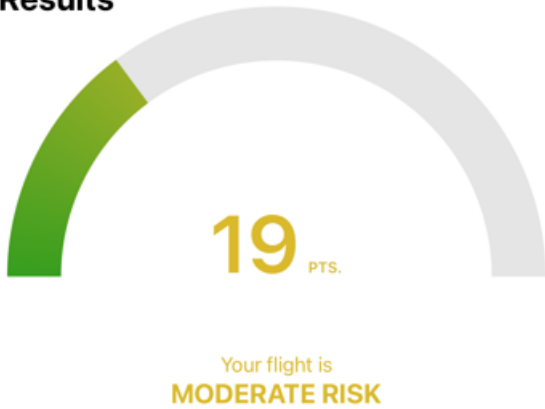


## Elements of Effective Teaching That Include Risk Management and Accident Prevention

<b>Objective</b>	<b>Results</b> 
<p>To ensure the applicant learns the purpose of and can exhibit a clear understanding of the principles of risk management and the risk management process.</p>	
<b>Purpose</b>	
<p>Flying is inherently a dangerous activity. While it is impossible to completely eliminate risk from flying, pilots should aim to take no unnecessary risks. This lesson introduces pilots to the concept of formal risk management, and teaches them tools they can use when flight planning to increase the margins of safety.</p>	
<b>Schedule</b>	<b>Equipment</b>
<ul style="list-style-type: none"> <li>● <b>Ground Lesson:</b> 20 minutes</li> <li>● <b>Student Q&amp;A:</b> 10 minutes</li> </ul>	<ul style="list-style-type: none"> <li>● Whiteboard / Markers (optional)</li> </ul>
<b>Student Actions</b>	<b>Instructor Actions</b>
<ul style="list-style-type: none"> <li>● Ask any questions, receive study material for the next lesson.</li> <li>● Watch linked video.</li> <li>● Review listed references.</li> </ul>	<ul style="list-style-type: none"> <li>● Deliver the ground lesson (below).</li> <li>● Answer student questions.</li> </ul>
<b>Completion Standards</b>	
<ul style="list-style-type: none"> <li>● Student can explain the following concepts: <ul style="list-style-type: none"> <li>● The purpose and principles of Risk Management</li> <li>● The Basic Risk Management Process</li> <li>● Risk Management Tools, including: <ul style="list-style-type: none"> <li>○ PAVE, IMSAFE, and 5P Checklists and their usage</li> </ul> </li> </ul> </li> </ul>	

## References

- FLY8MA.com Flight Training - “CFI ORAL EXAM: Part 1 | FOI”
  - YouTube - <https://www.youtube.com/watch?v=4lxiQeh0FFI>
- FAA-H-8083-9B (Aviation Instructor’s Handbook) - Chapter 10 [Teaching Practical Risk Management during Flight Instruction]
- FAA-S-ACS-25 (CFI ACS) - Area I Task G

## Ground Lesson Outline

- Principles of Risk Management - Formal system for identifying and analyzing hazards.
  - Hazards - Real or perceived conditions that could affect safety.
  - Risks - Possible future impact of hazards, and the probability and severity of them.
  - Safety - Freedom from risks that can affect health, endanger life, damage property, etc.
  - Types of Risk
    - Total Risk, Identified Risk
    - Unidentified Risk
    - Unacceptable Risk
    - Acceptable Risk
    - Residual Risk
  - Principles
    - Accept No Unnecessary Risk, Make Risk Decisions At The Appropriate Level, Accept Risk When Benefits Outweigh Costs, Integrate Risk Management Into Planning At All Levels
- Risk Management Process
  - Formal system which categorizes risks according to certain metrics
    - Step 1 - Identify the Hazard - Consider all risk areas to identify hazards (PAVE, etc)
    - Step 2 - Assess the Risk - Determine probability and severity
    - Step 3 - Analyze Risk Control Measures - Identify measures which reduce probability or severity
    - Step 4 - Make Control Decisions - Decide which measures will be taken
    - Step 5 - Implement Risk Controls - Implement the measures
    - Step 6 - Supervise and Review - Periodically reassess
  - Level of Risk - Combination of Severity and Probability
  - Assessing Risk - Determine severity and probability, cost vs. benefit
  - Mitigating Risk - Consider alternatives, avoid high-risk operations, use risk management tools
- Risk Management Tools for Pilots
  - IMSAFE checklist - Illness, Medication, Stress, Alcohol/Drugs, Fatigue, Eating
  - PAVE checklist - Divides Risk into Categories
    - Pilot, Airplane, enVironment, External Pressures
  - Flight Risk Assessment Tools (FRATs)
  - The Five Hazardous Attitudes
    - Anti-Authority, Impulsivity, Invulnerability, Resignation, Macho
    - Antidotes
  - 5P checklist - A tool for Single-Pilot Resource Management (SRM), scheduled review of risk areas at various points in the flight (before departure, midway, prior to approach, etc.)
    - The Plan, the Plane, the Pilot, the Passengers, and the Programming
- Managing Risk During Flight Instruction
  - When to introduce Risk Management - From the very beginning, use of FRATs pre-solo
  - Common risks during flight instruction - PAVE, Lack of familiarity, Busy Practice Areas, etc.
    - Distractions, special considerations while teaching takeoffs and landings
  - Best practices for minimizing the common risks - positive exchange of controls, collision avoidance
  - Use of ADM and SRM
  - Importance of Scenario Based Training (SBT)

## Ground Lesson Content

- **Principles of Risk Management** - Formal system for identifying and analyzing hazards.
  - **Hazards** - Real or perceived conditions that could affect safety.
  - **Risks** - Possible future impact of hazards, and the probability and severity of them.
  - **Safety** - Freedom from risks that can affect health, endanger life, damage property, etc.
  - **Types of Risk**
    - **Total Risk** - The sum of identified and unidentified risks.
    - **Identified Risk** - Risks which have been identified and analyzed.
    - **Unidentified Risk** - Risks which have not yet been identified. May be impossible to know until a mishap occurs.
    - **Unacceptable Risk** - Risks that must be eliminated or controlled. Consequences cannot be tolerated.
    - **Acceptable Risk** - Risks that can be allowed to exist, but should be carefully managed.
    - **Residual Risk** - Risks that are left over after risk and safety management processes have occurred.
  - **Principles**
    - **Accept No Unnecessary Risk** - Risks are a cost vs. benefit analysis, do not accept risks which provide no benefit.
    - **Make Risk Decisions At The Appropriate Level** - Risk management decisions should be made by the people most directly in a position to control them, e.g. the pilot should make decisions about risks related to the flight plan or passengers, etc.
    - **Accept Risk When Benefits Outweigh Costs** - When the benefits outweigh the costs, risks can be accepted. It is impossible to completely eliminate risk.
    - **Integrate Risk Management Into Planning At All Levels** - Risk management should be considered during flight planning, during preflight, and at every stage of flight. It is not a one-time process.
- **Risk Management Process** - Formal system which categorizes risks according to certain metrics.
  - **Step 1 - Identify the Hazard** - Identify any real or potential hazardous condition which could pose a danger to people or property.
  - **Step 2 - Assess the Risk** - Consider the probability and severity of the risk. For example, the risk of an in-flight structural failure for most aircraft is generally low, since it is improbable, although the severity (should it occur) is catastrophic.
    - **Probability** - Probable, Occasional, Remote, Improbable
    - **Severity** - Negligible, Marginal, Critical, Catastrophic
  - **Step 3 - Analyze Risk Control Measures** - What actions can be taken to reduce either the probability, or the severity of the risk?
  - **Step 4 - Make Control Decisions** - Identify the decision maker, and decide which risk control measures will be implemented.
  - **Step 5 - Implement Risk Controls** - Implement the risk control decisions. In some situations, this involves creating a plan and identifying who will perform the steps.
  - **Step 6 - Supervise and Review** - Periodically re-evaluate the situation to monitor for changes to the situation.
  - **Level of Risk** - Combination of Severity and Probability. Probable but Negligible risks may be considered Medium risks, whereas Probable but Marginal risks are considered Serious risks.
  - **Assessing Risk** - Determine severity and probability, cost vs. benefit.

Risk Assessment Matrix					
Likelihood		Severity			
		Catastrophic	Critical	Marginal	Negligible
Probable	High	High	Serious		
Occasional	High	Serious			
Remote	Serious	Medium		Low	
Improbable					

- **Mitigating Risk** - Consider alternatives, avoid high-risk operations, use risk management tools. For example, a very long flight may create a risk of fuel exhaustion, this risk can be mitigated by reducing the probability by planning shorter legs or fuel stops, etc.
- **Risk Management Tools for Pilots**
  - **IMSAFE Checklist** - Considers pilot risk aeromedical risk factors.
    - **Illness** - Do I have any symptoms?
    - **Medication** - Am I taking any medications which can affect my flying performance?
    - **Stress** - Am I under stress or pressure?
    - **Alcohol/Drugs** - Have I been drinking within 8 or 24 hours?
    - **Fatigue** - Am I well rested?
    - **Eating** - Am I adequately nourished?
  - **PAVE Checklist** - Divides Risk into Categories.
    - **Pilot** - Risk factors affecting pilot performance, health (IMSAFE), etc.
    - **Aircraft** - Risk factors affecting the airplane, maintenance, etc.
    - **enVironment** - Risk factors relating to weather, unfamiliar airports, etc.
    - **External Pressures** - Risk factors relating to external pressures, e.g. get-there-itis



- **Flight Risk Assessment Tools (FRATs)** - Automated tools that consider a pilot's particular experience with known risk factors and use a formula to generate a risk score. They are an easy way to decide whether a given flight is low or high risk.

The image displays two screenshots of a mobile application used for flight risk assessment. The left screenshot shows the 'Questionnaire' screen, and the right screenshot shows the 'Results' screen.

**Questionnaire Screen:**

- PILOT**
  - Fewer than 50 hours in aircraft or avionics type:
  - Fewer than 15 hours in last 90 days:
  - Flight will occur after work:
  - Fewer than 8 hours' sleep prior to flight:
  - Dual instruction received in last 90 days:
  - WINGS phase completion in last 6 months:
  - Instrument rated, current, and proficient:
- FLIGHT CONDITIONS**
  - Twilight or night:
  - Surface wind greater than 15 knots:
  - Crosswind greater than 10 knots:
  - Mountainous terrain:
- DEPARTURE AND DESTINATION AIRPORT**
  - Nontowered airport (or tower closed):
  - Runway length less than 3,000':
  - Wet or soft-field runway:
  - Obstacles on departure/approach:
- WEATHER**
  - Flight Type: IFR >
  - Ceiling less than 3,000' AGL:

**Results Screen:**

- Results**
- A semi-circular gauge shows a score of **19 PTS.** The gauge is divided into three segments: green (0-10), yellow (10-15), and grey (15-20).
- The text below the gauge reads: "Your flight is **MODERATE RISK**".
- Below the gauge, there is a note: "If your score falls in the yellow, try to mitigate some of the higher scoring items. That might entail waiting for the weather to improve or switching to an aircraft you have more experience with. If the score is still in the yellow, bring in the opinion of a designated 'contact' person such as a flight instructor or an FAA Team Representative. They may be able to help think of ways to further mitigate some of the risks for your flight."

Both screenshots show a bottom navigation bar with icons for Pilot, Questions, Results, and About. The 'Results' icon is highlighted in the right screenshot.

- **The Five Hazardous Attitudes** - There are five unique categories of hazardous attitudes among pilots that have been identified, and pilots should be vigilant to ensure that they do not find themselves exhibiting these attitudes.

The Five Hazardous Attitudes
<p><b>Anti-authority:</b> "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 pilot prerogative to question authority if it seems to be in error.</p>
<p><b>Impulsivity:</b> "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.</p>
<p><b>Invulnerability:</b> "It won't happen to me." Many people believe 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.</p>
<p><b>Macho:</b> "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.</p>
<p><b>Resignation:</b> "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 me," 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."</p>

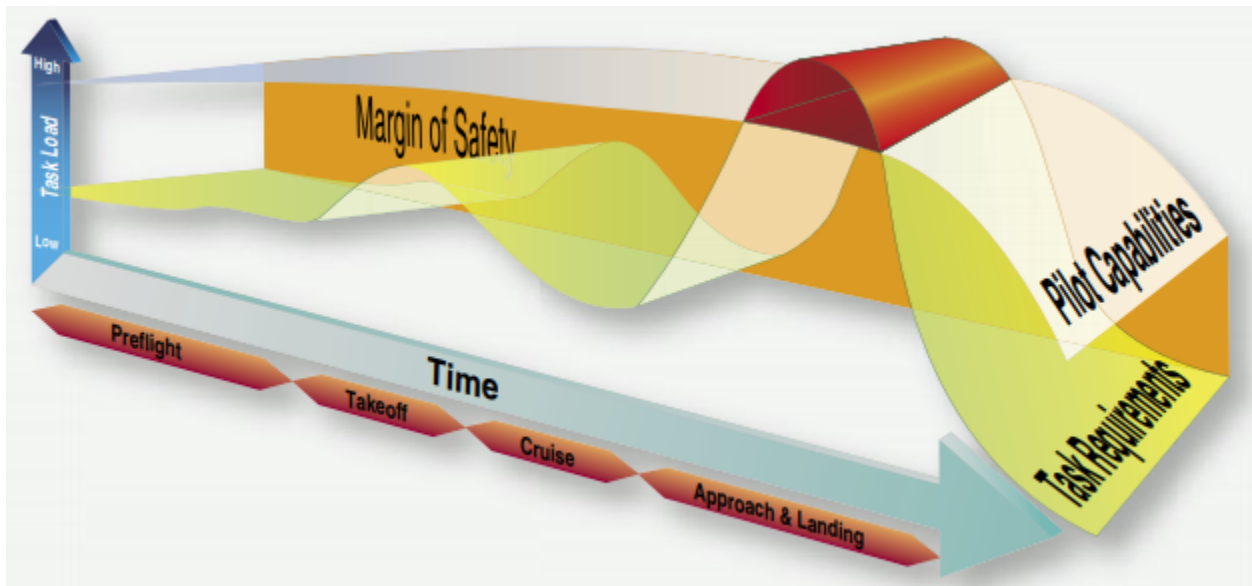
- **Anti-Authority** - "Don't tell me!"
- **Impulsivity** - "Do it quickly"
- **Invulnerability** - "It won't happen to me"
- **Resignation** - "What's the use?"
- **Macho** - "I can do it"

- **Antidotes To Hazardous Attitudes**

Hazardous Attitude	Antidotes
<b>Macho</b> Steve often brags to his friends about his skills as a pilot and how close to the ground he flies. During a local pleasure flight in his single-engine airplane, he decides to buzz some friends barbecuing at a nearby park.	<b>Taking chances is foolish.</b>
<b>Anti-authority</b> Although he knows that flying so low to the ground is prohibited by the regulations, he feels that the regulations are too restrictive in some circumstances.	<b>Follow the rules. They are usually right.</b>
<b>Invulnerability</b> Steve is not worried about an accident since he has flown this low many times before and he has not had any problems.	<b>It could happen to me.</b>
<b>Impulsivity</b> As he is buzzing the park, the airplane does not climb as well as Steve had anticipated and, without thinking, he pulls back hard on the yoke. The airspeed drops and the airplane is close to stalling as the wing brushes a power line.	<b>Not so fast. Think first.</b>
<b>Resignation</b> Although Steve manages to recover, the wing sustains minor damage. Steve thinks to himself, "It doesn't really matter how much effort I put in—the end result is the same whether I really try or not."	<b>I'm not helpless. I can make a difference.</b>

- **Anti-Authority** - Follow the rules, they are there for a reason.
  - **Impulsivity** - Not so fast, think.
  - **Invulnerability** - It can happen to you.
  - **Resignation** - I am not helpless, I can make a difference.
  - **Macho** - Taking chances is foolish.
- **5P checklist** - A tool for Single-Pilot Resource Management (SRM), scheduled review of risk areas at various points in the flight (before departure, midway, prior to approach, etc.). Accounts for the idea that the safety margin is the difference between the task requirements and pilot capabilities. During various phases of flight, these factors create differing levels of workload for pilots.
  - **The Plan** - The flight plan, the mission, etc. Includes the pilots familiarity with the airports, the route, etc.
  - **The Plane** - The airplane that will be used, including the pilot's familiarity with it.
  - **The Pilot** - The pilots current level of proficiency, currency, medical condition, etc.
  - **The Passengers** - The passengers, the pressures they may put on completing the mission, etc.
  - **The Programming** - Level of familiarity or proficiency with programming avionics, radios, or other modern electronic flying aids.



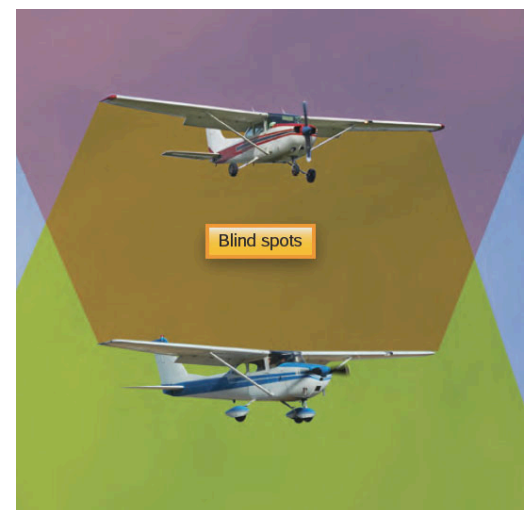


- **Managing Risk During Flight Instruction** - As pilots, every time we step into the flight deck of an aircraft, we are subject to risks. As described above, we use Risk Management techniques to help us decide how to deal with each one.
  - **When to Introduce Risk Management?** - Risk management should be an integrated part of flight training from the very beginning. Any formal ground instruction program should include at least a basic introduction to risk management tools, such as the PAVE checklist. It is also crucial that students see their instructors performing and discussing the risk management steps they take before every lesson, i.e. “We are going to go do stalls today, but the clouds are low over the usual practice area, so we will mitigate this risk by going to another area where this isn’t a concern”, etc.
    - **Pre-Solo** - To develop good habits, a discussion on risks should be a part of every preflight and postflight briefing. Students should also be introduced to simple electronic FRAT tools prior to solo flight, and should be expected to use the FRAT tools before each solo flight.
    - **Cross-Country Training** - Students should be able to perform a risk analysis of the planned cross-country route, with some instructor coaching. This should include use of the FRAT tools, and a discussion about all the unique aspects of each flight.
- **Common risks during flight instruction** - As with any flight, instructors should also be using the PAVE checklists to help them evaluate risks of instructional flight. Specifically, there are some risks specific to flight instruction:
  - **Pilot** - Student pilots are less proficient than instructors, but will be handling the controls the majority of the flight, so instructors must prepare for mistakes. Instructors may have currency or proficiency issues due to lack of individual practice. Instructors may operate in a large fleet of heterogeneous aircraft, and therefore may have familiarity issues with any different avionics or equipment that might be present.
    - **Deadly Distractions** - Distractions can be deadly in flight, and flight instruction by itself can be a tremendous distraction. (Especially for new instructors!) Flight Instructors must ensure that they divide their attention between the safe conduct of the flight and delivering effective teaching to their students.
  - **Aircraft** - The instructor is often not directly managing and is not directly involved with the maintenance of the aircraft. With two people onboard, payload may be limited, and full fuel may not be taken in some situations, which can create hazards in some high DA situations.
  - **enVironment** - Busy practice areas can create potential collision risks. Weather (convective



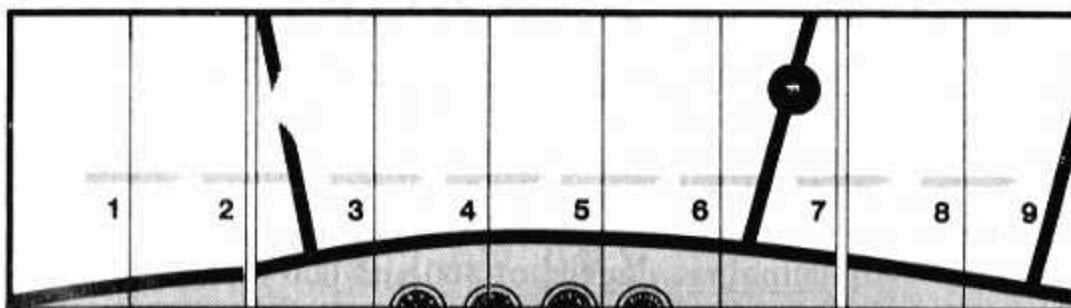
activity, haze, etc) is a factor in many high-density training areas.

- **External Pressures** - Scheduling issues create urgency where there otherwise would be none. Students may be anxious to move forward with their training, leading instructors to face pressures not to cancel flights, etc.
- **Special considerations while teaching takeoffs and landings** - When teaching takeoffs and landings, we are **low and slow, and close to the ground**. Takeoffs and landings happen quickly, and there is very little room for errors. Despite this, instructors must allow their students a limited amount of latitude to make these errors (so that they can learn), but without inviting unacceptably large risks! Some key points to keep in mind:
  - **Very low energy approaches cannot be tolerated** - Instructors must step in earlier in these situations, versus high energy approaches.
  - Takeoffs and landings happen quickly, and can go wrong quickly. They also represent a low energy state, and improper student actions could rapidly cause a serious compromise in safety of flight. Additionally, an engine failure after takeoff requires *immediate* reaction by the instructor. Instructors must be especially vigilant during this phase of flight. Loss of control during roundout, flare, and landing rollout is also a significant risk. Instructors should be primed to take control quickly during these phases of landing practice. **Never allow takeoffs or landings to be practiced when the actual conditions are near, or at the limit of the instructor's own capability!**
  - **Training on Takeoffs and Landings should involve realistic scenarios** - an imaginary obstacle at a particular location, etc. These scenarios should be within the limits of the capabilities of the aircraft, and well within the limits of the instructor. (*i.e. No scenario that requires excessive or unsafe pitch attitudes, or sink rates, etc*) The scenarios should also take into account the real environment: no flying too close to preceding aircraft, too close to real obstacles, etc.
- **Mid-Air Collisions Risks** - VFR flying provides an exceptional degree of freedom to pilots, but at the cost that, since there is no requirement to be on a flight plan or be receiving ATC services, pilots are solely responsible for avoiding collisions with other aircraft and terrain. This concept is referred to as “see and avoid”, and it requires pilots to maintain vigilance at all times during flight to prevent collisions.
  - **Poor Visual scanning Habits -> Increased Collision Risk** - Failure to adequately scan outside the cockpit creates a large risk of a mid-air collision.
  - **Barriers To Visual Scanning**
    - **Limitations of Vision** - Human visual system limitations described above.
    - **Aircraft Blind Spots - High Wing vs Low Wing** - High wing airplanes tend to be blind to the sides and above the airplane. Low wing airplanes are blind to the side and below the airplane. This can lead to extremely dangerous situations. There have been many accidents involving a low-wing airplane descending on top of a high-wing airplane on a simultaneous final approach at an uncontrolled airfield. To avoid this, pilots can make gentle S-turns to gain some visibility above and below, and exercising vigilance in airport traffic patterns.





- **Glaresield Reflections, Dirty Windshields** - If the windshield is not properly cleaned, reflections, dirt, and oil residue can make it difficult to scan properly.
- **Best practices for Minimizing Common Risks During Flight Instruction**
  - **Positive Exchange of Controls** - Absolutely crucial for safety, there can never be any doubt who is flying the airplane
    - **3-Way Exchange** - Best way to exchange flight controls, confirms both parties understand who is in control
      - “You have the flight controls”
      - “I have the flight controls”
      - “You have the flight controls” (Also visually confirm)
    - **Sterile Cockpit** - Important to minimize unnecessary discussion during critical phases of flight
      - **Prevents Runway Incursions** - Distractions by unnecessary discussion can lead to runway incursions
      - **Prevents Forgetting Critical Items** - Pilots can forget checklists or critical checklist items
    - **Tools for Reducing Collision Risks** - Pilots have a few important tools for reducing collision risks:
      - **Proper Visual Scanning Procedure** - Because of the limitations in the human visual system, namely that visual acuity is sharpest only at the very center of the visual field, pilots must employ a procedure that uses brief pauses to visually scan segments of the sky, as shown below. Note that at night, pilots should intentionally look off-center to avoid the night blind spot.

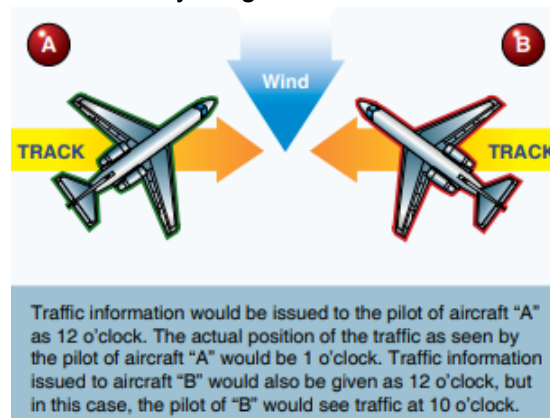


*Side-to-Side scanning method. Start at the far left of your visual area and make a methodical sweep to the right, pausing in each block of viewing area to focus your eyes. At the end of the scan, return to the panel.*

- **Proper Clearing Procedures** - Before performing certain maneuvers, it is crucial for pilots to visually ensure that the area is clear of other traffic and obstacles.
  - **Before Entering Runways** - Before entering any runway, even when cleared by ATC, pilots should visually scan the final approach path *at both ends* of the

runway.

- **Climbs/Descents** - It may be necessary to momentarily level off at intervals to scan for traffic.
- **Straight and Level, Before Turns** - The normal visual scan should be used during cruise flight. In high wing airplanes especially, pilots should raise a wing to ensure the area is clear before beginning a turn.
- **Before Maneuvering** - Before doing any maneuvers or air work, pilots must clear the area by performing at least 2 90 degree turns left and right, while looking for other traffic.
- **Before Landing** - Before landing, even when cleared by ATC, pilots should visually confirm the runway environment is clear.
- **Sunglasses, Crew Resource Management (ask for help)** - Wear sunglasses, employ proper scanning procedures, and ask passengers to help scan for traffic. (Divide the scanning responsibilities)
- **Aircraft Lighting - § 91.209** - Flying with landing lights and strobes on at all times can reduce collision risk. Flying with nav lights on at night is required.
- **CTAF/Practice Area Radio Calls** - Proper radio calls can supplement visual scanning to make other pilots aware of where they should be looking.
- **Right of Way Rules - § 91.113** - Obey proper right-of-way rules, which create predictable behavior that minimizes collision risks when used properly.
- **Proper Non-Towered Procedures - § 91.126 (Class G), § 91.127 (Class E)** - Proper pattern entries, and flying proper patterns (e.g. no right-hand patterns when not authorized by A/FD or ATC)
- **TIS-B (ADS-B In)** - Traffic data from ADS-B can greatly assist maintaining situational awareness.
- **ATC and Flight Following** - Use ATC services to assist with traffic avoidance.
  - **Traffic Calls** - ATC will call out traffic using their position relative to the nose, e.g. **“Traffic, 1 o’clock, 1 mile, 3,000 feet indicated”**
    - **Note:** ATC does not know your actual heading, and so clock positions are based on your ground track!



- **Synthetic Vision Systems** - Synthetic vision systems can help with terrain avoidance.
- **Knowing Minimum Safe Altitudes** - Know the minimum safe altitude for each area and maintain it.
- **Use of Aeronautical Decision Making (ADM) and Single Pilot Resource Management (SRM)** can help pilots maintain a margin of safety by giving a structured framework to make decisions, and avoiding unnecessary risk. Using the Risk Management tools described above is a good start.
  - **Task Prioritization** - Especially in the case of SRM, it is vital that pilots divide their attention appropriately, meaning that urgent items are paid more attention. The old adage of *“Aviate,*

*Navigate, Communicate*” is a great basis for making such prioritization decisions.

- When dealing with complex avionics, there is additionally a higher susceptibility to distraction... getting lost in menus and buttonology is a serious problem. Always divide attention when performing these tasks!
- **Scenario-Based Training** - Instructors can help student pilots develop risk management skills by using Scenario-Based Training, which requires students to think about common flying scenarios in a practical way.
  - **Elements of a Good Scenario**
    - **Clear Set of Objectives** - Training objectives are stated clearly
    - **Tailored to Student** - Tailored to individual students strengths and weaknesses
    - **Uses Local Environment Effectively** - Takes advantage of unique or challenging aspects of the local airport, airplane, environment, etc. For example, training in Florida involves decision making regarding convective weather, etc.
  - **Use of Distractions** - Student pilots should be evaluated by the instructor creating deliberate distractions
    - **Ensure Ability to Multitask** - Ensures that the student can divide attention between flying and other tasks
    - **Examples**
      - Drop a pencil, Ask for a heading to an airport, Ask student to identify ground objects, etc.