Collision Avoidance

Strategies and Tactics

Maintaining Separation

Despite improvements in the general aviation (GA) safety record in recent years, the number of midair collisions (MACs) shows no corresponding decline. MACs continue to occur about thirteen times a year on average, often resulting in multiple fatalities. On the ground, collisions caused by runway incursions are still a concern for GA. Instead of waiting until after takeoff to begin their collision avoidance scan, pilots can avoid a runway incursion by increasing their vigilance immediately after engine start.

Collision avoidance, both in the air and on the ground, is one of the most basic responsibilities of a pilot flying in visual conditions. During primary training, pilots are taught to keep their eyes outside the cockpit and look for traffic. This Safety Advisor goes a step further and teaches pilots how to visually identify potential collision threats and covers procedures that can lessen the risk of an in-flight collision or runway incursion.

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History of MACs

Many of the rules and procedures that apply to flight in controlled airspace are the legacy of MACs. In 1956, all 128 people aboard lost their lives when a DC-7 and a Lockheed Constellation collided over the Grand Canyon in VFR conditions. This tragedy led to public outcry for the modernization of the air traffic control system, resulting in the more effective system that we have today. A 1978 collision over San Diego involving a Boeing 727 and a Cessna 172—both under radar control—caused the deaths of 144 people and resulted in even tighter restrictions on flights in heavily trafficked areas. Congress passed the Airport and Airway Safety Expansion Act after the 1986 collision of a DC-9 and a single-engine Piper over Cerritos, California, which claimed the lives of 82 people in the aircraft and 15 on the ground. The Airport and Airway Safety Expansion Act now requires all civil air carrier aircraft to be equipped with Traffic Alert and Collision Avoidance Systems (TCAS).

No MACs involving air carrier aircraft have occurred in over a decade, thanks in part to TCAS equipment. But the possibility still exists, and a midair collision involving a passenger airliner and a GA aircraft would create pressure for further regulation, impairing the flexibility and convenience of aviation for all.

In VMC, it is the pilot's responsibility to see and avoid other traffic.

See and Avoid

The rules for maintaining separation from other aircraft during VFR operations are spelled out in FAR 91.113(b): "When weather conditions permit, regardless of whether an operation is conducted under instrument flight rules or visual flight rules, vigilance shall be maintained by each person operating an aircraft so as to see and avoid other aircraft." See and avoid is the common terminology for this method of collision avoidance.

Simply looking out of the cockpit may not be enough to avoid a MAC. Pilots need to know how to look, and what to look for, which requires an understanding of the limitations of human vision and tactics to compensate for its deficiencies.

The Physiology of Vision

A safe, conscientious pilot wouldn't take off as PIC in an airplane without knowing its performance limitations and how to operate the equipment aboard. Yet most pilots routinely fly without knowing the limitations and operating rules for the most important collision avoidance equipment in the plane – their eyes. Eighty percent of the information we absorb in everyday life is obtained through our eyes. An effective scan begins with an understanding of how vision works.

The Foveal Field

The central part of the retina, where vision is most acute, is called the fovea (see Figure 1). But this is a very small part of vision, comprising just one degree of horizontal and vertical vision. As a demonstration, this area of focus is the equivalent of a quarter seen from one eye at a distance of four and a half feet. Anything outside this small area will not be seen in detail. In practical terms, a plane that was visible in the foveal field from 5,000 feet away would only be visible at 500 feet or less if it was more than five degrees on either side of this central vision. Therefore, if you're simply staring straight ahead while flying, you're missing a vast amount of the sky.

Focus

Without proper focus, an object can be right in front of a pilot yet still remain unseen. In order to spot aircraft at a distance, the eyes must be focused for distant vision.

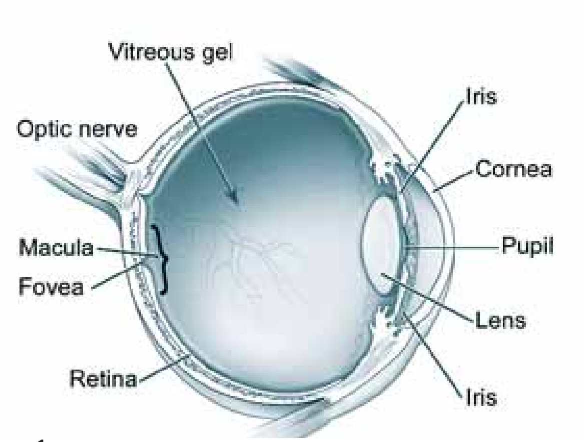


Figure 1

Yet without something distant to focus on, after 60 to 80 seconds the eyes naturally relax to an intermediate focal distance somewhere just in front of the propeller. To counteract this tendency, known as "empty field myopia," the eyes must be periodically refocused on the farthest object within sight – a cloud on the horizon, another aircraft at a distance, or a point on the ground. This refocusing needs to be incorporated in a pilot's scan technique.

Atmospheric Conditions

Haze, flight over open water, or an obscured horizon can make it difficult to see distant objects, impairing the ability to refocus. The same phenomenon can occur when you are over a haze or cloud layer with a high overcast layer above. This problem can be overcome by focusing on the farthest point visible; even the wing tip will suffice. In times of poor visibility, this form of refocusing should be repeated every minute or so.

Haze and fog can impact the eyes' ability to discern collision threats.

The position of the sun must also be considered. When low on the horizon, it makes any traffic between the observer and the sun very difficult to see. Operating in these conditions requires extra vigilance.

Optical Illusions

Optical illusions can affect what we see in flight. For example, an aircraft at a slightly lower altitude coming toward you may look like it's above you and appear to descend as it comes closer. At night, a pilot's ability to judge distance above the ground while on visual approach to a runway is impaired. Fortunately, spotting aircraft in flight isn't usually much of a problem at night, since a properly illuminated aircraft is much easier to see at night than an aircraft operating in daylight hours. The exception to this rule is identifying aircraft below you that blend in with lighting on the ground.

Other Factors

In addition to atmospheric conditions and optical illusions, irritants in the air, fatigue, age, residual alcohol in the bloodstream, and lower oxygen levels can all impact the ability of your eyes to perform at the optimum level.

Aircraft Design Considerations

The design of the aircraft itself can also hinder visibility. Windshield distortion, placement of window and windshield posts, and other structural elements can affect what a pilot sees. The brain requires input from both eyes to accurately interpret the visual cues it receives. If a windshield post or other obstruction blocks the vision of one eye, the brain may not perceive the object - even with the other eye providing input. The NTSB has concluded this could be a causal factor in some midair collisions. A high glare shield can also block vision, which is especially problematic during climbout.

When scanning for traffic, the pilot must be aware of the blind spots that can be created by aircraft design.

No matter how good the visibility is from the cockpit, all aircraft have blind spots. High-wing aircraft have reduced visibility of aircraft above them, and can have their view of traffic blocked when making turns in the pattern as the wing is lowered in the direction of the turn. Low-wing aircraft have a large blind spot beneath them that may obscure conflicting traffic when descending into the pattern or while on final approach. Pilots must recognize and compensate for visual limitations, whether it's raising a wing to check for traffic before making a turn in a high-wing airplane, or making shallow S-turns when climbing or descending in any aircraft.

When and Where

Knowing when and where MACs are most likely to occur enables you to tailor your see-and-avoid strategies to any given situation. Most MACs occur in day VMC conditions – the times of best visibility. They can also be correlated to traffic levels: most occur between 10 a.m. and 5 p.m. on weekends during the warmer months, essentially the times when the most traffic is in the air. Less than two percent of MACs occur after sundown.

In addition, most MACs occur within five miles of an airport. About 80 percent occurred at or below 3,000 feet above ground level (agl) and one third (31.1 percent) occurred at or below 500 feet. These statistics illustrate an important fact: most MACs occur in the traffic pattern, with a significant number on final approach.

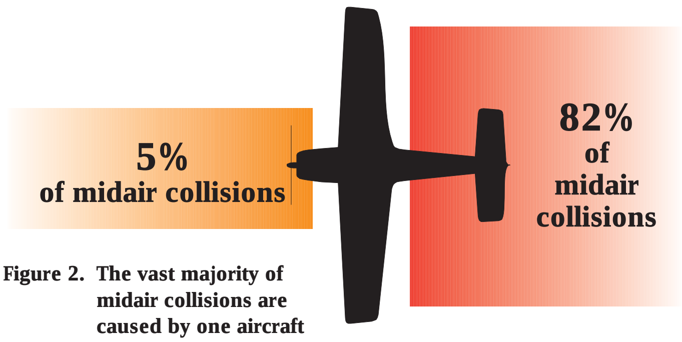


Figure 2. The vast majority of midair collisions are caused by one aircraft taking over another.

Many pilots envision MACs as high-speed, head-on collisions. In reality head-on collisions only account for five percent of all MACs. The majority of midair collisions, eight two percent, occur when one aircraft is overtaking another. (see Figure 2).

Pilot Experience

Flight time is not a major risk factor when it comes to MACs, considering accident reports list pilots from 12 hours to 37,000 hours total time. Whether it's inexperience or complacency, hours of uneventful flying can lead to one lapse that ends in tragedy.

Training flights are among the most dangerous from a MAC perspective. Flight instructors comprise less than 10 percent of the pilot population, yet a flight instructor was aboard one of the aircraft in more than one third (35.5 percent) of MACs. A possible explanation for this statistical anomaly is that flight instructors spend more time aloft than most pilots, much of it operating near airports (the most hazardous environment for MACs) and their attention is often focused on teaching, rather than scanning for traffic. Instrument flight training poses a unique hazard because the student's vision is often restricted by some type of view-limiting device.

The Scan

The scan is the technique used to optimize our vision for collision avoidance. However, the term may be a misnomer; scan implies a sweep of the eyes, while a proper scan for conflicting traffic is actually a sequence of intense, fixated observations. The eyes need one to two seconds to adjust before they can focus; a continuous sweep blurs the vision.

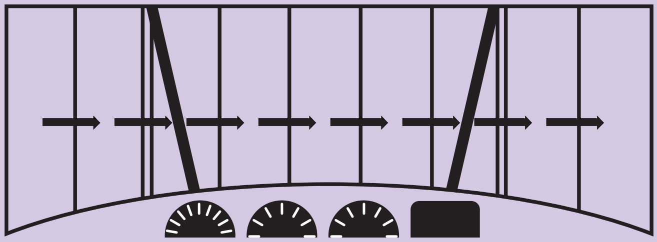
There is no "one size fits all" technique for an optimum scan. Many pilots use some form of the "block" system scan (see Figure 3 opposite pg.). This method divides the sky into blocks, each spanning 10 to 15 degrees of the horizon, and 10 degrees above and below it—for a total of 9 to 12 blocks, or scan areas. The block scan is based on imagining a point in space at the center of each block. Focusing on each point allows the eye to detect a conflict within the foveal field, as well as objects in the peripheral area between the center of each scanning block.

One common block scan technique is the "side-to- side" scan: Starting on one side of the aircraft, the pilot sweeps to the other side block by block. Another is the "front-to-side" scan: Starting with the block straight ahead, the pilot scans the blocks to one side of the aircraft, returns to the center, and repeats the process to the other side. Having a variety of scanning techniques available helps avoid the monotony of using one method all the time.

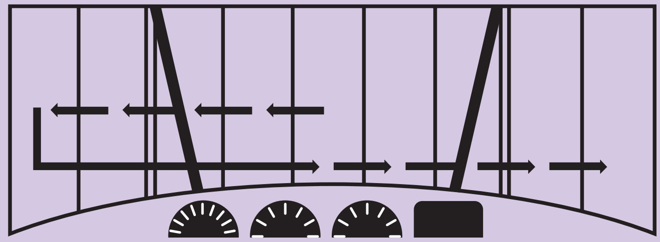
The block scan is an effective way to search the sky, but it does have limitations. Since most MACs are the result of one aircraft overtaking another, pilots should make an effort to check for overtaking aircraft after every few scans. This is particularly important during approach and landing when midair collisions are most likely to occur. It's also important to scan vertically. The area 10 degrees above and below your flight path contains virtually all potentially conflicting traffic. Unless the target is climbing or descending rapidly, aircraft outside that range can be discounted as a threat.

The "Blossom Effect"

Motion is invaluable in drawing the eye's attention. Yet two aircraft on a collision course will appear virtually motionless



Side-to-side scanning method.
Start at the left of your visual area and make a methodical sweep to the right, pausing in each block of viewing to focus your eyes. At the end of the scan, return to the panel.



Front-to-side scanning method.
Start at the center block of your visual field (center of front windshield); move to the left, focusing in each block then swing quickly back to the center block after reaching the last block on the left and repeat the performance to the right.

Figure 3. Block System Scan

to each other. When observed from the cockpit, the conflicting target will look like a small, stationary speck until it is at a distance from which it may be too close to avoid. This is called the "blossom effect." If a pilot sees an aircraft that remains in the same spot in the windshield (unless it is

Blossom Effect

directly ahead and moving in the same direction), there is a high probability the two aircraft will collide unless one changes their course. Once a threat has been identified, it's essential to keep the other aircraft in sight until the threat is resolved.

Cockpit Resource Management

Effective cockpit resource management (CRM) requires an efficient scan. The more quickly instruments and gauges can be monitored and interpreted, the more time available to scan for traffic. An experiment conducted with military pilots found the average time needed to conduct an effective scan was a total of 20 seconds – 17 seconds for the outside scan, and three seconds for the panel scan. As demonstrated by the military pilots, considerably more time should be devoted to scanning outside than inside.

CRM also includes effective management of distractions such as passengers, avionics, and chart management tasks.

Efficient scanning requires effective management of other flight tasks.

Today's GPS receivers are extremely capable, but they are also pilot workload intensive – particularly when multiple waypoints must be inserted into a flight plan. GPS receivers should always be programmed on the ground to provide more time for scanning in the air.

Phases of Flight

Midair collisions can happen in any phase of flight. Avoidance strategies need to be adjusted to reflect the flight environment and risks associated with each particular phase.

Takeoff and Climb

Nearly 11 percent of all midair collisions occur during takeoff and climb. Ensure that the runway is clear before departing and listen for other inbound aircraft. Don't forget to make position reports and understand other's reports at nontowered airports. During climb out use shallow S-turns or lower the nose occasionally to get a better view of the area directly in front of the aircraft. Pilots can also transition to cruise-climb speeds to gain better forward visibility (although some climb performance will be sacrificed).

Almost 45 percent of collisions occur in the traffic pattern, and of these 76 percent occur during approach and landing.

Cruise
Just over 27 percent of midair collisions occur during cruise flight. According to the NTSB, one common thread links the majority of these accidents: inattention on the part of the crews of both aircraft. In almost all cases, both crews were in a position to see the other aircraft in enough time to take evasive action.

Without the distractions created by arrival and departure, cruise is the phase of flight when pilots have the most time to look for traffic. However, it is also the longest phase of flight and the time of greatest complacency. During cruise flight practice the block scan and enlist the help of the passengers to spot traffic. You may also want to give some thought to avoiding high traffic areas such as the airspace near NAVAIDS and military training routes (MTRs). If you're flying below 3,000' agl, fly at atypical altitudes –more on this later.

Approach, Descent and Landing
Nearly 45 percent of collisions occur in the traffic pattern and of these, 76 percent occur during approach and landing – when aircraft are on final or actually on or over the runway. Given the small funnel of airspace airplanes occupy during landing, any confusion about who's landing in what order, and where they are, can have tragic consequences. If there is any consolation about collisions occurring during landing, it's that there are often survivors.

MACs can also occur while maneuvering in the traffic pattern as a result of improper or misunderstood position reports, which can lead to erroneous assumptions. This is particularly true at nontowered airports. A pilot may conclude, for example, that no aircraft are in the pattern because of lack of activity on the frequency. But aircraft without radios may be operating at these airports, or an inbound or outbound aircraft may be transmitting on the wrong frequency.

When entering an airport area, ensure that you are following all communication requirements and AIM recommendations, especially at nontowered airports. Check behind and below your aircraft throughout the traffic pattern. When in the traffic pattern, make sure final is clear before turning – due to fixation with the runway and poor rearward visibility, it is difficult to detect threats once established. Be prepared to make S-turns or 360-degree turns for spacing.

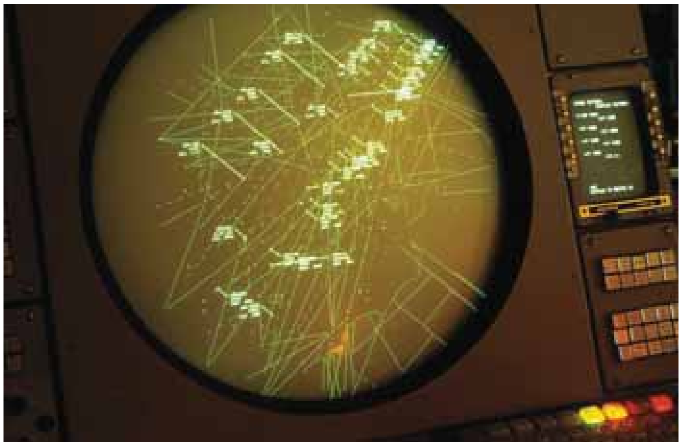
For a detailed discussion of flight safety around nontowered airports see *Operations at Nontowered Airports* **www.asf.org/advisors**

Maneuvering Flight
Although we do maneuver in the traffic pattern, the maneuvering phase of flight cited in accident reports typically refers to aerobatics, formation flying, air-to-air photography, and even flight training maneuvers. Seventeen percent of MACs occur during maneuvering flight. The best way to avoid these MACs is to seek specialized training before attempting any type of aerobatic or formation flight. Formation flight must be carefully planned on the ground, so that the pilots of both aircraft are fully briefed, properly trained, and know exactly how the flight will be conducted. Safety pilots should be used whenever possible. Avoid MACs during flight training by always using clearing turns before each maneuver.

Avoidance Strategies

Fly at the proper altitude. Above 3,000 feet agl VFR pilots should fly at cruising altitudes (msl) of odd thousands plus 500 feet when flying a magnetic course between zero and 179 degrees (ex: 5,500 feet msl). When flying a magnetic course between 180 and 359 degrees VFR pilots should fly even thousands plus 500 feet (ex: 4,500 feet msl).

Pilots on IFR flight plans should fly altitudes of odd thousands when flying a magnetic course between zero and 179 degrees (ex: 5,000 feet msl). When flying a magnetic course between 180 and 359 degrees altitudes of even thousands should be flown (ex: 4,000 feet msl).



Flight following is recommended when flying VFR.

When cruising at altitudes below 3,000 feet agl avoid flying at thousand or five hundred foot altitude intervals as these altitudes can get crowded.

Avoid flying through congested airspace. When flying VFR avoid overflying approach fixes and NAVAIDS as the airspace near these points can get congested.

When getting a preflight briefing find out which special use airspace along your route of flight is active. Try to avoid active military operations areas (MOAs), MTRs, warning areas, or alert areas.

Turn on the aircraft's exterior lights. Even during the day external lights make the aircraft more visible. If your aircraft does not have recognition lights consider having them installed as recog lights can increase the aircraft's visibility to others by a factor of 10. Turn the landing light on during final approach and departure so that the aircraft is easier for others to see. When ATC alerts you to traffic, or you see oncoming traffic, turn on the landing light to make your aircraft easier to spot.

Follow sterile cockpit procedures. The airlines have sterile cockpit procedures in place for altitudes below 10,000 feet agl. While sterile cockpit procedures are in effect conversation not pertaining to the operation of the aircraft is prohibited. The concept of sterile cockpit is relevant to general aviation (GA). The AOPA Air Safety Foundation recommends that GA pilots limit idle conversation during the first and last 10 minutes of each flight in order to concentrate on scanning for traffic and other operational concerns.

Obtain flight following on VFR flights. Requesting radar advisories and flight following from ATC can help pilots avoid conflicting traffic. While this service is only provided by ATC on a workload permitting basis, it can provide another set of watchful eyes to assist the pilot – those of ATC.

Be vigilant at nontowered airports. Many MACs occur near nontowered airports. To help avoid conflicting traffic begin monitoring the CTAF and making position reports 10 miles from the airport. When making position reports include the name of the airport at the beginning and end of the transmission. Once in the traffic pattern report each leg while keeping a watchful listen and eye out for other traffic (remember not all aircraft have radios). Fly the pattern at the normal speed for your aircraft to decrease the likelihood that you'll overtake another aircraft in the pattern.

Situational awareness is critical on the ground as well as in the air.

Runway Incursions

History's deadliest collision did not occur in the air, it happened on the ground. In 1977, two Boeing 747s collided on the runway while trying to depart Tenerife in the Canary Islands, claiming 583 lives.

Runway incursions are defined as 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 takeoff, landing or intending to land.

Between 1996 and 2003, reported runway incursions rose 21 percent. Since GA aircraft make up approximately 95 percent of all civil aircraft in the United States, it's not surprising that the FAA attributes a significant percentage of incursions to GA pilots who mistakenly taxi onto an active runway.

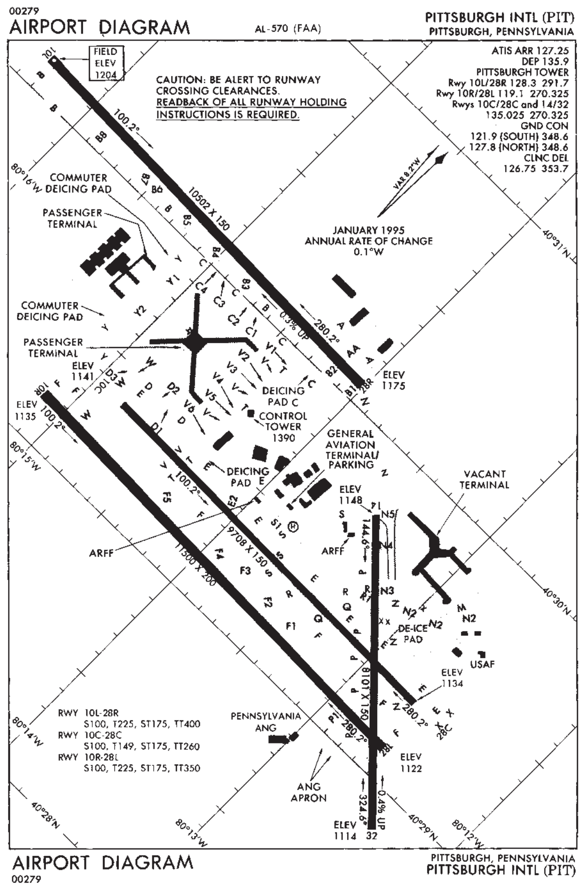
Situational awareness is critical in avoiding runway incursions. Miscommunication, inattention, and lack of information are usually at the root of a typical runway incursion. Pilots may misunderstand taxi instructions, controllers may misunderstand an aircraft's position, or a preoccupied pilot may taxi past an assigned hold short position. It is also possible that the pilot may not even know where he is if he's unfamiliar with the field. Typically, incursions by GA aircraft result in go-arounds or reduced separation between conflicting traffic rather than accidents.

To reduce the chances of a runway incursion, always review the layouts of destination and departure airports during your flight planning.

Accidents

A Cessna 172 and a Cessna 152 collided on the runway at Sarasota, Florida's towered airport, resulting in four fatalities. According to the NTSB report, confusion in the tower and lack of attention in the cockpit were factors in the accident. The 152 had been cleared for takeoff. The 172, which was holding short for an intersection departure, was then cleared onto the runway, and taxied right into the path of the 152 on its takeoff roll. The controller thought the 172 he'd cleared onto the active was the aircraft waiting behind the 152. And those aboard the 172 involved in the accident apparently didn't look for traffic before proceeding onto the active runway. This accident underscores the fact that pilots need to maintain constant vigilance, whether under the control of ATC personnel or not.

The November, 1996 collision of a Beech King Air and a Beech 1900 in Quincy, Illinois illustrates the potential consequences of incursions at nontowered airports. Cockpit Voice Recorder (CVR) tapes from the 1900 indicate that confusion and lack of attention and communication played prominent roles in this disaster. The 1900 was on a straight-in approach for Runway 13, and announced its intentions on the CTAF. The King Air announced it was going to take-off on Runway 4. The crew of the 1900 asked if the King Air was going to hold until they landed. However, a third aircraft at the airport, a Piper Cherokee behind the King Air on Runway 4, responded that he would hold, and that transmission was partially blocked, apparently leading the 1900 crew to believe the transmission was from the King Air. The 1900 continued with its landing as the King Air commenced its takeoff roll. They collided at the intersection of the two runways, claiming the lives of all those aboard both aircraft.



Avoiding Runway Incursions

- Review the anticipated taxi route before taxi (prior to departure) and en route (prior to landing).
- Listen carefully to ATC instructions at towered fields. The route you're given may not be the one you expected.
- Read back all taxi instructions.
- If uncertain, confirm permission to cross any and all runways prior to crossing them.
- Acquire airport diagrams for all airports, especially those with which you are unfamiliar. To print free airport diagrams, go to **www.asf.org/taxi.**
- If in doubt, ask for progressive taxi instructions.
- Look for traffic before taking the runway. Ensure that no conflicting traffic exists before beginning the takeoff.
- At nontowered airports with intersecting runways, check for traffic on the crossing runway as well as the one you intend to use for departure; do the same when landing at these airports.

- At airports with parallel runways, be aware of the potential for confusion created by the "left" and "right" runway designations.
- Be familiar with all relevant taxiway and runway signage.
- Stay up to speed with ASF's free online course *Runway Safety* at **www.asf.org/runwaysafety** and print flashcards for learning or reviewing airport markings and signage at **www.asf.org/flashcards.**

Collision Avoidance Technology

Technology in the cockpit can help pilots to see and avoid other aircraft. All air carrier aircraft are equipped with Traffic Alert and Collision Avoidance Systems, commonly referred to as TCAS. There are two versions: TCAS I and TCAS II.

TCAS I indicates the relative altitude, distance, and bearing of transponder-equipped aircraft within a selected range, generally up to 40 miles. With color-coded symbols and aural warnings called Traffic Advisories (TAs), the system indicates which aircraft pose a potential threat. TCAS I identifies potential problems, but it does not offer solutions in terms of what evasive action to take. However, it is still a valuable tool because it supplies pilots with important data they can use in determining the best course of action.

TCAS II, in addition to a traffic display, provides pilots with Resolution Advisories (RAs) when needed. The system determines the course of each aircraft and whether it is climbing, descending, or flying straight and level. TCAS II then issues a RA advising the pilots to climb or descend as necessary to avoid the other aircraft. If both planes are equipped with TCAS II, then the two computers offer deconflicting RAs, ensuring pilots' actions minimize, rather than exacerbate, a collision threat.

GA pilots also have access to three types of technology that provide information to determine relative altitude, distance, and bearing to assist in collision avoidance: passive, active and datalink. A passive system simply picks up on the results of other third party radar interrogations and the corresponding transponder replies, which can come from ATC, military radar, and active collision avoidance systems. Ryan International's Traffic Collision Avoidance Device (TCAD) is an example of a passive system. An active system, such as TCAS I, continuously interrogates other Mode A, Mode C, and Mode S transponders. Ryan International has introduced an active system for GA pilots called Traffic Advisory System (TAS), which interrogates other transponders within a range of over 20 miles. Datalink systems, often referred to as Traffic Information Systems (TIS) require a Mode S transponder and a Mode S radar-equipped facility to convert ATC data into collision avoidance information for pilots.

Ryan International's Traffic Advisory System (TAS).

ADS-B, Automatic Dependent Surveillance Broadcast, represents the next generation collision avoidance technology. An ADS-B equipped aircraft broadcasts a signal that contains a GPS-derived location. The signal, rebroadcast by a ground station or satellite, can be displayed in other ADS-B equipped aircraft, giving pilots critical collision avoidance information without input from ground-based ATC controllers. In addition, ADS-B is not dependent on Mode S equipment, which is not installed in all aircraft nor available from all radar facilities. This same technology also offers real-time weather and text messaging capabilities.

Collision Avoidance Checklist

You now have the knowledge to minimize the threat of collisions in the air and on the ground. Use the following tactics to enhance the safety of every flight.

☑ Plan your flight
Know your route, the frequencies you'll need along the way, and the pertinent information for your destination. Fold charts and preset navigational aids to maximize scan time. Program your avionics (including GPS units) on the ground to minimize heads-down time in the air. Anticipate where you may find high traffic/high workload areas. Avoid these areas if possible or plan on being extra vigilant during those phases of the flight.

☑ Equip yourself
If you operate an aircraft without radios or transponders, consider installing them to enhance your safety. Regulations require that aircraft equipped with transponders must have them on during flight in controlled airspace.

☑ Educate passengers
As part of your preflight briefing, explain basic scanning procedures to passengers and have them assist in spotting traffic. Explain FAA radar advisory procedures, so they can help locate traffic called by ATC.

☑ Communicate
When flying in controlled airspace, familiarize yourself with the required communication procedures. At nontowered airports, begin announcing your position when 10 miles out.

☑ Use sunglasses
Sunglasses that block out UV rays help protect your vision and reduce eye fatigue. Red/yellow spectrum lenses make it easier to see through haze. Polarized lenses reduce glare, but this may be a detriment to spotting traffic as the glint of light bouncing off an aircraft is often the very thing that helps make it visible.

☑ Observe proper procedures
Use correct cruising altitudes and traffic pattern procedures. Announce your position at nontowered airports. Recognize that not everyone follows the rules.

☑ Improve your visibility
Bugs or other contaminants on your windshield can block an aircraft from view and make it more difficult to focus properly. During climbout, make S-turns for improved forward visibility. Once you've reached a safe altitude, use cruise-climb airspeeds to get a better view over the nose.

☑ Scan for traffic!
Use the techniques presented in this Safety Advisor (see Page 5). Remember to devote more time to scanning for traffic outside than scanning the instruments inside.

☑ Use aircraft lights
Install and use additional lighting to help other pilots see your aircraft. Use your landing light on approach, departure, and climbout – especially within 10 miles of any airport.

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