climbing or descending at steep angles.



3.1.4 Airport Operations

Each time a pilot operates an airplane, the flight normally begins and ends at an airport. An airport may be a small sod field or a large complex utilized by air carriers. This chapter discusses airport operations and identifies features of an airport complex, as well as provides information on operating on or in the vicinity of an airport.

To increase safety at airports, a voluntary program called Operation Lights On has been established by the FAA. Operation Lights On encourages you to use your landing lights during departures and approaches, both day and night, especially when operating within 10 miles of an airport, or in conditions of reduced visibility. It is recommended that you check your pilot's operating handbook for any limitations on the use of your aircraft lights.

In addition, your aircraft's anti-collision lights are required to be on whenever the engines are running, day or night. However, anti collision lights need not be turned on when they might interfere with safety. For example, strobe lights should be turned off when their brightness might be detrimental to the vision of others.

3.1.5 Maneuvers in the Training Area

It is important not only to maintain your scan, but to clear the area for traffic while practicing maneuvers. Your instructor will teach you to make clearing turns before performing maneuvers in the training, or practice, area. Clearing turns, which usually consist of at least a 180° change in direction, allow you to see areas blocked by blind spots and make it easier to maintain contact with other aircraft in the area.

3.1.6 Right-of-Way Rules

The FARs state very clearly that the pilot in command is responsible for seeing and avoiding all traffic in visual flight conditions. To help avoid conflicting traffic situations, right-of-way rules have been established.

An aircraft in distress is one which requires immediate assistance due to a serious problem or emergency, and therefore, has the right-of-way over all other air traffic. If two aircraft are approaching each other head-on or nearly so, both aircraft will give way to the right. An overtaking aircraft must pass the slower aircraft to the right and stay well clear. When aircraft of the same category are converging, the aircraft to the other's right has the right-of-way. The general rule regarding converging aircraft of different categories is that the least maneuverable aircraft usually has the right-of-way over all other air traffic.

Right-of-way rules also apply to specific airport operations. An aircraft on final approach or an aircraft that is landing has the right-of-way over other aircraft in the traffic pattern and those on the ground. When two or more aircraft, which are preparing to land,



enter the traffic pattern at the same time, the aircraft at the lowest altitude has the right-of-way. However, this is not intended to allow aircraft to enter the pattern below the specified traffic pattern altitude and disrupt or cut in front of those already established in the pattern.

3.1.7 Minimum Safe Altitudes

For safety reasons, the FARs specify minimum altitudes that you must maintain during flight. Maintaining minimum safe altitudes is required at all times except during takeoffs and landings.

Over a congested area, such as a city or metropolitan area, you are required to fly at least 1,000 feet above any obstacle within a horizontal radius of 2,000 feet of your aircraft. When flying over an uncongested area, you must fly at least 500 feet above the surface. Over sparsely populated or open water areas you cannot fly within 500 feet of any person, vessel, vehicle, or structure. The lowest altitude at which you can fly anywhere is one which allows an emergency landing without undue hazard to persons or property on the surface. Keep in mind that the altitudes specified in the FARs are minimums. A higher altitude will give you more time to troubleshoot any problems and choose a better landing site engine failure.

3.1.8 Flight over Hazardous Terrain

Although it depends on where you learn to fly, mountain flying and flight over open water usually are beyond the scope of private pilot training. To safely operate over mountainous terrain or over open water, you need to obtain specialized training from an experienced instructor who is familiar with the area over which the flight will be conducted. Appropriate survival gear is an absolute necessity. Although it can be a rewarding experience, mountain flying, in particular, introduces numerous hazards for the inexperienced. Decreased aircraft performance at high altitudes, turbulence, rapidly changing weather, and difficulty in locating a forced landing site are just a few of the challenges facing you on a mountain flight.

3.1.9 Taxiing in Wind

Another safety concern that you will be introduced to early in your flight training is the effect of wind during taxi operations. Strong winds passing over and around the wings and horizontal stabilizer during taxi can actually lift the airplane. In the most adverse conditions, it is possible for the airplane to flip or roll over.

Proper use of the aileron and elevator controls normally will counteract the wind and help you maintain control of your airplane. For example, if the wind is blowing from the left front quarter, you should turn the yoke to the left which will hold the left aileron up to counteract the lifting tendency of the wind. When you turn while taxiing, the flow of



air around the airplane changes direction, and you will have to compensate by altering the position of the control surfaces. In a tricycle-gear airplane, the elevator should be in a neutral position to prevent the wind from exerting any lifting force on the tail.

You will encounter some differences in taxiing tricycle-gear airplanes versus conventional-gear, or tail wheel airplanes. The most critical situation exists when you are taxiing a tricycle-gear airplane with a high wing in a strong quartering tailwind. The high wing is susceptible to being lifted by the wind. In extreme conditions, a quartering tailwind can cause the airplane to nose over and flip on its back.

When taxiing a tail wheel airplane, you will position the ailerons the same as you do for a tricycle-gear airplane. However, to help keep the tail wheel on the ground, hold the elevator control aft (elevator up) in a headwind, and in a tailwind, hold the elevator control forward (elevator down).

3.1.10 Positive Exchange of Flight Controls

Frequently during your flight training, it will be necessary for you to exchange the flight controls with your instructor. For example, your instructor normally will demonstrate a maneuver first, before passing the controls to you. To ensure that it is clear as to who has control of the aircraft, the FAA strongly recommends the use of a three-step process when exchanging the flight controls. During the preflight briefing, the following procedure to pass control of the aircraft should be reviewed.

Pilot passing control: “You have the flight controls.”

Pilot taking control: “I have the flight controls.”

Pilot passing control: “You have the flight controls.”

The pilot passing the controls should continue to fly until the pilot taking the controls acknowledges the exchange by saying, “I have the flight controls”. A visual check is also recommended to ensure that the other pilot actually has the controls. There may be times when your instructor desires to assume control of the aircraft from you. If this is necessary, your instructor should take the controls while informing you, “I have the flight controls.”

3.2 Airports

Each day, aircraft takeoff and land at private grass strips, busy international airports, and every type of field in between. Whether most of your flying is out of your local airport or you frequently journey to new destinations, an airport will never be unfamiliar territory once you learn the basic procedures for operating in the terminal environment. Regardless of your choice of airport, knowing how to determine the correct runway to use and understanding the markings on taxiways and runways is essential every time you fly. Night flying offers a new challenge as the airport is transformed by a myriad of lights



designed to make aircraft operations safe and efficient in the darkness.

3.2.1 Controlled and Uncontrolled Airports

There are two types of airport environments that you will operate in—controlled and uncontrolled. A controlled airport has an operating control tower and is sometimes referred to as a tower airport. Since all aircraft in the vicinity, as well as those on the ground, are subject to instructions issued by air traffic control (ATC), a two-way radio is required for you to operate in the controlled airport environment. At an uncontrolled airport, or non-tower airport, control of VFR traffic is not exercised. Although you are not required to have a two-way radio, most pilots use radios to transmit their intentions to other pilots. You are also responsible for determining the active runway and how to enter and exit the traffic pattern.

3.2.2 Traffic Pattern

Traffic patterns are established to ensure that air traffic flows into and out of an airport in an orderly manner. Although the direction and placement of the pattern, the altitude at which it is to be flown, and the procedures for entering and exiting the pattern may vary, a standard rectangular pattern with five named legs is used at most airports. At controlled airports, you may be instructed to deviate from the standard pattern to keep traffic moving smoothly adhering to the rectangular traffic pattern procedures.

Uncontrolled airports increase safety by reducing the possibility of conflict between aircraft. As specified in FAR Part 91, turns should be made to the left in the traffic pattern unless right turns are indicated by visual marking on the airport, approved light signals, or the tower controller specifically directs otherwise. In addition, some terminal areas, such as Anchorage, Alaska, have unique traffic pattern procedures which are covered in FAR Part 93, Special Air Traffic Rules and Airport Traffic Patterns.

3.2.3 Wind Direction Indicators

In most cases, you will want to take off and land into the wind. At a controlled airport, there are various methods of obtaining current airport information, including surface winds and the active runway, or runway in use. In addition, a controller will assign you a runway for takeoff or landing. At an uncontrolled airport, you must make the final decision as to which runway to use. Some uncontrolled airports have radio operators who are able to tell you the wind direction and speed, and advise you of the active or favored runway. Airports normally have a designated calm-wind runway which is used whenever the wind is 5 knots or less. However, you must still watch carefully for other traffic that may be using other runways. When approaching an unfamiliar uncontrolled airport, it is recommended that you over fly the airport at 500 to 1,000 feet above the traffic pattern altitude to observe the flow of traffic and to locate the wind direction



indicator.

Of the two types of airport wind direction indicators, the most common is the wind sock. Used at both controlled and uncontrolled airports, the windsock may not be your initial source of wind information, but will provide you with the present wind conditions near the touchdown zone of the runway. The stronger the wind, the straighter the extension of the wind sock. Gusty conditions are indicated by back and forth movement of the wind sock.

Although you can determine the wind direction from a wind tee, wind intensity or gusty conditions are not indicated. The tail of the tee aligns itself like a weather vane into the wind, so you need to take off or land on the runway that most closely parallels the direction of the tee. The wind tee is not as common as the wind sock and in some cases, a wind sock and tee may be at the same location. If so, the tee may be manually aligned to show which runway is active.

A tetrahedron is a landing direction indicator, usually located near a wind direction indicator. The tetrahedron may swing around with the small end pointing into the wind, or it may be manually positioned to show landing direction. In either case, you are cautioned not to use it solely as a wind direction indicator, but to use it in conjunction with a wind sock.

3.2.4 Airport Visual Aids

When you begin your flight training, the airport environment can seem confusing. However, just as you learn how to interpret traffic signals, road signs, and highway markings, you will soon become familiar with the visual aids at an airport that help you maintain orientation and keep traffic flowing smoothly.

1. Runway Markings

Runway markings vary between runways used solely for VFR operations and those used in conjunction with IFR operations. A visual runway usually is marked with only the runway number and a dashed white centerline. When flying instrument approaches, pilots can use the additional markings on IFR runways as references for landing. Instrument approach procedures allow pilots to navigate to the runway using only the flight instruments.

Instrument approaches which use an electronic glide slope for guidance to the landing runway, such as the instrument landing system (ILS), are called precision approaches. Nonprecision approaches do not incorporate an electronic glideslope, and the corresponding runway markings vary accordingly.

When a visual runway is used in conjunction with a nonprecision instrument approach, threshold and aiming point markings are added. A precision instrument runway also includes touchdown zone markings. Occasionally, you may see threshold or aiming



point markings on visual runways. Runway threshold markings help identify the beginning of the runway that is available for landing. Runway aiming point markings serve as a visual aiming point for a landing aircraft.

A blast pad/stopway area, sometimes referred to as an overrun, is different from the area preceding a displaced threshold because it cannot be used for landing, takeoff, or taxiing. The blast pad is an area where propeller or jet blast can dissipate without creating a hazard to others. The stop way area is paved so that in the event of an aborted takeoff, an aircraft can use it to decelerate and come to a stop.

Sometimes construction, maintenance, or other activities relocated temporarily, method of identifying the relocated common practice is to use a ten-foot wide white threshold runway. A yellow X indicates that an entire runway or taxiway is closed.

A Notice to Airmen (NOTAM) may be issued to inform pilots of a runway closure. NOTAMs contain time-critical information which is of either a temporary nature or is not known far enough in advance to permit publication on aeronautical charts or other operational publications. In addition to runway closures or construction, NOTAMs can include changes in the status of navigational aids or instrument approach facilities, radar service availability, and other information essential to planned enroute, terminal, or landing operations.

2. Taxiway Markings

The links between the airport parking areas and the runways are the taxiways. They are easily identified by a continuous yellow centerline stripe. At some airports, taxiway edge markings are used to define the edge of the taxiway and are normally used to separate the taxiway from pavement that is not intended for aircraft use. Runway holding position markings, or hold lines, which are located wherever the taxiway intersects a runway, keep aircraft clear of the runway in use.

At an uncontrolled airport, you should stop and check for traffic and cross the hold line only after ensuring that no one is on an approach to land. At a controlled airport, the controller may ask you to hold short of the runway for landing traffic. In this case, you should stop before the hold line and proceed only after you are cleared to do so by the controller, and you have checked for traffic.

At airports equipped with an instrument landing system, it is possible for aircraft near the runway to interfere with the ILS signal. If this is the case, the hold line may be placed farther from the runway to prevent any interference, or you may find two hold lines for some runways. The one closest to the runway is the normal hold line, while the one farthest away is the ILS hold line. At other locations, only an ILS hold line may be used.

3. Airport Signs

Major airports usually have complex taxi routes, multiple runways, and widely



dispersed parking areas. In addition, vehicular traffic in certain areas may be quite heavy. As a result, most airfield signs are standardized to make it easy for you to identify taxi routes, mandatory holding positions, and boundaries for critical areas. Another benefit, if you fly outside the United States, is that the U. S. standards are practically the same as ICAO specifications. The International Civil Aviation Organization (ICAO) is a specialized agency of the United Nations whose objective is to develop standard principles and techniques of international air navigation and to promote development of civil aviation. Specifications for airport signs include size, height, location, and illumination requirements. Sometimes the installation of a sign is not practical so a surface-painted sign may be used. Surface-painted signs may include directional guidance or location information. For example, the runway number may be painted on the taxiway pavement near the taxiway hold line.

4. Runway Incursion Avoidance

The official definition of a runway incursion is “any occurrence at an airport involving an aircraft, vehicle, person, or object on the ground that creates a collision hazard or results in loss of separation with an aircraft taking off or intending to take off, landing, or intending to land.” Runway incursions are primarily caused by errors associated with clearances, communication, airport surface movement, and positional awareness. There are several procedures that you can follow and precautions that you can take to avoid a runway incursion.

During your preflight planning, study the airport layout by reviewing the airport diagram and taxi routes.

Complete as many checklist items as possible before taxi or while holding short.

Strive for clear and unambiguous pilot-controller communication. Read back (in full) all clearances involving active runway crossing, hold short, taxi into position, and hold instructions.

While taxiing, know your precise location and concentrate on your primary responsibilities. Don't become absorbed in other tasks, or conversation, while the aircraft is moving.

If you are unsure of your position on the airport, stop and ask for assistance. At a controlled airport, you can request progressive taxi instructions.

When possible, while in a run-up area or waiting for a clearance, position your aircraft so you can see landing aircraft.

Monitor the appropriate radio frequencies for information regarding other aircraft cleared onto your runway for takeoff or landing. Be alert for aircraft which may be on other frequencies or without radio communication.

After landing, stay on the tower frequency until instructed to change frequencies.

To help others see your aircraft during periods of reduced visibility or at night, use