Federal Aviation Administration

The Art of Aeronautical Decision-Making
Course Table of Contents

Introduction

Introduction

Life is full of decisions. Some (e.g., deciding what to wear to work) are so routine that we are hardly aware of making them. Others (e.g., changing jobs) take more effort because they have significant and lasting implications.

Flying is also full of decisions. Many may appear to be routine, but even "small" decisions made in the cockpit can have a large impact on flight safety. Good aeronautical decision-making (ADM) is therefore an essential pilot skill.

This course offers a practical framework to help you develop this vital pilot skill and use it to stay safe in all of your flying activities. After completing the course, you will be able to explain the 3-P model and apply it to flight scenarios that appear in Chapter 7.

At the end of the course is a short quiz drawn primarily from these scenarios. The point of the quiz is to give you a chance to practice applying the 3-P model to flight scenarios. Just as in the real world, there may not always be a single "right" answer to quiz questions. If your answer differs from the official "right" answer, you may want to discuss some of the questions and answers with a flight instructor or another pilot. The most important thing is to understand how, and why, you reached the answer you provided.

Chapter 1 – What is Aeronautical Decision-Making?

Aeronautical Skills

To fly an airplane safely, you need three sets of separate, but related, skills.

Physical Airplane . You need basic stick-and-rudder skills to safely control the airplane itself. When you learn to fly; work on a new pilot certificate, rating, or endorsement; or transition to a new airplane, the emphasis naturally tends to fall on maneuvers ("airwork") that help you develop the necessary "physical airplane" skills.

Mental Airplane . You need to thoroughly understand and correctly operate the various aircraft systems, which some experts characterize as the "mental airplane" component. These include avionics, hydraulics, fuel, electrical, and other systems that help you aviate, navigate, and communicate.

Aeronautical Decision-Making (ADM). Many pilots get in trouble not because of deficient "physical airplane" or "mental airplane" skills, but because of faulty ADM and risk management skills. Why should that be so? One reason is that ADM, unlike physical airplane and mental airplane skills, is an invisible process. An instructor or examiner can easily observe and evaluate your ability to land the aircraft (physical airplane) or your proficiency in programming the GPS (mental airplane). ADM, on the other hand, is a process that takes place inside the pilot's brain. Because ADM is harder to observe and evaluate than basic aircraft control and systems skills, it sometimes gets less emphasis than it deserves.

ADM Defined

So what exactly is ADM? In AC 60-22, the FAA defines ADM as a

> *Systematic approach to the mental process of evaluating a given set of circumstances and determining the best course of action*.

Although this sentence provides a good description of the ADM process, you may be asking yourself how to translate this formal definition into practices that you can easily use in real world flying. Let's take a look at one approach.

Related Media for this Section

AC 60-22 on Aeronautical Decision-Making AC 60-22.pdf (2.74 MB)

Chapter 2 – The 3-P Model for ADM

Perceive, Process, Perform

To help pilots put the concept of ADM into practice, the FAA Aviation Safety Program developed a new framework for aeronautical decision-making and risk management: **P**erceive – **P**rocess – **P**erform.

This model offers a simple, practical, and systematic approach to accomplishing each ADM task during all phases of flight. To use it, you:

Perceive the "given set of circumstances" for your flight.
Process by evaluating their impact on flight safety.
Perform by implementing the best course of action.

The next few chapters will describe how you put each of these steps into practice.

Related Media for this Section
3-P Model for Aeronautical Decision-Making 3P Risk Management Process.pdf (47.01 KB)

Chapter 3 – Perceive

Develop Situational Awareness

To navigate to a particular destination, the first step is to determine exactly where you are right now. The same principle applies in ADM: to navigate to a safe outcome, you first need to understand the "given set of circumstances" you face.

The first step in the 3-P model, *PERCEIVE,* is about developing a clear and comprehensive awareness of your particular situation. Consider:

P ilot

A ircraft

En **V** ironment

E xternal Pressures
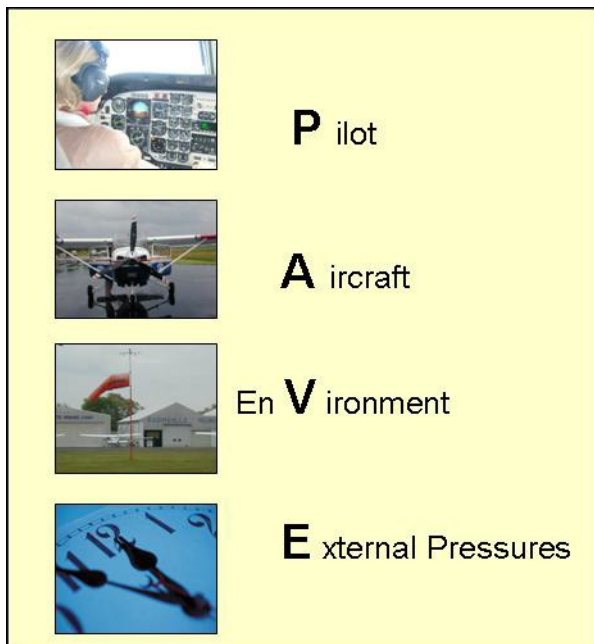
For each element, ask "what could hurt me, my passengers, or my aircraft?"

All four elements combine and interact to create a unique situation for any flight. Pay special attention to the pilot-aircraft combination, and consider whether the combined "pilot-aircraft team" is capable of the mission you want to fly. For example, you may be a very experienced and proficient pilot, but your weather flying ability is still limited if you are flying a 1970s-model aircraft with no weather avoidance gear. On the other hand, you may have a new technically advanced aircraft with moving map GPS, weather datalink, and autopilot – but if you do not have much weather flying experience or practice in using this kind of equipment, you cannot rely on the airplane's capability to compensate for your own lack of experience.

Chapter 4 – Process

Evaluate with CARE

Next, you mentally *PROCESS* information about the circumstances that you have identified. The goal is to evaluate their impact on the safety of your flight, and consider "why must I CARE about these circumstances?"

For each hazard that you perceived in step one, process with CARE. Example: for a night flight to attend a business meeting:

C onsequences (e.g., departing after a full workday creates fatigue & pressure)

A lternatives (e.g., delay until morning; reschedule meeting; drive)

R eality (e.g., dangers and distractions of fatigue could lead to an accident)

E xternal pressures (e.g., business meeting at destination might influence me)

A good rule of thumb for the processing phase: if you find yourself saying that it will "probably" be okay, it is *definitely* time for a solid reality check.

If you are worried about missing a meeting, be realistic about how that pressure will affect not just your initial go/no-go decision, but also your inflight decisions to continue the flight or divert.

Chapter 5 – Perform

Mitigate, Eliminate, Evaluate

Once you have perceived a hazard (step one) and processed its impact on flight safety (step two), it is time to *PERFORM* by taking the best course of action, and then evaluating its impact. Your goal is to

M itigate or eliminate risk

E valuate outcome of action(s)

Your mental willingness to follow through on safe decisions, especially those that require delay or diversion is critical. You can bulk up your mental muscles by:

- Using *personal minimums checklist* to make some decisions in advance of the flight. If you are unsure of how to develop personal minimums, take a look at the methods presented in the three documents below. Choose one that works for you, and stick to it!

- Develop a list of *good alternatives* during your processing phase. In marginal weather, for instance, you might mitigate the risk by identifying a reasonable alternative airport for every 25-30 nm segment of your route.

- *Preflight your passengers* by preparing them for the possibility of delay and diversion, and involve them in your evaluation process. Download the Passenger Preflight Checklist below for specific ideas.

Related Media for this Section
Personal and Weather Risk Assessment Guide Personal and Wx Risk Assessment Guide V1.0.pdf (1.03 MB)
PAVE Personal Minimums Checklist Personal Minimums Checklist.pdf (154.92 KB)
Personal Minimums Worksheet Personal Minimums Worksheet.pdf (31.04 KB)
Passenger Preflight Checklist Preflighting Your Passengers.pdf (24.79 KB)

Chapter 6 – Common Errors in ADM

Types of Pilot Error

Pilot mistakes are often called "pilot error," formally defined as:

An action or inaction that leads to a deviation from intentions and expectations.

Sometimes, pilot error involves deficiencies in aircraft control, or "physical airplane," skill. These errors can be prevented through maneuvers-based training and practice.

In other cases, accidents attributed to pilot error result from shortcomings in the pilot's "mental airplane" systems knowledge. Examples might include misprogramming the autopilot, or turning the wrong knob on the GPS navigator. Use of aircraft training devices, computer-based training, and regular practice in the aircraft can help prevent these errors.

Since this course focuses on aeronautical decision-making, this chapter will take a closer look at factors involved in "decisional errors," which usually involve a combination of cognitive activities and judgments.

Effects of Human Limitations

Human limitations can play a significant role in how we perceive, process, and perform in complex activities, like flying. For example:

Filtering: The brain's working memory capacity is limited to about seven (7) pieces, or "chunks," of information at one time, so one of the life skills we acquire is the ability to filter the flood of information arriving through our senses. In any flight, especially one with challenging weather, we may unconsciously screen out vital information. Use of the PAVE checklist as a guide to your ongoing mental hazard scan can help prevent inappropriate filtering, because it provides a comprehensive and methodical approach to the information gathering process.

Filling in the Gaps: When there is more information than the brain can accurately perceive and process, it compensates by filling in the gaps and producing an interpretation that is not correct.

Take a look at the corridor illustration below.
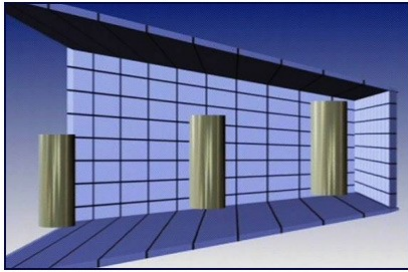
The brain quickly processes the information in this illustration and concludes that the cylinders in the picture are different heights, and that they appear to be growing larger from left to right.
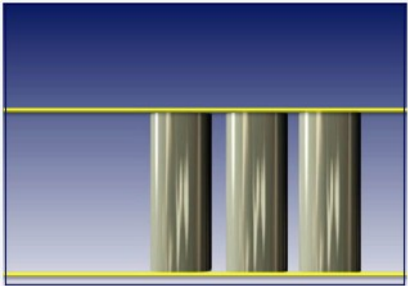
In fact, however, they are all the same size.

Runway illusions, which can result in unsafe decisions when flying an approach, are a good example of this type of human error.

Patterns and Expectations: The brain uses existing knowledge and experience as a shortcut to processing new information. This tendency can be useful, but it can also be dangerous. Examples:

- When you are processing information from an unfamiliar GPS navigator, you might unconsciously make incorrect assumptions on the basis of how information is accessed or displayed on the one you normally use.
- If previous experience at a familiar airport leads you to expect a clearance to land on runway 10, you may "hear" a clearance to land on "one-zero," even if the controller in fact clears you to land on runway 01.

Confirmation Bias: Human beings also have a tendency to look for information that confirms a decision we have already made. For example, imagine that you have decided to continue a flight you have already started. You call Flight Watch for updated weather information on several nearby airports, but you might unconsciously give more weight to the information that supports your decision to press ahead.

The "reality" part of the systematic ADM process is especially useful in countering errors associated with patterns, expectations, and confirmation bias. Make a conscious effort to identify your expectations, and then be alert to how reality differs.

Framing: When you evaluate options for a decision, be sensitive to how you state, or "frame," your alternatives. Assume you are deciding whether to continue a flight in deteriorating weather. If you frame the "continue" decision in positive terms (e.g., "I can save a lot of time and inconvenience if I go on"), you are probably more likely to decide on continuing. If, on the other hand, you frame the decision in negative terms

(e.g., "I could get myself in real trouble if I push on"), you are more likely to divert to a safer destination.

Error Prevention, Detection, and Management

No matter how hard we try, it is simply not possible for human beings to avoid errors entirely, especially when complex systems are involved. By using a systematic approach to continuous ADM, however, and developing awareness of common types of human ADM error, we can seek to minimize mistakes.

Consistent use of these tools can also help with quick recognition of errors we do make, and safe management of the resulting situation.

Chapter 7 –Flight Scenarios

ADM Flight Scenarios

Download the document below, which contains several flight scenarios that require the use of decision-making skills. These scenarios are the primary basis of the course exam, so you will want to have them available as you go through the quiz. Read through each one, and use the 3-P model to develop situational awareness (perceive), evaluate risk (process), and consider the decisions you would make (perform) in similar circumstances.

Most of the quiz questions ask you to use scenario information to choose the response that *you* believe to be the best, or most complete, answer for each multiple-choice question.

You may not always agree with the official "correct" answer, and you may have a very good reason for choosing a different response.

If your responses differ, you might find it interesting to discuss the scenarios, and your reasoning, with an instructor or another pilot. The point of the exercise is to practice using the 3-P framework to spot hazards, evaluate consequences and options, and choose a safe course of action.

Since many of the questions involve decisions affected by weather, you might also find it helpful to review the *General Aviation Pilot's Guide to Preflight Planning, Weather Self-Briefings, and Weather Decision Making*, which uses the 3-P framework.

Related Media for this Section
ADM Flight Scenarios ADM Course Flight Scenarios.pdf (354.94 KB)
GA Pilot's Guide to Weather Decision-Making GA Weather Decision-Making Dec05.pdf (1.28 MB)

Review

Chapter 1 – What is ADM?

ADM is a *systematic approach* to the mental process of *evaluating* a *given set of circumstances* and *determining the best course of action*.

Chapter 2 – The 3-P Model for ADM

The *P*erceive – *P*rocess – *P*erform model for aeronautical decision-making offers a simple, practical, and systematic approach to accomplishing each task during all phases of flight.

Chapter 3 - Perceive

To *PERCEIVE*, think through circumstances related to the: *P*ilot, *A*ircraft, en*V*ironment, and *E*xternal pressures. The fundamental question to ask is, "what could hurt me, my passengers, or my aircraft?

Chapter 4 - Process

To *PROCESS*, think through the *C*onsequences of each hazard, *A*lternatives available, *R*eality of the situation, and *E*xternal pressures that might influence your analysis.

Chapter 5 - Perform

To *PERFORM*, determine the best course of action. Your goal is to *m*itigate or *e*liminate the adverse impact, and then evaluate to ensure that your course of action is having the desired effect.

Chapter 6 – Common Errors in ADM

Pilot mistakes are often called "pilot error," formally defined as: *An action or inaction that leads to a deviation from intentions and expectations*.

There are three basic types of pilot error in aviation:

- Motor or control errors associated with "physical airplane" skills.
- Turning the wrong knob on the GPS navigator is an example of error associated with "mental airplane" systems.
- A "decisional" error, which involves a combination of cognitive activities and judgments, is associated with ADM skills.

Even with the use of a systematic ADM process, watch out for errors that can result from the way human beings naturally see perceive, process, and perform in complex situations.